MA/MSc Anthropology

AN-SA.E. 525 Development Anthropology

Introduction: This course is aimed at acquainting students with the anthropological approaches toward the development of communities. It also talks about the planning process that need to besensitive to the culture of people.

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Development Anthropology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit I	Development: Meaning and evolution of the concept: Indices and measurements ofdevelopment; Development theories and Models.
Unit II	Applied, Action and Development Anthropology: Meaning, scope and the emerging trends; Contributions of anthropology to development studies; Development studies' contribution to anthropological thought and method.
Unit III	Policy and Planning: Concept of planning; formulation of policy and strategy – phases, targets, regions, resources and people. Gender issues in development, Sustainable development: Environment, natural resources, peoples' concerns and needs.
Unit IV	Participatory approach in development; Anthropological perspectives and data indevelopment planning; Conflict in people centered and programme centered paradigms.

Recommended Readings:

1. Zamara, D. Mario,1998. *Perspectives on Cultural Change and Development*.
2. Vorhies *et al*.,1988. *The Politics of Hunger*.
3. Rogers Everll, 1987.*Communication and Development: Critical Perspectives*.
4. Chambers Robert, 1999. *Rural Development*.
5. Kapoor & Singh, 1987. *Rural Development through NGOs*.
6. Vidyarthi, L.P. 1982. (Ed.), *Applied Anthropology in India*.

AN.C. 425 Fundamentals of Human Genetics

Introduction: This paper will impart knowledge about the genetic constituent of human being. It will deal with the science of inheritance wherein various modes by which transmission of trait from the parents to offspring is accomplished.

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Fundamental on Human Genetics
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit I: Meaning and Scope of Human Genetics; Structure and function of Human Cell, RNA and DNA , Genetic Code; Cell Division- Mitosis and Meiosis , significance of cell division.

Unit II: Mendel's law of Inheritance and its application; Pattern of Inheritance- Autosomal-Dominantand Recessive, co- dominance, Sex Linked and Sex Limited inheritance.

Unit III: Methods of Studying Heredity: Twin, Sibs, Pedigree, Family and Adopted child.

Unit IV: Human variation: Morphological, environmental and genetic basis of Human Variation; Concept of Race- UN statement on Race, Distribution and Characteristics of Major races of World- Caucasoid, Mongoloid and Negroid. Classification of Indian population by Risley, Guha and Sarkar. Blood group variation in Human Population- ABO, MN, Rh, and ABH (secretor factor)

Suggested Reading:

1. Buettner Janusch, J. 1969. *Origins of Man: Physical Anthropology*. Wiley Eastern Pvt.Ltd., NewDelhi.
2. Das B.M. 2008. *Outlines of Physical Anthropology*. Kitab Mahal, New Delhi
3. Cavalli-Sforza, L., P. Menozzi, and A. Piazza. 1996. *The History and Geography of Human Genes*. Princeton University Press.
4. Klung S. W, M. R.Cummings and C. A. Spencer.2007. *Essentials of Genetics*, Sixth
5. Edition. Pearson Education International. Crawford, M. (Ed). 2006 *AnthropologicalGenetics*.Cambridge University Press.
6. Cummings, M. R. 2009. *Human Genetics*. Cengage Learning

M.Phil. Anthropology/Ph.D. Anthropology

(Course-614) Soft Skill Development and Capacity Building (4CH)

Introduction:

The course introduces the students to the specific skills necessary to improve their personality and confidence to carry on research and be able to disseminate the finding with appropriate presentationskills.

Objectives:

1. Students will be given adequate exposure to deliver lecture on the given topic.
2. The focus should be to improve their writing skill in making proposals, developing interview schedules , organizational Brochures and various types of reports including research reports.
3. Handling various situation in the fields and making good power point presentation to disseminate research findings in conference/seminars.

Unit-I: Students will be asked to deliver lecturers on a topic and assignment will be made on clarity and consistency, feeling and attitude perception of dynamic of interaction.

Unit-II: Students will be made to learn the skill of writing (1) Plan Proposal(2) Project Report (3) Resume (4) Organizational Brochure (5) Questionnaire (6) Annotated Bibliography and References.

Unit-III: They will be further made to learn (1) Skill of Participating in group – discussion (2) Making scholarly presentations with proper style of documentation (3) Preparing text for PowerPoint Presentations (4) Skill for handling events and press conference (5) Conducting Interviews.

Unit-IV: Students will be introduced to an imaginative situation/problem and will then be askedto

resolve the situation/problem applying anthropological skill.

Unit-V: Students will be given orientation on the following: Collection of secondary literature on a specific topic, writing a research proposal, Preparation of interview schedule/Questionnaire, observation of an event and recording, Reference writings, Preparation of bibliography for a given topic of research, Rapport Establishment, MockInterview, Focus Group Discussion (FGD).

The Knowledge of the students on the above item shall be examined by an external examinerin consultation with the internal examiner.

M. Sc Bioinformatics

BI-411 (A) PHYSICAL SCIENCES 3 CH 50 MARKS

Objective: To bridge the gap between biology and physical sciences needed for the understanding and designing of biological problems for the students of biology background.

CO-1	Remember and understand the basic concepts/Principles of Physical Sciences
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Basic Mathematics: Logarithms, exponential series, factorials, graphs, coordinate geometry – straight line and non-linear relationships. Differentiation– Rates and limits, Differential coefficients, differentiation of a function, integration – basic concepts of integration, integration by substitution, integration by parts. Matrix algebra – linear transformation between vector spaces, representation of linear transformation by matrices, algebra of matrices, Eigen values and Eigen vectors of linear transformation.

Unit-II

Basic Physics and Computer Fundamentals: Surface tension, viscosity, photoelectric effect, basic characteristics of electricity and magnetism, charge, current, voltage, resistance, capacitor, electric field and impedence diodes, photoresistors, Semiconductors, transistors, integrated circuits and chips.

Computers: types, basic organization of computers, computer languages, software and hardware, operating systems, bit, byte, word, computer memory – types, data processing and storage.

Unit-III

Basic chemistry:atomic structure – waves and wave functions, quantum numbers, atomic orbitals, electronic configuration of atoms and periodic properties of elements, ionic radii's, ionization potential, electronic configuration of molecules. Bond lengths, bond angles, bond order and bond energies, types of chemical bond (weak and strong), intermolecular forces, structure of simple ionic and covalent bonds, carboxylic acids, aldehydes and ketones, amines (overview).

Suggested readings:

1. Basic Mathematics, Serge A. Lang, Springer publisher (1988).ISBN-13: 978-0387967875.
2. Higher Engineering Mathematics, B.S. Grewal and J.S.Grewal, Khanna Publishers, New Delhi (2007).ISBN-13: 978-8900120905.

3. Calculus and analytical geometry, G. B Thomas, R. L. Finney, 9th Ed., Pearson Education Asia (Adisson Wesley), New Delhi (2000). ISBN-13: 978-0201531749.
4. Trigonometry, Algebra and Calculus, T.Veerarajan, Tata McGraw Hill Publishing Co. Ltd, New Delhi (2003). ISBN: 978-0070535077.
5. Fundamentals of Physics, D. Halliday, R. Resnick, J. Walker. John Wiley and Sons (2010).ISBN-13: 978-9971513306.
6. Chemistry: An Introduction to General, Organic, and Biological Chemistry,Karen C. Timberlake. Pearson(2015). ISBN-13: 978-1292061320.
7. Fundamental Principles of Inorganic Chemistry,D Banerjea. Sultan Chand and Sons(2001). ISBN-13: 978-8170148159
8. Fundamentals of Computers,ReemaThareja. Oxford University Press (2015). ISBN-13: 978-0199452729.

BI-411 (B) FOUNDATION BIOLOGY 3 CH 50 MARKS

Objective: To provide basic knowledge of biology for the understanding of the advance courses of Bioinformatics & Biotechnology for the students from non-biology background.

CO-1	Remember and understand the basic concepts/Principles of Foundation Biology
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Chemistry of living organisms: biomolecules, origin of life, cell- unit of living organisms and multicellular organisms, structure of animal, plant and bacterial cell, sub-cellular organelles (cytoskeleton, mitochondria, golgi complex, endoplasmic reticulum, chloroplast, ribosome, lysosome, nucleus).

Unit II

Classification and nomenclature of living organisms (plant and animal): survey of microbial world, diversity in animal and plant kingdom, phylogeny, organic evolution, evidences in support of evolution (morphological, embryological, taxonomy, genetic, biochemical and molecular), origin of species and speciation; environmental and anthropogenic impact on living organisms.

Unit III

Genetics- science of heredity:chromosome number and structure, cell division- meiosis and mitosis, mendelian principle of heredity; monohybrid and dihybrid cross (examples); physiological basis of life (locomotion, respiration, digestion, circulation, excretion); reproduction in plants and animals; hormonal integration of physiological processes.

Suggested readings:

1. Life: The Science of Biology: Volume III: Plants and Animals. David Sadava, David M. Hillis, H. Craig Heller, May Berenbaum. 10th Ed., W. H. Freeman(2003).ISBN-13: 978-1464141249.
2. Biology, Peter H. Raven, George B Johnson, Kenneth A. Mason, 10thEd., Tata McGraw Hill (2013). ISBN-13: 978-9351341802.
3. Life Sciences Fundamentals and Practice (Part I&II), Pranav Kumar, Usha Mina. Pathfinder Academy Pvt. Ltd (2017). ISBN-13: 978-8190642705.
4. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, P.S. Verma,V.K. Agarwal V.K, S. Chand and Company Limited (2016). ISBN-13: 978-8121924429.
5. Cell Biology for Biotechnologists, Shaleesha A Stanley. Narosa Publishing House (2008). ISBN-13: 978-8173198083.
6. Concepts of Genetics, William S Klug, Michael R Cummings, Charlotte A Spencer,10thEd., Pearson Education Limited (2016). ISBN-13: 978-9332577466.
7. Principles of genetics, Eldon John Gardner, Michael J Simmons, D Peter Snustad, 8th Ed., Wiley India Pvt.Ltd (2014). ISBN-13: 978-8126510436.

BI-412 CHEMISTRY OF BIOMOLECULES 3 CH 50 MARKS

Objective: To offer extensive coverage of important biomolecules (carbohydrates, lipids, nucleic acids, proteins) that are involved in the maintenance and metabolic processes of all living organisms.

CO-1	Remember and understand the basic concepts/Principles of Chemistry of Biomolecules
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Biomolecules: carbohydrates (monosaccharides, disaccharides, formations of polysaccharides and structural diversity), lipids (types of fatty acids and lipids), sphingolipids, conjugated and complex lipids; DNA structures: Nucleotides and nucleosides, DNA double helix, DNA structure (Z-DNA, B-DNA, A-DNA), triple helix DNA, tetraplex DNA, DNA binding proteins, Sequence specific Protein – DNA interactions, RNA secondary and tertiary structures.

Unit II

Protein structure: chemical building blocks, Peptide bond, torsion angles and rotatable bonds, Ramachandran map, protein structures (primary, secondary, super-secondary, tertiary, different classes and sub-classes of protein structures, quaternary), protein folding, protein motifs, and domains; protein structure determination; purification of proteins, crystallization of proteins, X-ray crystallography, NMR and its limitations.

Unit III

Engineering & design of protein structure, Homologous protein, Protein sequencing, Site-directed mutagenesis, Protein flexibility and stability, Engineering of protein structure and applications (case studies). Membrane proteins and its function, Metalloproteins, Carbohydrate binding proteins, Metalloenzymes: Structure and Function.

Suggested reading:

- DNA Structure and Function,Richard R Sinden. Academic Press(2012). ISBN-13: 978-0126457506.
- Lehninger Principles of Biochemistry,David L. Nelson, Michael M. Cox, Freeman, W. H. & Company (2008). ISBN-13: 978-0716743392.
- Fundamentals of Biochemistry: life at the molecular level,Donald Voet, Judith G. Voet, Charlotte W. Pratt, New York: Wiley (2016). ISBN-13: 978-1118129180.
- Outlines of Biochemistry,Eric E Conn, Paul K Stumpf, George Bruening,Wiley India Pvt.Ltd (2011). ISBN-13: 978-8126509300.
- Biochemistry, Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto, LubertStryer,8th Ed., Freeman and company (2015). ISBN-13: 978-1464126109.
- Harper's Illustrated Biochemistry,Victor W Rodwell, David A Bender, Kathleen M Botham, Victor W Rodwell, David A Bender, Kathleen M Botham, 29th Ed., Mcgraw- Hill Book Company (2015). ISBN-13: 9781259252860.

BI-415 MOLECULAR BIOLOGY- I 3 CH 50 MARKS

Objective: To educate the students on basic components and complex architecture of genetic material in different organisms and to introduce mechanism and regulation of replication of genetic material in different organisms.

CO-1	Remember and understand the basic concepts/Principles of Molecular Biology-1
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Genetic organization of prokaryotes and eukaryotes including nuclear genome and organelle genome; DNA as the genetic material (experimental evidences); central dogma; genome complexity; C-value paradox, Cot value, repetitive DNA, satellite DNA; gene structure in prokaryotes and eukaryotes; split genes, overlapping genes, pseudogenes, clusters and repeats.

Unit-II

Condensation of chromosome, Lampbrush chromosome, Polytene chromosome, Supercoiling of DNA, nucleosomes, DNA methylation, genetic imprinting, epigenetic inheritance, Transposable elements, types of transposable elements, mechanism of transposition, retroposons and its types, mechanism of retrotransposition, rearrangement of DNA.

Unit-III

DNA replication: models of DNA replication, enzymes of DNA replication, pprocess of DNA replication (initiation, elongation, termination), DNA replication at the telomere; organization and replication of extranuclear genome (Mitochondrial and Chloroplast) genome, DNA recombination (site specific and homologous); DNA repair (base-excision, mis-match, SOS, recombination); Phage strategies (lysogenic cycle and lytic cycle).

Suggested reading:

1. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, 6th Ed., Taylor & Francis Group / Spon Press (2015). ISBN-13: 9780815344643.
2. Genes IX, Benjamin Lewin, Jones and Bartlett Publishers (2010). ISBN-13: 978-9380108537.
3. Molecular cell biology, Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, HiddePloegh, Angelika Amon, Kelsey Martin, 8th Ed., WH Freeman(2016). ISBN-13: 978-1464183393.
4. Molecular Biology of the Gene, James D Watson, Tania A Baker, Stephen P Bell,Pearson Education Limited (2017). ISBN-13: 978-9332585478.
5. Cell and Molecular Biology, Gerald Karp, 5th Edition, John Wiley (2013). ISBN-13: 978-1118301791.
6. Cell Biology, Thomas D. Pollard, William C. Earnshaw, Jennifer Lippincott-Schwartz, 3rd Ed., Elsevier - Health Sciences Division (2017). ISBN-13: 978-0323417402.

BI-417	**Practical (Genetics and Microbiology)**	**2 CH**	**50 marks**
BI-418	**Practical (Biochemistry)**	**2 CH**	**50 marks**

BI-422 BIOENERGETICS AND METABOLISM 3 CH 50 marks

Objective: To provide an insight into complete set of chemical reactions of metabolism as well as the regulatory interactions that guide these reactions.

CO-1	Remember and understand the basic concepts/Principles of Bioenergetics and Metabolism
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Enzymes: basic concepts and kinetics, classification of enzymes, coenzymes and cofactors, effect of temperature and ph on enzyme activity, Michaelis-Menten kinetics, inhibitors and activators, enzyme inhibition (competititive, non-competitive, uncompetitive), allosteric enzymes and regulation, concepts of bioenergetics, multi-enzyme complexes, regulatory enzymes, feedback and feed forward systems, bisubstrate reaction kinetics, enzyme substituted model (ping pong model).

Unit II

Metabolism and regulation of carbohydrate (glycolysis, gluconeogenesis, pentose phosphate phathway and its physiological significance); carbohydrate biosynthesis in plants, co- ordinated regulation of glycogen synthesis and breakdown; citric acid cycle, regulation of citric acid cycle, glyoxylate cycle, electron transport in mitochondria and chloroplast; principle of oxidative and photophosphorylation.

Unit III

Amino acid oxidation and production of urea (metabolic fates of amino groups, fatty acid catabolism (digestion, metabolism and transport of fats), oxidation of fatty acids, ketone bodies, lipid biosynthesis, urea cycle, pathway of amino acid degradation), biosynthesis of amino acids, biosynthesis of nucleotides (purines and pyrimidines), metabolic disorders, inborn error due to metabolism, hormonal regulation of metabolism.

Suggested readings:

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, Freeman, W. H. & Company (2008). ISBN-13: 978-0716743392.
2. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto, Lubert Stryer, 8th Ed., Freeman and company (2015). ISBN-13: 978-1464126109.
3. Fundamentals of Biochemistry: life at the molecular level, Donald Voet, Judith G. Voet, Charlotte W. Pratt, New York: Wiley (2016). ISBN-13: 978-1118129180.
4. Basic Concepts In Biochemistry: A Student's Survival Guide, Hiram F. Gilbert, 2nd Ed., McGraw-Hill Publisher (1999). ISBN-13: 9780071356572.
5. Harper's Illustrated Biochemistry, Victor W Rodwell, David A Bender, Kathleen M Botham, Victor W Rodwell, David A Bender, Kathleen M Botham, 29th Ed., Mcgraw-Hill Book Company (2015). ISBN-13: 9781259252860.

BI-423 IMMUNOLOGY 3 CH 50 marks

Objective: To educate the students on cells, organs and their mechanism of action in protecting our body from any pathogenic organism or substances. In addition, the subject educates student regarding the use of immune molecules (like antibodies and cytokines) for therapeutic and diagnostic purposes.

CO-1	Remember and understand the basic concepts/Principles of Immunology
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Basics of immunity, cell and organs of immune system in human and evolution of immune system, immunogen, antigen and haptens, factors affecting immunogenicity, immunoglobulins – classification, structure and properties, primary and secondary immune response, genetic basis of generation of antibody diversity, other B cell receptors.

Unit-II

T-cell receptors, major histocompatibility complex proteins, antigen processing and presentation, complement activation. Interleukins. Brief idea regarding immunology of allergy, AIDS, organ transplantation; autoimmune diseases; cancer types, causes and mechanisms.

Unit-III

Immunotechnology – antigen-antibody interaction, affinity and avidity, agglutination, precipitin formation, immunodiffusion (SRID and DRID). Immunoelectrophoresis – types and uses, radio immuno assay, ELISA, western blotting, ELISPOT assay, immunofluorescence, immunoelectron microscopy; surface plasmon resonance, biosensor assays for assessing ligand-receptor interaction, CMI techniques- lymphoproliferation assay, mixed lymphocyte reaction.

Suggested readings:

1. Immunology, Janis Kuby, 3rd Edition, WH Freeman (2007). ISBN-13: 9789812435163.
2. Janeway's Immunobiology, Kenneth Murphy, 8th Edition, Garland Science 2016. ISBN-13: 9780815345305
3. Cellular and Molecular Immunology, Abul K. Abbas, Andrew H. H. Lichtman, Shiv Pillai, 7th Ed., Elsevier (2001). ISBN-13: 9788131248928.
4. Kuby Immunology. Judith A Owen, Jenni Punt, Sharon A Stranford, 7th Ed., W.H. Freeman and Co., New York (2013). ISBN-13: 9781429219198
5. Essential Immunology, Ivan M Roitt, Peter J Delves, 12th Ed., Blackwell Scientific Publications (2011). ISBN-13: 9781405196833.
6. Principle of gene manipulation and Genomics, S.B Primrose, R.M Twyman, 6th Ed., Blackwell Science Ltd (2014). ISBN-13: 9788126548392

BI-424 MOLECULAR BIOLOGY- II 3 CH 50 marks

Objective: To enables the student to answer the complex mechanism of action and regulation of various timely response of cell according to the surrounding.

CO-1	Remember and understand the basic concepts/Principles of Molecular Biology-II
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Transcription: components of transcription machinery in prokaryotes and eukaryotes, trancriptional factors, transcription process (initiation, elongation and termination); post-transcriptional processing, regulation of transcription (protein-DNA interaction: zinc finger motif, homeodomain, helix-loop-helix, leucine zipper), m-RNA stability, m-RNA editing; nuclear splicing, catalytic RNA, mechanism of gene silencing.

Unit-II

Translation:genetic code- principle of translation, translation machinery in prokaryotes and eukaryotes (t-RNA, aminoacyl synthetase, ribosome), translation process (initiation, elongation and termination). Regulation of gene expression: constitutive and induced gene expression; regulation of gene expression in prokaryotes and eukaryotes; operon concept (lac, ara, trp and his).

Unit-III

Protein trafficking (glycosylation, coated vesicles, budding and fusion reactions, protein localization, receptor recycle), Signal transduction (carriers and channels, G protein mediated, Ras/MAPK pathway, cAMP mediated, JAK-STAT pathway), cell cycle and its regulation, genetics of cancer (proto-oncogenes, tumor suppressor genes), signaling pathways.

Suggested readings:

1. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, 6th Ed., Taylor & Francis Group / Spon Press (2015). ISBN-13: 9780815344643.
2. Genes IX, Benjamin Lewin, Jones and Bartlett Publishers (2010). ISBN-13: 978-9380108537.
3. Molecular cell biology, Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey Martin, 8th Ed., WH Freeman (2016). ISBN-13: 978-1464183393.
4. Cell and Molecular Biology, Gerald Karp, 5th Edition, John Wiley (2013). ISBN-13: 978-1118301791.
5. Cell Biology, Thomas D. Pollard, William C. Earnshaw, Jennifer Lippincott-Schwartz, 3rd Ed., Elsevier - Health Sciences Division (2017). ISBN-13: 978-0323417402.
6. Molecular Biology of the Gene, James D Watson, Tania A Baker, Stephen P Bell,Pearson Education Limited (2017). ISBN-13: 978-9332585478.
7. Genetics, Monroe W Strickberger. 3rd Edition. Prentice Hall India Learning Private Limited (2015). ISBN-13: 978-9332555105.

BI-426	BIOINFORMATICS PROGRAMMING	3 CH	50 marks

Objective: To acquire programming techniques essential for analysis and processing of biological data from the best compatible programming languages

CO-1	Remember and understand the basic concepts/Principles of Bioinformatics Programming
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Perl programming: Introduction to Perl, Installation & running programs, Sequences & Strings: Strings, String functions, transcription, reverse complement, Reading Files, Introduction to Arrays, Motifs & Loops: Arrays to Strings, Writing to Files, Subroutines: Creating Subroutines, Command line Arguments, Modules & Libraries, Randomization, Hashes, Translation, Introduction to regular expressions & restriction enzymes, GenBank & PDB, Parsing BLAST, Introduction to Object Oriented Perl, Bioperl & modules.

Unit II

Web Programming: Basics of HTML tags – Document tags, paragraph and lines, Lists, images, links, text, tables, forms, CSS, JavaScript Basics, Variables, subroutines, event handling, form handling, PERL- CGI Scripting

Unit III

Server Side Scripting: Introduction to web servers – setup and configuration, Introduction to PHP- variables, loop construction, arrays and objects, MySQL basics and Database Integration- SQL commands, integration of SQL in PHP, retrieval and update of data, Building web applications using PHP and MySQL- full stack development with development and deployment.

BI-427	**Practical (Immunology and Molecular Biology)**	**2 CH**	**50 marks**
BI-428	**Practical (Bioinformatics Resources and Programming)**	**2 CH**	**50 marks**

BT-543 (A) SYSTEM BIOLOGY 3 CH 50 MARKS

Objective: To develop the skills towards system level understanding of biological systems.

CO-1	Remember and understand the basic concepts/Principles of Systems Biology
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Introduction to systems biology, biological knowledge and kinetic modeling, cellular networks: the structure of molecular networks; network motifs and their systems properties and roles they

play in biological processes; complexity and robustness of molecular networks; hierarchy and modularity of molecular interaction networks, reconstruction of cellular networks, edinburg pathway editor, static modeling, DBSolve, enzyme kinetics modeling, kinetic modeling of biological pathways, application of the kinetic modeling approach to problems in biotechnology and biomedicine

Unit II

Analysis of biological networks: signal transduction and gene regulation networks, protein interaction networks, metabolic networks, phylogenetic networks, correlation networks; computational system modeling: logic gates, design of biocircuits, blocks, designing, various case studies and applications, gene circuits, Petri Nets, Fuzzy implementation

Unit III

Controlling metabolic networking: metabolic fluxes, metabolic flux analysis, mass/flux balance analysis; BioXML, SBML, CellML and their applications towards modeling and simulation of biological systems, online tools and databases for system biology (STRING, BIND, MINT, IPATH, GeneGo, GYPASI, MetaCYC, etc.); E-cell project

Suggested Readings:

1. Systems Modeling in Cellular Biology, by Zoltan Szallasi, Joerg Stelling, Vipul Periwal, MIT Press,
2. Systems Biology : Properties of Reconstructed Networks, by Bernard Palsson, Cambridge Univ. Press
3. Advances in Systems Biology (Advances in Experimental Medicine and Biology). Opresko, L., Gephart, J., and Mann, M. (eds.), Plenum US, 2005
4. Artificial Intelligence Methods and Tools For Systems Biology, Dubitzky, W. and Azuaje, F. (eds.), Kluwer Academic Publisher
5. Metabolome Analyses: Strategies for Systems Biology, Vaidyanathan, S. et al (eds.), Springer-Verlag
6. Systems Biology in Practice: Concepts, Implementation And Application Klipp, E et al., John Wiley & Sons Inc.

7. Foundations of Systems Biology, Kitano, H.(ed.); The MIT Press
8. Systems Biology, Alberghina L. & Westerhoff, H.V., eds.; Springer Verlag

BI-543 (B) CLINICAL DATA MINING & IMAGE PROCESSING 3 CH 50 MARKS

Objective: To develop the clinical data warehouse for the electronic repository of multidimensional clinical data and analysis using data mining techniques.

CO-1	Remember and understand the basic concepts/Principles of Clinical Data Mining and Image Processing
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Electronic Health Records **-** EHR technology; evolution of EHR; EHR adoption and usability; scenario of EHR implementation in India, clinical data management - specialized form of clinical databases; clinical data model and its implementation; clinical data warehouse.

Unit-II

Data Mining and CDS - statistical pattern recognition techniques; supervised learning - decision trees, logistic regression, neural networks, nearest neighbor approach, support vector machine, evaluation of classifiers - ROC Graphs, Kolmogorov-Smirnov test; unsupervised learning - cluster analysis; genetic algorithm; temporal mining algorithm.

Unit-III

Introduction to image processing – fundamentals & applications of image processing; human visual perception; components of an image processing system.
Biomedical image processing – macroscopic and microscopic image analysis; biometric pattern recognition, sampling and quantization; binary image; 3-D imaging; image file formats, image segmentation (point and line detection, region growing and object segmentation)

Suggested readings:

- The Data Warehouse Toolkit, 2nd Edition: The Complete Guide to Dimensional Modeling by Kimball, Ralph; Ross, Margy, John Wiley & Sons Publisher.
- Building the Data Warehouse by Bill Inmon, Wiley and Sons Publication.
- Mastering Data Warehouse Design by Imhoff C, Galemmo N, Giger J.G., Wiley Publication.
- DW 2.0 - Architecture for the Next Generation of Data Warehousing by Bill Inmon, Derek Strauss and Genia Neushloss, Elsevier Press.
- Data Mining and Analysis: Fundamental Concepts and Algorithms by Zaki, Mohammed J., Cambridge University Press.
- Data Mining: Concepts and Techniques by Jiawei Han and Micheline Kamber, Morgan Kaufmann Publisher.
- Digital Image Processing (2^{nd} Ed.) by Rafael C Gonzalez and Richard E Woods, Pearson Publisher.

BI-543 (C) NGS AND MICROARRAY DATA ANALYSIS 3 CH 50 MARKS

Objective:
To enable the students to analyze and infer information from whole genome sequence data and high through put gene expression data of microorganisms, plants and animals.

CO-1	Remember and understand the basic concepts/Principles of NGS and Microarray Data Analysis
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I
Overview of next generation sequencing technology (Roche/454 FLX, Illumina Genome Analyzer, SOLiD™ sequencing, Ion Torrent™, Nanopore), data processing, NGS and genetics of complex disease, exome sequencing, RNA-seq experiments and data analysis, differential expression analysis, chip-seq analysis, sequencing mappability.

Unit-II
NGS Data Quality Control methods, NGS Data Structure, Resources and Repositories, genome annotations, haplotyping (concepts and application), SNP technologies (platforms and analysis), trascriptome preparation and annotation, transcriptome abundancy calculation and pathway mapping, pharmacogenomics (concepts and application in healthcare).

Unit-III
Metabolic pathway analysis: macromolecular networks, topology of macromolecular networks, modulatory and dynamics of macromolecular networks, inference of regulatory networks, simulation of molecular networks, simulation of biological processes. DNA and protein microarray: fabrication of microarray, printing of DNA, sample preparation and hybridization, image segmentation and data acquisition, data normalization, data analysis and clustering, case studies, screening of proteins: protein array, antibody array, case studies.

Suggested Readings:

- Next Generation DNA Sequencing Informatics by Stuart M. Brown, Cold Spring Harbor Laboratory.
- Network Analysis and Synthesis by Franklin F. Kuo, Wiley Publisher.
- RNA-seq Data Analysis: A Practical Approach by Eija Korpelainen, CRC Press.
- Bioinformatics: Genomics and post-genomics, Noah Hardy, John Wiley & Sons, Ltd
- Microarray Bioinformatics, by Dov Stekel, Cambridge University Press
- Protein Arrays – Method and Protocols by Fung, Human Press
- Next-Generation DNA Sequencing Informatics, Stuart M. Brown, *New York University School of Medicine, Cold spring Harbor Laboratory.*

BI-538	**Practical (Molecular Modeling and Computer Aided Drug Design)**	**2 CH**	**50 marks**

BT-421 PROBABILITY AND BIOSTATISTICS 3 CH 50 marks

Objective: To make the students acquainted with the various statistical techniques for the collection, organization, analysis and interpretation of the experimental data.

CO-1	Remember and understand the basic concepts/Principles of Probability and Biostatistics
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit I

Concepts from probability:elementary sets as events and their complements, independent and disjoint events, probability rules, permutations and combinations, probability distributions, binomial distribution, poisson distribution, random variables and their properties, continuous random variables, conditional probability and Bayes theorem.

Unit II

Systematic organization and display of data**:** populations, samples, types of data, frequency tables and histograms; graphical methods (histograms, box and whisker plots), measure of central tendency (arithmetic mean, median, mode, geometrical mean), measure of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), normal distribution: importance and properties; areas under standard normal curve; central limit theorem, skewness and kurtosis.

Unit III

Tests of hypothesis**:** student's t-test, paired t-test, hypothesis testing; categorical data and chi-square tests: 2 x 2 contingency table, correlation and linear regression: scatter diagram, pearson's correlation coefficient, regression analysis, multiple regression; analysis of variance: one-way analysis of variance, two way analysis of variance, non-parametric methods and its advantages and disadvantages, Wilcoxon rank-sum test, Wilcoxon signed-rank test. Principal component analysis.

Suggested readings:

6. Introductory Biostatistics for the Health Sciences, Michael R. Chernick, Robert H. Friis, Wiley-Interscience Publications (2003). ISBN-13: 9780471411376.
7. Statistics: Concepts and Applications, Nabendu Pal, Sahadeb Sarkar, Prentice-Hall Of India Pvt Ltd (2009). ISBN-13: 9788120334458.
8. Handbook of Computational Statistics Concepts and Methods. J. E. Gentle, Wolfgang Hardle, Yuichi Mori, Springer (2004). ISBN-13: 9783540404644.
9. Schaum's Outline of Statistics, Murray R. Spiegel, Larry J. Stephens, 3rd Ed., McGraw- Hill New Delhi (2000). ISBN-13: 9780070151536.
10. Probability and statistics for engineers and scientists, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying E. Ye, 9th Ed., Pearson (2011). ISBN-13: 9781292161365.

BT-428	Practical (Cell Biology and Industrial Biotechnology)	2 CH	50 marks

BT-534 CELL CULTURE TECHNIQUES 3 CH 50 marks

Objective: To enable the students to culture the plant, animal and stem cells in vitro as well as their molecular characterization, production of plantlets and differentiated tissue.

CO-1	Remember and understand the basic concepts/Principles of Cell Culture Techniques
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Plant tissue culture concepts and methods: concept of totipotency and plasticity, tissue culture media and its composition, plant growth regulators; initiation and establishment of culture: explant preparation, callus culture, single cell culture, suspension culture, microspore culture, embryo rescue; micropropagation: organogenesis, somatic embryogenesis, artificial seed; protoplast technology: isolation and culture of protoplast, somatic hybridization, screening and selection of somatic hybrid.

Unit-II

Animal cell culture: equipments and safety parameters, aseptic techniques, cell culture reagents, media (defined and undefined media, complete-incomplete media), culture condition, maintenance of cell culture: culturing, sub-culturing, primary and continuous culture; *in vitro* transformation of animal cells; anchorage-dependent, monolayer and suspension culture; cryopreservation and cell revival; cell line banking; contamination check and prevention; biological characterization of cultured cell; measuring parameter of growth; cytotoxicity assay; cell viability measurement.

Unit-III

Embryonic stem cells and adult stem cell; differences between stem cells and differentiated cells;isolation and culture of stem cells; use of embryonic stem cells and adult stem cells for health care;tissue engineering; three-dimensional culture: multi-cellular tumour spheroids mcts)-mono and co-cultures, re-aggregate organ cultures; drug testing *in-vitro*.

Immunolabeling of cells to study molecular expression pattern–microscopy, flow cytometry, cytospin, immunohistochemistry, transfection, transient and stable cell line generation.

Suggested readings:

1. Animal Cell Culture and Technology,Michael Butler, BIOS Scientific Publishers (2004). ISBN-13: 9781859960493.
2. Animal Cell Culture-A Practical Approach,John R.W. Masters, Oxford University Press (2000). ISBN-13: 9780199637966.
3. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications,RIan Freshney,Oxford University Press (2000). ISBN-13: 9780199632138.
4. Introduction to Plant biotechnology, H.S Chawala, Oxford & Ibh Publishing Co. Pvt Ltd (2016). ISBN-13: 9788120417328.
5. Plant tissue culture: Theory and Practice, S.S.Bhojwani, M.K Razadan, Reed Elsevier India Pvt.Ltd (2016). ISBN-13: 9788181473257.
6. Elements of Biotechnology, P K Gupta, Rastogi Publication (2015). ISBN-13: 9788171339372.
7. Plant cell and tissue culture, Narayan Swamy, McGraw Hill Education (2013). ISBN-13: 9780074602775.

BT-536 (A) AGRICULTURAL BIOTECHNOLOGY 3 CH 50 marks

Objective: The course is intended to provide the technology involve in crop improvements, molecular farming and production of transgenic crops.

CO-1	Remember and understand the basic concepts/Principles of Agricultural Biotechnology
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit -I

Introduction to agricultural biotechnology: conventional method of crop improvements vs. Biotechnological interventions, manipulation of resistance: fungal and bacterial disease, viral disease, strategies for engineering insect resistance (bt genes, protease inhibitors, α-amylase inhibitors), strategies for engineering herbicide resistance, strategies for engineering stress resistance (drought stress, salt stress, temperature stress).

Unit-II

Plant disease resistance: introduction, plant pathogen interaction, major type of plant pathogens, natural disease resistance pathways, biotechnological approaches to disease resistance (case studies), improvement of crop yield and quality: long shelf life of fruits and flowers, use of ACC synthase, poly-galactorunase, ACC oxidase; modification of fruit and flower color, seed storage protein quality, vitamin e fortification, fe and mineral fortification, case studies of phytase production and golden rice.

Unit-III

Genetic manipulation of crop yield by photosynthesis, nitrogen fixation, advances in agricultural biotechnology: molecular farming: plants as factories for pharmaceuticals and biomaterials, smart breeding: marker-assisted selection: non-invasive biotechnology alternative to genetic engineering of plant varieties,biofertilizers and biopesticides.

Suggested readings:

1. Plant Biotechnology Genetic Manipulation Of Plants, Adrian Slater, Nigel W. Scott and Mark R. Fowler, Oxford University Press (2017). ISBN-13: 9780199560875.
2. Biotechnology: Expanding Horizons, BD Singh, Kalyani Publishers / Lyall Bk Depot (2016). ISBN-13: 9789327222982.
3. Introduction to Plant biotechnology, H.S Chawala, Oxford & Ibh Publishing Co. Pvt Ltd (2016). ISBN-13: 9788120417328.
4. Elements of Biotechnology, P K Gupta, Rastogi Publication (2015). ISBN-13: 9788171339372.
5. Modern Food Microbiology, James M. Jay, CBS Publishers & Distributors (2005). ISBN-13: 9788123904757.

BT-536 (B) CLINICAL PATHOLOGY & DIAGNOSTICS 3 CH 50 marks

Objective: To enable the students to interpret and understand the various pathological tests report pertaining to diagnosis of different diseases.

CO-1	Remember and understand the basic concepts/Principles of Clinical Pathology and Diagonostics

CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit- I

General pathology: introduction to systemic pathology haematology, cytopathology, chemical pathology, immunopathology, and general neoplasia. Histopathology: collection of specimen, labelling, documentation, fixation. Grossing techniques and tissue processing. Cutting and staining of sections, use of special stains and immunocytochemistry, frozen sections, interpretation and reporting.

Unit- II

Haematology: haemoglobin estimation , blood counts, staining and reporting of smears, LE cells , ESR , packed cell volume and absolute values, staining methods for blood cells, blood bank serology , ABO grouping , Rh typing , special blood groups, blood banking
Clinical and chemical pathology: examination of urine, body fluids and stool, collection of blood , anti-coagulants, protein precipitants, estimation of blood sugar, urea, creatinine, proteins, bilirubin, cholesterol, uric acid, electrolytes, calcium and enzymes, use of autoanalyzer techniques.

Unit-III

Microbiology and serology: collection , handling , documentation and section of material for important procedures, use of various microbiological stains, use of various culture media and identification of bacterias by specific procedures, antibiotic sensitivity tests, sterilization and disinfection . Identification of fungi in specimen and culture. Diagnostic procedures in important viral infections. Serological techniques, widal, weil felix, VDRL, HIV, HBV, CRP, RF, ASO and pregnancy tests. ELISA and CLIA, medical imaging techniques: CT scan, X-ray, ultrra Sound.

Suggested readings:

1. District Laboratory Practice In Tropical Countries, Monica Cheesbrough, Cambridge University Press (2006), ISBN-13: 9780521684590.
2. Basic Medical Microbiology, Patrick R. Murray, Elsevier (2017). ISBN-13: 9780323476768.
3. Medical Microbiology, David Greenwood, Richard Slack, John Peutherer, Churchill Livingstone (2012). ISBN-13: 9780702040900.

BT-536 (D) PHARMACEUTICAL BIOTECHNOLOGY 3 CH 50 marks

Objective: To enable the students to develop the novel drugs in Pharma industry and experimental evaluation of their efficacy.

CO-1	Remember and understand the basic concepts/Principles of Pharmaceutical Biotechnology
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit- I

Introduction to pharmaceutical industry & development of drugs; economics and regulatory aspects; quality management; GMP. Bioavailability and factor affecting bioavailability; drug kinetics and bio pharmaceutics mechanism of drug absorption, distribution, biotransformation and excretion; factors affecting the ADME process; bioequivalence; pharmacokinetics.

Unit- II

Principles of drug manufacture; liquid dosage forms (solutions, suspensions and emulsions); topical applications (ointments, creams, suppositories); solid dosage forms (powders, granules, capsules, tablets, coating of tablets); aerosols; preservation; packing techniques. Advanced drug delivery systems; sustained release drug delivery system and controlled release; transdermals, liposomes; drug targeting.

Unit-III

Biopharmaceuticals understanding principles of pharmacology, pharmacodynamics; study of a few classes of therapeutics like recombinant therapeutics, monoclonal antibodies, vaccines, gene therapy, antibiotics and hormones. Immunogenicity of biopharmaceuticals: immunogenicity; factors contributing to immunogenicity (product related factors, host- related factors), consequence of immunogenicity to biopharmaceuticals; measurement of immunogenicity. Case studies: insulin, somatotropin, interleukin-2, interferon, factor VIIa, factor IX, factor VIII, monoclonal antibodies etc.

Suggested readings:

a) Pharmaceutical Biotechnology, Manoj Kumar, Anmol Publications Pvt Ltd (2010). ISBN-13: 9788126142231.

b) Pharmaceutical Biotechnology: Fundamentals and Applications, Daan J. A. Crommelin, Robert D. Sindelar, Bernd Meibohm, Springer (2016). ISBN-13: 9781493943395.

c) Handbook of Pharmaceutical Biotechnology, Shayne Cox Gad, Wiley, John & Sons (2007). ISBN-13: 9780471213864.

d) Biopharmaceuticals: Biochemistry and Biotechnology, Gary Walsh, 2nd Ed., John Wiley & Sons Inc (Sea) Pte Ltd (2011). ISBN-13: 9788126530014.

e) Pharmaceutical Biotechnlogy: Concepts and Applications, Gary Walsh, cbspd (2007). ISBN-13: 9780470012451.

f) Handbook of Pharmaceutical Biotechnology, Jay P Rho, Stan G Louie, Viva Books Private Ltd (2004).ISBN-13: 9788176497855.

BT-537	**Practical (Cell Culture and Recombinant DNA Technology)**	**2 CH**	**50 marks**
BT-538	**Practical (Bioinformatics)**	**2 CH**	**50 marks**

BT-537	**Practical (Cell Culture Tech. and Bioinformatics)**	**2 CH**	**50 marks**
BT-538	**Practical (Plant and Animal Biotechnology)**	**2 CH**	**50 marks**

MASTER OF PHILOSOPHY (BIOTECHNOLOGY)

BT-611 INSTRUMENTATION & TECHNIQUES 4 CH 100

Objective: To educate the students on principle of operation and application of various instruments used for qualitative and quantitative analysis of chemical and biological samples.

Learning outcome: After studying this subject the students can be eligible to become a application specialist or technician in operating an instrument.

Unit-I

Principle, instrumentation and applications of microscopy (light, phase contrast, fluorescence); electron microscope (TEM and SEM); AFM; FACS; principle, instrumentation and application of scintillation counter, Geiger-Muller counter; radiolabeling for the measurement of metabolic activity; autoradiography.

Unit- II

Principle, instrumentation and applications of spectrophotometer (UV-VIS, Fluorescence, IR spectroscopy); mass spectroscopy: tandem MS, MALDI-TOF. characterization of nucleic acid and protein using MALDI-TOF and MS-MS.

Unit-III

Principle, instrumentation and applications of chromatography (size exclusion, ion-exchange, affinity, GLC, HPLC and FPLC); characterization of molecular structure using circular dichorism (CD), Optical Rotary Dichorism (ORD), NMR, ESR, X-ray crystallography.

Unit-IV

Principle, instrumentation and applications of Electrophoresis (Agarose, PAGE, IEF, 2-DE, DGGE); Principle, operation and application of Polymerase chain reaction (PCR), Variants of PCR; Blotting techniques (Southern blotting, Northern blotting, Western blotting); Nucleic acid sequencing.

Suggested readings:

1. Biochemical Techniques Theory and Practice by R. White (2009)

2. A Biologist Guide to Principle and Techniques by K. Willson and K.H. Gounding (2009)

3. An Introduction to Practical Biochemistry by D.T. Plummer (2008)

4. Analytical Chemistry by G.D. Christion (2000)

5. Principle and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker, Seventh Edition

BT-612(A) APPLIED IMMUNOLOGY 4 CH 100

Objective: To educate the students on cells, organs and their mechanism of action in protecting our body from any pathogenic organisms or substances. In addition, the subject educates student regarding the use of immune molecules (like antibodies and cytokines) for therapeutic and diagnostic purposes.

Learning outcome: After studying this subject the students can be able to answer how immune system of our body functions and what is the effect if they are suppressed or overactive. The students can also be expert in diagnostic techniques used in research and diagnostic labs

Unit-I

Cell and organs of immune system, soluble molecules and membrane associated receptors of innate immune system, toll-like receptors, antigens and antibodies, cytokines, complement system, major histocompatibility complex and antigen presentation, B-cell receptors, T-cell receptors.

Unit-II

Pathophysiology of important diseases of immune system; current approaches to diagnosis and treatment: hypersensitivity reaction, tolerance and autoimmunity, influenza, diphthereia, tuberculosis, malaria, SARS, AIDS, cancer and immunotherapy.

Unit-III

Application of immunological assays: antigen-antibody interaction, radioimmunoassay, ELISA, ELISPOT assay, western blotting, immunoprecepitation, immuno-fluorescence, alternatives to antigen-antibody reaction, immunoelectron microscopy, surface plasmon resonance, biosensor assays for assessing ligand-receptor interaction, CMI techniques (lymphoproliferation assay, mixed lymphocyte reaction).

Unit-IV

Tools and techniques in immunology: experimental animal models, cell culture, two-photon microscopy for *in vivo* imaging, use of bioinformatics tools in immunological research. Application of immunological concepts in drug development, vaccines and diagnostics: development of antibodies, antibodies as drugs, designing vaccines for active and passive immunization.; hybridoma technology and application of Mabs. Biotechnology produced Mabs.

Suggested readings:

1. Immunology (2007) by J. Kuby
2. Kenneth Murphy (Charles A Janeway, Paul Travers, Mark Walport) 8th Edition: Immunobiology
3. Abbas AK, Lichtman AH and Pillai S (2001) Cellular and Molecular Immunology; Elsevier, USA, 7th Ed.
4. Kindt, T.J., Goldsby, R.A. and Osborne, B.A. (2007). Kuby Immunology .W.H. Freeman and Co., New York, 7th Ed.
5. Roit, I. (2012). Essential Immunology. Blackwell Scientific Publications, Oxford, 12th Ed.
6. Primrose SB, Twyman RM and Old RW (2002) Principle of gene manipulation. Wiley-Blackwell, UK, 6th Ed.

BT-612(B) BIOPROCESS ENGINEERING & TECHNOLOGY 4 CH 100

Objective: To educate pupils on tools and techniques used in growing microbes and monitoring their growth for producing useful products in industrial scale through various downstream processes.

Learning outcome: The students become aware about principle and instrumentation of methods and instruments used in the industries for commercial production. They also become eligible to join food and pharmaceutical industries.

Unit-I

Design and operation of conventional fermenter (probes, sterilization, agitation, aeration, heat and mass transfer, control parameters). Submerged vs solid substrate fermentation. Bioreactor design and application: batch, fed-batch, CSTR, tubular flow, plug flow, fluidized bed, membrane reactor), fermentation economics.

Unit-II

Cell kinetics: models of microbial growth; Substrate inhibition kinetics, product inhibition kinetics, ideal and non-ideal reactors; residence time distribution in bioreactor (E-curve, C-curve and F-curve), determination of average conversion in Batch reactor and CSTR. scaling up operation in bioreactor and its advantages.

Unit-III

Enzyme kinetics: michaelis-menten equation, briggs and haldane quasi steady-state approximation, enzyme inhibition (competitive, non-competitive, uncompetitive) and inhibitory kinetics, turnover number and kcat. Bi-substrate reaction kinetics, ordered and random kinetics, ping-pong catalysis (Delziel's form) and mathematical modeling.

Unit-IV

Downstream processing. Enzyme immobilization- types and methods; application of enzyme immobilization in bioreactors. Biosensors: enzyme biosensors, bio-electrodes, optrodes and immunochemical sensors.

Bioreactor design for animal cell culture (integrated suspension culture, immobilized cell cultivation); strategies of maximizing the productivity of amino acid and SCP production (case study).

Suggested readings:

1. Bioprocess Engineering Principles-Pauline M. Doran
2. Bioprocess Engineering-Basic Concepts-M.L Shuler & F. Kargi
3. Fermentation Microbiology and Biotechnology-El-Mansi and Bryce
4. Biotechnology- A text book of Industrial Biotechnology- Crueger & Cruger

BT-612(C) COMPUTATIONAL BIOLOGY 4 CH 100

Objective: To provide training to the students on using computational tools for in silico analysis of bioactive compounds

Learning outcome: After studying this subject the students can be eligible to address problems regarding acquiring, storing, retrieving and analysis of bio-information.

Unit-I

Sequence databases and their uses; dynamic programming methods; database searching - Heuristic methods, Markov chain and Hidden Markov model. pairwise alignment using HMM; multiple sequence alignment methods; genome annotation - gene finding algorithms.

Unit-II

Basic concept of molecular evolution and phylogeny; ultrametric trees and distances, data preparation; phylogenetic inference algorithms: distance-based methods, character-based methods; assessment of tree reliability; software packages.

Unit-III

Building molecules: basic chemistry, steric and other constrains, analysis of PDB structure; structure and topology: protein structure, prediction of protein structure, fold, topology (algorithm and implementation). DNA structure and topology; interactions: force fields (classical & quantum), electrostatics, surface area; mapping of binding sites and interaction with small molecules; energy minimization, molecular simulation; molecular dynamics, Monte Carlo simulation (algorithm and implementation).

Unit-IV

Introduction to systems biology; classification of enzymes and metabolic pathways, genetic and biochemical networks: deterministic and stochastic descriptions, pathway databases, pathway inference, visualization tools (DAVID), pathway miner and similar software. Applications in chemical kinetics and metabolic pathway analysis. software packages: SBML, and open source programs eCell, virtual cell, StochSim, BioNets.

Suggested readings:

1. Bioinformatics: D.W. Mount

2. Introduction to Bioinformatics by Arthur Lesk

3. Bioinformatics Methods and applications by Mendiratta and Rastogi

4. BLAST, Ian Korf, Mark & Josaph; O'Reily Pub

5. Bioinformatics and Functional Genomics; J. Pevsner

BT-612(D) RATIONAL DRUG DESIGN AND EVALUATION 4 CH 100

Objective: To impart knowledge to students on drug discovery cycle, use of bioinformatic tools for prediction, structure determination and analysis of new drugs, clinical trials and toxicological evaluation of new drug candidates.

Learning outcome: After studying this subject the students can be eligible to pharmaceutical industries where researches on new drug discovery are carried out.

Unit-I

Drug discovery cycle, rational drug design techniques and types, 2D structures (atom lookup and connection tables; SMILES; SD files), 3D structures (pdb file format), conformational flexibility, structure minimization, 2D and 3D molecular descriptors, QSAR in drug design: QSAR methodology, QSAR applications in drug design, QSAR model selection and validation, pharmacophore and drug discovery, Lupinski rule of five, structure based drug design and virtual screening (CombiChem library development, molecular docking, MM-GBSA, MM-PBSA, LIE-SGB).

Unit-II

High-throughput chemistry: mix and split synthesis, solid-phase synthesis, solution-phase synthesis, combinatorial biosynthesis, library design, high-throughput screening of synthetic library, ADME/Tox of drug, toxicological evaluation of drug (OECD guideline, types of toxicity evaluation), *In vitro* assay and *in vivo* assay (case study).

Unit-III

Clinical trials of drug: pre-clinical vs clinical trials, objectives and principles, phases of clinical trial: Phase I (assess safety), Phase II (test for effectiveness), Phase III (large-scale testing), study design and trial consideration - study population, classifications of epidemiological research, randomization process, blinding, sample size, recruitment, ethics in clinical research, quality control in clinical trials, clinical trial registries, participant adherence, survival analysis, multicentric trials.

Unit-IV

Toxicology of drugs: pharmacokinetic and pharmacodyanamic drug-drug interactions, receptors involved in toxicology of drug **(**dopamine receptor, serotonergic receptor, GABA receptor, opioid receptor); metabolism

of toxicants: phase-i reactions, phase-ii reactions, human cytochrome p450 isozymes and selected substrates, hepatotoxicity, nephrotoxicity, neurotoxicity, immunotoxicity, drug dependent and drug abuse.

Suggested readings:

1. Bioinformatics: D.W. Mount
2. Introduction to Bioinformatics by Arthur Lesk
3. Bioinformatics Methods and applications by Mendiratta and Rastogi
4. BLAST, Ian Korf, Mark & Josaph; O'Reily Pub
5. Bioinformatics and Functional Genomics; J. Pevsner
1. Robbins Pathological Basis of disease – 8th Edition
2. General Pathology by J.R.Walter and Israel – 7th edition
3. Andersons Pathology - LINDER – 10th Edition
4. Systemic Pathology . W St C Symmers

BT-612(E) GENOMICS AND PROTEOMICS 4 CH 100

Objective: The course is intended to provide thorough understanding modern technologies of the genomics pertaining to whole genome sequencing, genome mining, comparative genomics, global gene function technologies, protein structure & function technologies at the genome level, etc.

Learning outcome: Students will have a thorough understanding of various genomic technologies such as whole genome mapping & sequencing, genome annotation, global gene cloning and gene expression technologies, comparative genomics, Concept of haplotyping, introduction to pharmacogenomics, proteomics, etc. The students will know the vast amount of genome information in publicaly available databases and how to access and best utilize for practical purposes.

Unit-I

Genome sequencing techniques (sanger and pyrosequencing methods), NGS sequencing techniques (Roche/454 FLX, illumina genome analyzer, SOLiD™ sequencing, Ion Torrent™, Nanopore), NGS data quality control methods, NGS data structure, resources and repositories, genome assembly and annotation, gene prediction methods, comparative genomics, trascriptome preparation and annotation, transcriptome abundancy calculation and pathway mapping.

Unit-II

Global gene cloning expression platforms & technologies (microarrays, affymatrix, cDNA-AFLP), image segmentation, normalization techniques and expression analysis, RT-PCR, pharmacogenomics: concepts and applications in healthcare, SNP technologies: platforms and analysis; haplotyping: concepts and applications, gene function technologies (gene targeting, gene silencing (RNAi)).

Unit-III

Proteomics: protein sequencing ; protein-protein interactions; protein arrays, global analysis of protein modifications, protein structure determination (X-ray, NMR), protein structure prediction (homology, threading and *ab initio*), prediction of protein function, protein biomarkers: identification and utilization.

Unit-IV

Molecular phylogeny (phylogenetic tree and terminology, methods of phylogenetic tree prediction: maximum parsimony, distance (UPGMA, NJ), maximum likelihood methods, bootstrapping), EST sequence and mining of simple repeats, types of DNA bands, scoring and distance matrix, population genetic analysis, Analysis of molecular variance, DNA barcoding techniques, Mt DNA & cpDNA and their uses in phylogenetic analysis.

Suggested readings:

1. Introduction to Genomics by Arthur M. Lesk
2. Genomes-3 by T.A. Brown
3. Functional Genomics by
4. Introduction to Proteomics : Daniel C. Liebler and John R. Yates from "Humana Press" (2002)
5. Proteome Research : New Frontiers in Functional Genomics (Principles and Practice) by M. R. Wilkins (Editor) 1997

BT-612(F) MEDICAL MICROBIOLOGY 4 CH 100

Objective: To educate the students on host-pathogen interactions, basics of microbial infection, diagnostic techniques used for detection of microbial infection and preventive measures taken to avoid microbial infections.

Learning outcome: After studying this subject the students can be able to answer how microbes exploit different ways to survive and grow inside the host and how host tries to check microbial growth. Besides students will learn the techniques used in microbiology labs for detection of infections and way to prevent or get cure from microbial infections.

Unit-I

Microbial pathogenesis: pathogrenicity: predisposing factors, PAI (characteristics, origin, virulence factors, evolution, pai prediction, barcoding of PAI, PAI regulation). Pathogenesis of viral infections, pathogenesis of fungal infections.

Unit-II

Basics of microbial infections: nosocomial infections (types of HAI, sources and reservoirs of HAI, microorganisms causing nosocomial infections), bacterial infections (MRSA, VRE, ESBL producing bacilli, carbapenem resistant enterobacteriaceae, CPE), viral infectious diseases (SARS, Avian influenza, H1N1 influenza), fungal infections (dermatomycoses: *Trichophyton* sp. *Epidermophyton* sp.), systemic infections (Coccidiodomycetes, Candidiasis, Cryptococcosis), opportunistic fungal infections.

Unit-III

Microbial diagnostics: bacteriology: staining procedures in clinical microbiology, typing methods: biotyping, antibiogram typing, bacteriocin typing, biofilm typing, bacteriophage typing, phage typing. nucleic acid based typing: PCR typings, ribotyping, plasmid profile based typing, optical map typing, WGS typing.
Mycology: signs and symptoms of fungal infection, culture methods: specimen collection, direct microscopy, culture of filamentous and yeast like fungi, laboratory diagnostic tools, non culture methods: PCR based identification of DNA from body fluids, detection of glucan in blood, galactomannan Ag testing.
Virology: sampling, cell culture, seropyting, diagnostics, assays, cytopathic effect test, genome sequencing, isolation and identification of structural and non-structural proteins.

Unit-IV

Prevention and control of diseases: principles and measures taken for infectious diseases, Biotechnologically produced vaccines, Mabs, antibiotics, anti-metabolites, genome knock out programmes using CRISPER/Cas 9.

Suggested readings:

1. Microbiology (2nd Edn) by Talaro (2005)
2. Biology of Microorganism (9th Edn) by Broak (2005)
3. Principal of Microbiology by Atlas (2009)
4. Microbiology (6th Edn) by Fred Alcamo (2006)
5. General Microbiology by Stanier (2006)
6. Microbiology by Pelczar & Krieg (2009)
7. Microbial Genetics by David Fridflelder (2007)

BT-612(G) PLANT GENOME MAPPING AND GENOMICS 4 CH 100

Objective: The objective of the course is to familiarize the students with the basic concepts in Genetic Engineering. The detailed biology of different Cloning Vehicles, methodologies in construction of genomic libraries; strategies used in gene cloning; DNA transfer in bacteria, plant, mammalian cell, fungal cell, etc. Analysis and expression of the cloned genes in host cell. Practical applications of rDNA and to familiarize with the Ethical issues and Biosafety regulations related to genetic engineering.

Learning outcome: At the end of the course the student will have thorough understanding of the techniques and applications of recombinant DNA technology from a academic and industrial perspective. The students should be capable of pursuing a career in an industry such as in a pharmaceutical industry, diagnostics company, Agricultural Biotechnology, etc.

Unit-I

Molecular markers: concept of molecular markers; molecular markers (RFLP, RAPD, AFLP, SSR, SCAR, STS, EST, SNP) and their development for molecular dissection of plant genome. concept of minimal cell genome, molecular marker based inference.

Unit-II

Genome mapping: molecular mapping of plant genome- mapping population, constructing molecular maps; molecular tagging and mapping of oligogenes and QTL; marker assisted selection of qualitative and quantitative traits; physical mapping of gene; map based cloning of gene and QTL; association mapping; comparative mapping and synteny map.

Unit-III

Plant genome sequencing and structural genomics: rationale of genome sequencing, genome sequencing: principles, methodology and strategies; genome sequencing projects in plants; curation draft sequence of genome; Recognition of coding and non-coding sequences and gene annotation; Tools of gene cataloguing and gene structure prediction; High throughput cloning of ORFs.

Unit-IV

Functional genomics: identification of candidate genes using positional cloning, microarray analysis, transcriptome analysis (EST, SAGE), proteome comparison and metabolome profiling; characterization and functional analysis of genes: TILLING, reverse genetics, gene knockout system and heterologous expression system.

Suggested readings:

1. Principles of Gene Manipulation by S.B. Primrose, RM Twyman and RW Old (6th Edition)
2. From Genes to Genomes: Concepts and Applications of DNA Technology by JW Dale and M Schantz
3. Biotechnology by BD Singh
4. Biotechnology by PK Gupta
5. Recombinant DNA: A Short Course by JD Watson, J. Tooze and DT Kurtz
6. Plant Biotechnology- Adrian Slater, Nigel W. Scott and Mark R. Fowler (Text Book)
7. Biotechnology- Expanding Horizons by B.D. Singh
8. Introduction to Plant Biotechnology by H S Chawla
9. Elements of Biotechnology by P K Gupta

BT-613 RESEARCH METHODOLOGY 4 CH 100
(Quantitative Analysis & Computer Applications)

Objective: To impart knowledge to students on meaning, objective, criteria of research. Students also learn how to define research problems, design experiments and way of acquiring, analyzing and representing biological data in statistically valid manner and testing their statistical significance.

Learning outcome: After studying this subject the students can be eligible not only to define research problems but also to design experiment and analyze statistical significance and represent the biological data in statistical manner.

Unit-I

Introduction to research methodology: meaning of research, objectives of research, research and scientific methods, research process, criteria of research, defining research problems, research design, basic principles of experimental design, developing research plan, sample design and its types, characteristics of sampling procedure.

Unit II

Methods of data collection, processing and analysis; frequency distribution, diagrammatic representation, probability distribution, binomial distribution, poisson distribution, distribution of data: normal, skewness and kurtosis; measure of central tendency (arithmetic mean, median, mode, geometrical and harmonic mean), measure of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), normal distribution: its importance and properties, tabulating areas under standard normal distribution, central limit theorem, skewness and kurtosis.

Unit- III

Tests of hypothesis**:** one-tailed versus two-tailed tests, p-value, type-i and type-ii errors, hypothesis tests, student t-test, paired t-test; categorical data and chi-square test: chi-square distribution and table, 2x2 contingency table, goodness of fit test; correlation and linear regression: relationships between two variables, uses of correlation and regression, scatter diagram, pearson's correlation coefficient, regression analysis,

multiple regression; analysis of variance: one-way analysis of variance, two-analysis of variance, F distribution and application, non-parametric methods: advantages and disadvantages, Wilcoxon rank-sum test, Wilcoxon signed-rank test.

Unit- IV

Basics of computer: hardware and software, generation of computers, information storage devices, ROM and RAM, methods of computing (workstation, server, grid computing, parallel computing, cloud computing), application of computer softwares in biostatistics and data management.

Suggested readings:

1. Introductory Biostatistics for the Health Sciences, Michael R. Chernick and Robert H. Frills, Wiley-Interscience Publications
2. Pal Nabendu, Sarkar Sahadeb. Statistics: Concepts and Applications. PHI Learning Pvt. Ltd., 2005. ISBN: 8120326792.
3. Gentle, James E., Härdle, Wolfgang K. Mori, Yuichi (Eds.). Handbook of Computational Statistics Concepts and Methods. Springer 2004. ISBN:354040464.
4. Murray R. Spiegel, Larry J. Stephens Schaum's Outline of Statistics 3rd edition, McGraw-Hill New Delhi 3rd edition 2000. ISBN:0070435103.
5. Schaum's Outline of Introduction to Probability and Statistics. McGraw-Hill, 1999.

BT-614	**PRACTICAL (Based on BT-611 and BT-612)**	**4 CH**	**100**

BT-615	**REV IEW OF RESEARCH PAPERS IN REFERRED JOURNALS** **(Review Report: 2 CH & Seminar: 2 CH)**	**2+2 CH**	**100**

SECOND SEMESTER

BT-621	**SEMINAR (At least two)**	**2 CH**	**50 + 50**

BT-622	**DISSERTATION** **(Interim Report: 8 CH & Final Presentation: 10 CH)**	**18 CH**	**100 + 200**

BT-614 RESEARCH AND PUBLICATION ETHICS 2 CH 50

Objective: Theoretical knowledge is handicapped without practical and research based knowledge acquisition and knowledge dissemination. Hence, research and publications are inseparable form teaching. The objective of this course is to orient the students towards ethical practices in research and publications of research outcomes.

Learning outcome: At the end of the course the student will have thorough understanding of what is allowed to do and what should be done during their dissertation work and how they should publish their findings in reputed peer-reviewed journals safeguarding themselves from predatory journals and without plagiarism.

Unit-I

Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgements and reactions. *Scientific Conduct:* Ethics with respect to science and research; Intellectual honesty and research integrity;

Unit-II

Scientific Misconducts: Falsification, Fabrication, and Plagiarism (FFP); Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data. *Group Discussions:* Subject specific ethical issues, FFP, authorship, conflict of interest, Complaints and appeals: examples and fraud from India and abroad. *Software tools:* Use of plagiarism software like Turnitin, Urkund and other open source software tools

Unit-III

Publication Ethics: Definition, introduction and importance; Best practices/ standards setting initiatives and guidelines: COPE, WAME etc.; Conflict of Interest; Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals

Unit-IV

Open access publications and initiatives: SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies; Software tool to indentify predatory publications developed by SPPU; Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.
Databases and Research Metrics: Databases, Indexing databases, Citation databases: Web of Science, Scopus , etc. Research Metrics: Impact Factor of journal as per journal Citation Report,SNIP, SJR, IPP, Cite Score, Metrics: h-index, g-index, altmetrics

Suggested readings:

1. Bird, A. (2006). Philosophy of Science. Routledge.
2. MacIntyre, Alasdair (1967). A Short History of Ethics. London.
3. P. Chaddah, (2018). Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 9789387480865
4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine, (2009).On Being a Scienctist: A Guide to Responsible Conduct in Research: Third Edition. National Academics Press.
5. Resnik, D. B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10, Retrieved from https;//www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm, https://doi.org/10.1038/489179a

Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN: 9788193948217. http://www.insaindia.res.in/pdf/Ethics_Book.pdf

MBA

✪CP-105: MANAGERIAL SKILL DEVELOPMENT

Objectives

The course is aimed at equipping the students with the necessary and techniques and skills of communication to inform others inspire them and enlist their activity and willing cooperation in the performance of their jobs.

Course Contents

Unit - I: INTRODUCTION: Definition and classification of communication, purpose of communication, process of communication, importance of communication in management, communication structure in organization, barriers & gateway in communication, 7 C's of communication, Impact of cross cultural communication.

Unit – II: EMPLOYMENT COMMUNICATION: Writing CVs & Application Letter, Group discussions, interview, types of interview, candidates preparation, Interviewers preparation; Impact of Technological Advancement on Business Communication; Communication networks, Intranet, Internet, teleconferencing, videoconferencing

ORAL COMMINICATION: What is oral Communication, principles of successful oral communication, two sides of effective oral communication, effective listening, non–verbal communication, Body language, Paralanguage.

Unit - III: WRITTEN COMMUNICATION: Purpose of writing, pros & cons of written communication, clarity in writing, principles of effective writing, writing technique.

BUSINESS LETTERS AND REPORTS: Introduction to business letters, Types of business letter, Layout of business letter, Reports: definition & purpose, types of business reports, reports writing.

Unit - IV: GROUP COMMUNICATION- Meetings: need, importance & planning of Meetings, drafting of notice, agenda, minutes & resolutions of Meeting, writing memorandum, press release, press conference, Business etiquettes – netiquettes, telephonic & table etiquettes.

PRESENTATION SKILLS: What is a presentation: elements of presentation, designing a presentation, advanced visual support for business presentation, types of visual aid, appearance & posture, practicing delivery of presentation.

Unit - V: CORPORATE COMMUNICATION : Definition, scope, importance & components of corporate communication, professional communicator responsibilities, corporate communication & Public Relation, role of social media in communication. Case Study.

Suggested Readings:

1. Bowman, Joel P and Branchaw, Bernadine P. "Business Communication: From process to Product", 1987, Dryden Press, Chicago.
2. Hatch, Richard, "Communicating in Business", 1977, Science Research Associates, Chicago.
3. Murphy, Herta A and Peck, Charrles E. "Effective Business Communications", 2nd ed. 1976, Tata McGraw Hill, New Delhi.
4. Pearce, C Glenn etc. "Business Communications: Principles and Applications", 2nd ed. 1988, John Wiley, New York.

Treece, Maira, "Successful Business Communications", 3rd ed. 1987, Allyn and Bacon Boston.

The list of cases and specific references including recent articles will be announced in the class at the time of launching of the course.

COMPUTER SCIENCE

Course Title: PROGRAMMING WITH JAVA

Course Code: MSC-201

No. of Credits - 4

- To understand basic syntax of JAVA programming language
- To able to differentiate between JAVA and C++
- To able to understand concepts of inheritance and polymorphism in java
- To understand use of exceptional handling in JAVA
- To get basics of graphics programming in java

Programme Education Objectives

PEO1	Understand the nature and basic concepts of PROGRAMMING WITH JAVA Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of PROGRAMMING WITH JAVA
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

An overview of object oriented programming and Terminology: Abstraction variable and methods, encapsulation interfaces, message: object communicating with objects, modularity, classification, inheritance.

UNIT-II

Overview of JAVA Language, Java development environment, Language fundamental : how java differs from C AND C++: Programs structure and environment name space: packages, classes and members, Command line argument, no processor, Unicode and character escape, primitive data type, reference data type, objects, array, strings, operators, statement, exceptions and exception handling, multi-threading .

UNIT-III

Classes and objects in Java: introduction to class and objects, objects creation, class variables, class methods, object destruction, subclass and inheritance overriding methods, Data hiding and encapsulation, abstract class and interface, strings arrays and utility classes, standard system streams. IO streams, filtered stream.

UNIT-IV

Introduction to Applet, designing basics, drawing graphics, handling events, reading applet parameters, images and sounds, AWT overview, graphics, fonts, colors, images, Java controls, layout components.

Books Recommended:

1. Herbert Schildt, "JAVA- The Complete Reference", Mcgraw Higher Ed, 7th Edition, 2007
2. David Flanagan**, "**Java in Nutshell", O'Reilly, 6th Edition, 2015
3. E. Balaguruswami,**"**Programming with JAVA 5th Edition", Mcgraw Higher Ed, 5th Edition, 2014
4. P Radha Krishna, "Object oriented Programming through Java", Orient BlackSwan, 1st Edition, 2006

Course Title: OBJECT ORIENTED PROGRAMMING USING C++

Course Code: MSC-101

No. of Credits - 4

- To understand basics of OOPS which includes classes, objects etc.
- To understand inheritance, polymorphism concept
- To understand how to use exceptional handling in C++

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Object Oriented Programming using C++ Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of Object Oriented Programming using C++
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

Object-Oriented programming paradigm, Drawbacks of procedural programming, Advantages of OOP, Basic data types, Tokens, Keywords, Identifiers, Variables, Operators: Arithmetic, Relational, Logical, Assignment, Ternary, Bitwise, Unary Operators, Expressions and statements, Input and Output in C++, manipulators with parameters, Flow of control - if, if-else, while, do-while, for loop, Switch, break and continue.

UNIT-II

defining and initializing arrays, accessing array elements, Single and multidimensional arrays. Character array, string variables, reading multiple lines, arrays of strings, specifying the structure, accessing structure

members, array of structures. Classes and objects, Class declaration, Data member and Member functions, private and public members, scope resolution operator

UNIT-III

Inline Functions, Passing objects as arguments, returning objects, Function overloading, Friend function, constructors, destructors, overloaded constructors, Types of Constructor, operator overloading: Unary Operator, Binary Operator,

UNIT-IV

Inheritance: Derived Class and Base Class, specifying the derived class, accessing base class members, the protected access specifier, abstract base class, single, multilevel, multiple inheritance, ambiguity andmultiple inheritance. Polymorphism, pointers, Virtual base class, Virtual functions & dynamic binding, Exception handling.

Books Recommended:

1. E. Balguruswamy,"Object-Oriented programming with C++",TMH, 5th Edition, 2011
2. R.Lafore,"Object-oriented programming in TURBOC++", Galgotia, 1st Edition, 1997
3. Y.P.Kanetkar,"Let us C++", BPB publication , 2nd Edition, 2015
4. Stanley B. Lippman, Josée Lajoie, "C++ Primer", Pearson Education, 4th Editio

PROGRAMMING IN C

Course Code	**CSC113**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	**I**

Category: Foundation Course

Prerequisite: Na

Objective

To understand the various steps in Program development.
To understand the basic concepts in C Programming Language.
To learn how to write modular and readable C Programs
To learn to write programs (using structured programming approach) in C to solve problems.
To make the student understand simple sorting and searching methods.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PROGRAMMING IN C
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Computer Fundamentals and Introduction to C: Role of computer and programming languages, compiler, interpreter, loader and linker, classification of programming languages, structured programming, concepts, algorithms and flowcharts.
Basics of C: Developing programs in C, a simple C program, structure of a C program, concept of a variable, data types in C, variables, program statement, declaration. All tokens, literals, operators and expressions, type conversions in C. Non-formatted input and output, formatted input and output.

UNIT – II: **(10 hours)**

Control Statements: Introduction, conditional execution (if, if-else, nested if), selection (switch), unconditional types (break, continue, goto).Loops: Iteration and repetitive execution (for, while, do-while) nested loops. Arrays and Strings: Introduction, definition, one dimensional array, two dimensional arrays, accessing elements and storing elements.String- Introduction, C characters and strings, character handling library, string conversion functions, standard input output library functions, comparison functions of string handling, string manipulation functions, search and memory functions of string handling library.

UNIT – III: **(10 hours)**

Functions: Designing structured programs, functions, basics, parameter passing,call by value and call by reference mechanism to working with functions-example programs, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions andpassing arrays to functions.Dynamic memory allocation.
Pointers: Introduction, Pointer variable definition and initialization,void pointer, null pointer, use of pointers, pointer operators, pointer to a pointer, const keyword, constant pointer and pointer to a constant.Relationship between pointer and array, array of pointers and pointers to array.

UNIT – IV: **(10 Hours)**

Structures: Declaring structures and structure variables, accessing members of a structure, arrays of structures, arrays within a structure. structures and functions, pointers to structures. Union: Declaring union and its members, accessing and initializing members of a union, structure versus union.

Input and output: concept of a file, opening a file, closing a file; Working with text files, reading from and writing into text files, error handling and C program examples.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, Programming in C, 2/e, Oxford University Press, 2013.
2. A Structured Programming Approach Using C, B.A. Forouzan and R.F. Gilberg, Third Edition,Cengage Learning.

REFERENCE BOOKS:

1. R.S.Bichkar, Programming in C, University Press (India) Pvt. Ltd., 2012.
2. K.R.Venugopal and S.K.Prasad, Mastering C, McGraw Hill, 2009.
3. B.A.Forouzan and R.F.Gilberg, Computer Science: A Structured Programming Approachusing C, 3/e, Cengage Learning.
4. E.Balaguruswamy, Programming in ANSI C, 6/e, McGraw Hill.
5. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education, India.

Course Title: Python Programming
Course Code: MSC-301

No. of Credits - 4

- To enable the students to understand the basic principles of the Python Language.
- To use the tools to do simple programs in python.

Programme Education Objectives

PEO1	Understand the nature and basic concepts of Python Programming Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of Python Programming
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

Unit-II

Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.

Unit-III

Overview of Programming: Structure of a Python Program, Elements of Python. Introduction to Python:

Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator)

Unit-IV

Creating Python Programs: Input and Output Statements, Control statements (Branching, Looping, Conditional Statement, Exit function, Difference between break, continue and pass.), Defining Functions, default arguments.

Text Books

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Reference Books

1. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist :learning with Python , Freely available online.2012

M. Sc Chemistry

CH-521	**ADVANCED ORGANIC SYNTHESIS**	**3 credits**
Course Objective:	1. Learning and understanding the principles behind physical and chemical nature of heterocyclic compounds and their reaction mechanisms 2. Imparting knowledge in the theory and applications of various heterocyclic compounds and their physical and chemical behaviour in order to synthesize them for further use in medicinal and material science applications. 3. Knowing the synthetic utility of various metallic reagents in chemical transformations in the preparation of various natural and synthetic drugs, materials.	
Course Outcome	CO-1. Remember and understand the basic concepts/principles of advanced organic synthesis CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course	
UNIT-I	Chemistry of some natural products, A study of the following compounds involving their	

	isolation, structure elucidation, synthesis and biogenesis – Alkaloid - morphine, flavonoids - quercetin, cyanidin and genestein, α-terpeneol, α-pinene. coumarins	
UNIT-II:	Systematic nomenclature (Hantzch-Widman system) for monocycle and fused heterocycles. General approach to heterocyclic synthesis-cyclisation and cycloaddition route, Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S): furan, pyrrole, thiophene, indole, thiazole, oxazole, imidazole, pyrazole, pyrimidine, seven membered heterocycles (azepine).	
UNIT-III:	Organometallics Chemistry of Transitional Element and applications in organic synthesis: Preparative structural and characteristic aspects: oxidative insertion, reductive elimination, ligand migration from metal to carbon. Organo lithium, organo copper compounds, organo boranes, organometallic compounds of Zinc, Cadmium, nickel, palladium, mercury and their utilization in chemical reactions. Reactions involving triple bond (Sonogashira reaction), C-C (Kumada, Negishi, Heck, Suzuki and Stille reactions) and C-N (Buchwald-Hartwig reaction) cross-coupling reaction.	
TEXT BOOKS:	*1. Organic Chemistry II by I. L. Finar* *2. Principles of Organic Synthesis by R. O. C. Norman* *3. Creativity in Organic Synthesis by J. S. Bindra and R. Bindra* *4. Heterocyclic Chemistry by A R Katrizsky* *5. Recent Literatures and Review Articles*	
REFERENCE BOOKS:	*1. Jonathan Clayden, Nick Greeves, and Stuart Warren. "Organic Chemistry," Oxford University Press, 2014.* *2. The Essence Of Heterocyclic Chemistry, Parikh, Arun, New Age International, 1st Edition, 2013* *3. Heterocyclic Chemistry, V. K. Ahluwalia, Alpha Science International, 2012* *4. Advanced Organic Chemistry: Structure and Mechanisms (Part A &B). Frances A Carey and Richard J Sundberg, Springer, 2015* *5. Heterocyclic chemistry, R. K. Bansal, New Age International Private Limited; Fifth edition, 2017.*	
CH-522:	**PHOTOPHYSICAL PROCESSES & INSTRUMENTATION**	**3 credits**
Course Objective	1. To provide in-depth knowledge on different photophysical processes, and determination of their rate constants. 2. To elucidate students about the physical significance of photophysical processes and their application in chemical and biological sciences. 3. To provide knowledge of instruments to monitor different photophysical processes.	
Course Outcome	CO-1. Remember and understand the basic concepts/principles of photophysical processes & instrumentation CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course	
UNIT-I:	Importance of photochemistry, Laws of photochemistry, photochemistry and spectroscopy, Interaction between light and matter, electronic energy states of atoms, spectroscopic terms for electronic states, orbital symmetry and molecular symmetry, and notation for excited states of organic molecules, Electric dipole transition, Einstein's treatment absorption and emission phenomena, time-dependent Schrödinger equation, the rules governing the transitions between two energy states, Nature of changes on electronic excitation, Electronic, vibrational and rotational energies, potential energy diagram, shapes of absorption band and Frank-Condon principle, emission spectra, environmental effect on absorption and emission spectra, excited state dipole moment, excited state acidity constants-pk^* values, and Wigner spin conservation rule.	
UNIT-II:	Types of photophysical pathways, radiationless transitions-internal conversion and	

	intersystem crossing, fluorescence emission, fluorescence and structure, delayed fluorescence, Quenching of Fluorescence, Theory of Collisional Quenching, Derivation of the Stern-Volmer Equation, Theory of Static Quenching, Combined Dynamic and Static Quenching, Examples of Static and Dynamic Quenching, Deviations from the Stern-Volmer Equation, Quenching Sphere of Action, Derivation of the Quenching Sphere of Action, Effects of Steric Shielding and Charge on Quenching, Fractional Accessibility to Quenchers, Applications of Quenching to Proteins and Membranes, Characteristics of Resonance Energy Transfer, Theory of Energy Transfer for a Donor– Acceptor Pair, Distance Measurements Using FRET.	
UNIT-III:	Principles & techniques of Steady State Spectrofluorometers & TCSPC Spectrofluorometers and its Applications, brief concept and applications of Fluorescence Anisotropy & Fluorescence lifetime.	
TEXT BOOKS:	1. *Fundamentals of Photochemistry by K. K. Rohatagi-Mukherjee, New Age International, 3rd edition (2014)* 2. *Principles of Fluorescence Spectroscopy by J. R. Lakowicz*	
REFERENCE BOOKS:	1. *Molecular Photochemistry by N. J. Turro,* 2. *Principles of Photochemistry by J.A. Baltrop & J.D. Coyle*	
CH-523:	**CHEMISTRY OF NANOMATERIALS**	**3 credits**
Course Objective:	1. Learning and understanding the principles of nanomaterials, syntheses and their characterizations. 2. Introduce students to the modern areas of nanotechnology and train them in the current topics to enable them to take up positions in industry and education research. 3. Apply and communicate the knowledge of nanomaterials in science and technology. 4. Enable students to apply the concepts of advanced polymers to various industrial applications.	
Course Outcome	CO-1. Remember and understand the basic concepts/principles of chemistry of nanomaterials CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course	
UNIT-I:	***Semiconductors and Devices***	
	(a) Conducting and semiconducting organic materials. Synthesis and characterizations of organic semiconductors, band gap engineering. Doping of semiconductors. Core-shell structures and applications. (b) Nanostructured Carbon based materials: Fullerene, Carbon nanotube, graphene. Artificial photosynthetic devices, storage-memory and sensors. Electronic devices and coating. High temperature resistant organic/inorganic polymers.	
UNIT-II:	***Nanomaterials for Energy Conversion and Storage Materials***	
	(a) Nanomaterials for Solar Energy Conversion Systems. Principles of photovoltaic energy conversion (PV), Structural characteristics and concepts. Types of photovoltics Cells, Physical concept of photovoltaic cells, Organic solar cells, Dye-Sensitized Solar Cells, Organic-Inorganic Hybrid solar cells. (b) Conducting and ferroelectric materials, structure and features of ferroelectric materials, ceramic materials, organic/inorganic hybrid materials and their fabrications and applications.	
UNIT-III:	***Structure Properties of Polymers and Applications***	
	(a) Structure-property relationship, stress-strain behavior, crystalline melting point, effect of chain flexibility and other steric factors, entropy and heat of fusion, glass transition temperature, relationship between Tm and Tg. Effect of	

	molecular weight, property requirements and its utilization. (b) Synthetic procedure commercial polymers (polycarbonate, polyurethane, polymethylmethacrylate, polyethyethyleneterpthalate, Nylon, polystyrene), Fire retarding and biomedical polymers
TEXT BOOKS:	*1. Semiconductor for Solar Cells by H J Moller, Artech House Inc, MA, USA, 1993.* *2. Solis State Electronic Device by Ben G Streetman, Prentice Hall of India Pvt Ltd., New Delhi.* *3. Text Book of Polymer Science by F.W. Billmeyer Jr, Wiley.*
REFERENCE BOOKS:	*1. Organic Photovoltaics – Materials, Device Physics and Manufacturing Technologies, Eds. By C. Brabec, V. Dyakonov, U. Scherf), 2nd Ed., Wiley-VCH, Germany, 2014.* *2. Polymer Science by V.R. Gowariker, N.V. Viswanathan and J. Sreedhar, Wiley-Eastern.*
CH-524:	**INDUSTRIAL PROCESSES** **3 credits**
Course Objective:	1. Learning and understanding the principles of different industrial processes. 2. Introduce various concepts related to industrial process and applications to students. 3. Applying and communicate the knowledge of advanced technologies. 4. Enable students to apply the concepts to various industrial applications.
Course Outcome	CO-1. Remember and understand the basic concepts/principles of industrial processes CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course
UNIT-I:	Petroleum and coal based chemicals: Composition of petroleum, cracking processes, Commercial production of ethylene, acetylene, polymerization mechanisms, Addition, condensation, step growth, chain growth, method of polymerization, Distillation of coal.
UNIT-II:	(a) Oil based industries: Oils and fats: Solvent extraction of oils, hydrogenation of oil, use of oil in the manufacturing of soap, paints and varnishes. (b) Surface active agents: classification and manufacturing of detergents used for cleansing purpose. (c) Fermentation industries. A general discussion on fermentation conditions, manufacturing of penicillin.
UNIT-III:	Pesticides and Pharmaceutical industries: DDT manufacture, BHC manufacture, 2,4-D manufacture, parathion manufacture, Pharmaceutical industry
BOOKS:	*1. Outlines of Chemical Technology by M. Gopala Rao and Marshall Sittig, Affiliated East-West Press Pvt. Ltd.* *2. Industrial Chemistry by B. K. Sharma, Krishan Prakashan, 2014*

CH-531:	**ADVANCED ANALYTICAL CHEMISTRY**	**3 credits**
Course Objectives:	1. To provide the students an in-depth knowledge of various modern analytical techniques. 2. To inculcate basic knowledge of statistical treatment of data among the students. 3. To understand the applications of chromatographic techniques and spectrophotometry in a variety of fields.	
Course Outcome	CO-1. Remember and understand the basic concepts/principles of advanced analytical chemistry CO-2. Analyse the various concepts to understand them through case studies	

	CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course	
UNIT-I:	***Reliability of Analytical Data***	
	Errors in chemical analysis, classification of errors, significant figures, precision and accuracy, methods of expressing accuracy, absolute error and relative error, methods of expressing precision, average deviation, standard deviation, confidence limits, median value, range, coefficient of variation. Sampling in analysis definition: Theory of sampling, technique of sampling, statistical criteria of good sampling and required size, stratified sampling, transition and storage samples.	
UNIT-II:	***Solvent Extraction and Ion Exchange***	
	Solvent extraction: basic principles, classification of extraction, mechanism of extraction, extraction equilibria, technique of extraction, applications in analytical chemistry. Ion exchange: synthesis and characteristics of ion exchange, ion exchange equilibrIa, technique of ion exchange, application of ion exchange for separation.	
UNIT-III:	***Ultraviolet and Visible Spectrophotometry***	
	Introduction, nature of absorbing species, visual colorimetry, photo-electric cell and filters, Photoelectric filter photometry, errors in photoelectric photometry, Spectrophotometry, working of spectrophotometer, simultaneous spectrophotometry, differential spectrophotometry, reflectance spectrophotometry, photometric titrations, composition of coloured complex Sandell's sensitivity, relative concentration and Ringbon's plot, principle of Nephelometry and Turbidimetry, application and factors affecting Nephelometric and Turbidimetric measurement.	
TEXT BOOKS:	1. *Instrumental Methods of Chemical Analysis by Gurdeep R. Chatwal, Sham K. Anand, Himalaya Publishing House, 5th Edition,2014.* 2. *Basic Concept of Analytical Chemistry by S.M. Khopkar,* New Age International (P) Ltd., 2008. 3. *A Text Book of Quantitative Inorganic Analysis by A.I. Vogel,* P*earson Education Ltd., 7th edition, 2012.*	
REFERENCE BOOKS	1. *Instrumental Method of Analysis by H. Willard, L. Merritt, J. Dean & F. Settle, CBS publisher and distributors Pvt. Ltd., 7th edition, 2004.* 2. *Analytical Chemistry (Theory and Practice) by U.N. Dash, Sultan Chand & Sons Pvt. Ltd., Mew Delhi, 2013.*	
CH-532:	**SUPRAMOLECULAR CHEMISTRY**	**3 credits**
Course Objective:	1. Understanding basic concepts related to chemical and physical properties of supramolecules. 2. To impart knowledge in the theory and applications of various supramolecular concepts and their utilization in different fields of science	
Course Outcome	CO-1. Remember and understand the basic concepts/principles of supramolecular chemistry CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course	
UNIT-I:	***Fundamentals of Supramolecular Chemistry***	
	Terminology and definitions in supramolecular chemistry. Intermolecular forces: Ion	

	pairing, ion-dipole and dipole-dipole interactions; hydrogen bonding; cation-pi, anion-pi, pi-pi interactions and Van der Waal forces. Solvent and solution properties, solvation and hydrophobic effect. Binding constants; definition and use, determination of binding constant by physical methods.	
UNIT-II:	***Molecular Recognition***	
	Principle of molecular recognition, host-guest complementarity, preorganisation, chelate effect, cooperativity. Synthesis and applications of supramolecular host (crown ethers, lariat ethers, podands, cryptands, spherands, calix[n]arenes, cyclodextrine) as cation and anion binding receptors and receptors for ion-pair recognition.	
	Supramolecular Reactivity and Catalysis	
UNIT-III:	Organocatalysis mediated through hydrogen bonding, preconcentration, self-assembly	
	of catalysts and preorganisation of catalyst-substrate systems. Influence of organisation (effective molarity) on catalysis, Catalytic acyl transfer, acid-base catalysis, catalysis hydrolysis as ATPase mimic	
TEXT BOOKS:	• *Supramolecular Chemistry: from Molecules to Nanomaterials Eds. by P.A. Gale and J.W. Steed (2012).* • *Modern Supramolecular Chemistry by F. Diederich, P. J. Stang, R. T. Tykwinski (2008). .* • *Core Concepts in Supramolecular Chemistry and Nanochemistry by J. W. Steed, D. R. Turner, K. J. Wallace (2007).* • *Supramolecular Chemistry by J.W. Steed and J.L. Atwood (2011).* • *Supramolecular Chemistry: Concepts and Perspectives by J.-M. Lehn, Wiley VCH, Weinheim (1995).*	
REFRENCE BOOKS:	1. *Supramolecular Chemistry by V. Balzani (Editor), L. De Cola, Kluwer, Dordrecht (1992).* 2. *Introduction to Supramolecular Chemistry by H. Dodziuk, Kluwer Academic Publishers, The Netherlands (2002).* 3. *Supramolecular Assemblies Y. Murakami (Editor), Mita Press, Tokyo, (1990).* 4. *Advances in Supramolecular Chemistry, Vol 1 (1990), Vol 2 (1992), Vol 3 (1993) by G. W. Gokel (Editor), JAI Press, Greenwich.* 5. *Supramolecular Chemistry – Fundamentals and Applications. Advanced Textbook by T. Kunitake, K Ariga, Berlin: Springer-Verlag Heidelberg, 2006. 208 p. ISBN 978-3-540-01298-6.*	
CH-533:	**SURFACE CHEMISTRY & CATALYSIS**	**3 credits**
Course Objectives:	1. To understand the structures of the various organised molecular assemblies. 2. To provide knowledge about the analytical applications of the organised assemblies. 3. To impart knowledge about the characterisation and applications of the solid catalysts.	
Course Outcome	CO-1. Remember and understand the basic concepts/principles of surface chemistry & catalysis CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course	
UNIT-I:	***Structural Aspects of Organized Molecular Assemblies***	
	Surfactants, classification of surfactants, micelles, critical micellar concentration, different methods for determination of critical micellar concentration, thermodynamics of micellization, aggregation number, shape & size and their	

	determination, shape transition, reverse micelles, emulsion, microemulsion (oil in water and water in oil), effect of cosurfactants, thermodynamics of microemulsion formation.
UNIT-II:	***Analytical Applications of Organized Assemblies***
	Application of micellar systems for UV-Visible/fluorescence spectroscopic detection of ions, micellar enhanced phosphorescence and fluorescence, micellar systems in liquid-liquid extraction, surfactant aggregates in flame and plasma atomic spectrometry, micellar systems in chromatography, recent developments in micellar chromatography, application of surfactants in gel electrophoresis.
UNIT-III:	***Characterization of Industrial and Model Solid Catalysts***
	Historical development of catalysis, dividing of catalysis to homogeneous and heterogeneous, enzymatic, phase transfer catalysis. Preparation and characterization of catalysts, influence of heat and mass transport on the rate of catalytic process. Evaluation of activity and selectivity of catalysts. Catalysts acido-basic, hydrogenation-dehydrogenation, oxidation-reduction, zeolite. Mechanisms of catalyzed reactions. Examples of catalysts applications– cracking, alkylation, hydrogenation, hydration and dehydration processes. Modern sorption and spectral methods of characterization of catalysts.
TEXT BOOKS	*1. "Catalysis (An integrated Approach to Homogeneous, Heterogeneous and Industrial Catalysis)" by Jacob A. Moulin P. W. N. M. van Leeuwen, and R. A. Van Santen, Elsevier(Studies in Surface Science and Catalysis, vol 79).*
REFERENCE BOOKS	*2. Physical Chemistry of Macromolecules by C. Tanford, John Wiley & Sons, 1st edition, 1961.* *4. Introduction to Surface Chemistry and Catalysis by Gábor A. Somorjai,* Wiley-Blackwell,
~~CH-534:~~	**MATERIAL AND ENERGY BALANCE** **3 credits**
Course Objectives:	1. To understand the materials concept and chemical processes. 2. To provide knowledge about the analytical applications. 3. To impart knowledge about the characterisation and applications.
Course Outcome	CO-1. Remember and understand the basic concepts/principles of material and energy balance CO-2. Analyse the various concepts to understand them through case studies CO-3. Apply the knowledge in understanding practical problems CO-4. Execute/Create the project or field assignment as per the knowledge gained in the course
~~UNIT-I:~~	***Material Balance***
	(a) Material Balances Without Chemical Reactions: Process Flow-Sheet, Material Balances, Recycling Operations, Material Balances of Unsteady State Operations. (b) Material Balances Involving Chemical Reactions, Definition of Terms, Electrochemical Reactions, Recycling, Parallel and Bypassing Operations, Metallurgical Applications.
~~UNIT-II:~~	***Energy Balance***
	Energy and Thermo-Chemistry, Energy Balances, Heat Capacity, Heat Capacity of Gases at Constant Pressure, Sensible Heat Changes in Liquids, Heat Capacity of Gaseous Mixtures, Latent Heats, Enthalpy Changes During Phase Transfers Accompanied by Sensible Heat Changes, Enthalpy Changes Accompanying

	Chemical Reactions, Effect of Temperature on Heat of Formation, Heat of Reaction, Adiabatic Reactions, Effect of Pressure on Heat of Reaction, Thermochemistry of Mixing Process, Dissolution of Solids, Liquid-Liquid Mixtures, Heat of Solution by Partial Molal Quantities.
UNIT III:	***Stoichiometry and Unit Operations***
	Distillation, Absorption and Stripping, Extraction and Leaching, Crystallisation, Psychrometry, Drying, Evaporation, Less Conventional Operation
BOOK:	*Stoichiometry by B I Bhatt and S. M. Vora, Tata McGraw Hill, New Delhi 2007*

MA ECONOMICS

ECO-405: FINANCIAL INSTITUTIONS & MARKETS –I

Objective: *The present course is designed to acquaint the students the theory and practice of different financial institutions, financial assets, and markets. It is also aimed at to acquaint them with the Government policies and, the role of financial sector over time.*

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Financial Institutions and Market-I**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

I. Nature and Role of Financial system

Meaning and structure of the financial system, Money and Finance- Money and near money, Equities and debt, financial intermediaries, Money market and capital market, Primary and secondary market, Equilibrium in Financial markets, Indicators of financial development, Financial system and Economic development.

II. Return, risks and security valuation

Time Value of Money, Expected rate of return, required rate of return, current return and yield to maturity; Risks - meaning, types and measures, Risk –Return trade off, risk and return of a portfolio, capital asset pricing model (CAPM), present value of annuity and perpetuity, Valuation of bond, Valuation of Stock- P/E ratio and dividend discount method.

III. Structure of interest rates

Theories of interest rate determination, Level of interest rates, Long period and short period rates- Term structure of interest rates, Interest rate Structure and its determinants, Spread between lending and deposit rates. Administered interest rates, India's interest rate policy over time, Appropriate interest rate policy.

IV. Banks, and Non-bank Financial Intermediaries

Functions of commercial banks, Profitability and liquidity of banks, Need for the regulation of the banking sector, efficiency of banks, Development banks- role and functions, Non-banking financial companies- types and functions, role and growth, Need for the regulation of NBFCs.

Reading List:

1. L. M. Bhole and J. Mahukud*, Financial Institutions and Markets,* Tata McGraw Hill, 5th edition, 2011.
2. Prasanna Chandra, *Financial Management, Theory and Practice,* Tata McGraw Hill, 6th edition, 2006.
3. John C., Hull, *Options, Futures and Other Derivatives*, Pearson Education, 6th edition, 2005.
4. Dominick Salvatore, *International Economics: Trade and Finance*, John Wiley International Student Edition, 10th edition, 2011
5. Edminister, R.O, *Financial Institutions, markets and Management*, Mc Graw Hill, New York.1986.
   R.I Robonson, and D. Wrightman, *Financial Markets*, Mc Graw Hill, London.1981.

ECO-403: QUANTITATIVE METHODS & COMPUTER APPLICATION-I

Objective: *The main objective of this paper is to train the students to use the techniques of mathematical and statistical analysis which are commonly applied to understand and analyse economic concepts. Economics being an empirical science, computers have emerged as the pivotal instruments of economic analysis, research and forecasting.*

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Quantitative Methods & Computer Application -I**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

UNIT-1 **CALCULUS**

1.1 Concepts of function, Limit and Continuity
1.2 Differentiation: rules of differentiation
1.3 Functions of several variables: partial derivatives, differentials, total differentials, second and higher order differentials, total derivative, implicit functions, Euler's theorem

UNIT-2 **MAXIMA AND MINIMA OF FUNCTIONS, CONCEPT OF INTEGRATION**

2.1 Maxima and minima in single and multivariable functions
2.2 Simple rules of integration.
2.3 Application of derivatives and integration in Economics

UNIT-3 **MATRIX ALGEBRA**

3.1 Concept of Matrix- their types, simple operations on matrices
3.2 Determinants and their basic properties
3.3 Solution of Simultaneous equations through Crammers rule
3.4 Matrix inversion and rank of a matrix, Concept of vector- its properties; Matrices and vectors, Concept of Quadratic forms- Eigen roots and Eigen vectors

UNIT-4 **DIFFERENCE EQUATIONS, DIFFERENTIAL EQUATIONS AND COMPUTER APPLICATION IN ECONOMICS**

4.1 Solution of non-linear differential equation and linear differential equation
4.2 Solution of first order and second order difference equations
4.3 Economic applications of Difference and Differential equations
4.4 Basic applications of Microsoft Office- Excel, MS Word and Power Point
4.5 Application in Tabulation, Frequency Distribution, Correlation & Regression Analysis

Reading List:

1. Chiang A.C. (1986), Fundamental methods of Mathematical Economics, McGraw Hill, New York.
2. Allen, R.G.D. (1974), Mathematical Analysis for Economists, Macmillan Press and ELBS London.
3. Yamane, Taro (1975), Mathematics for Economists, Prentice Hall of India, New Delhi.
4. K. Sydsaeter and P. Hammond (2002), *Mathematics for Economic Analysis*, Pearson Educational Asia: Delhi.
5. Gupta, S. P. (1978), Statistical Methods, Sultan Chand and Sons.
6. Gupta, S. C. and V. K. Kapur (1970), Mathematical Statistics, Sultan Chand and Sons.
7. Murray R. Spiegel (1992), Theory and Problem of Statistics, Schaum's Outline Series, Metric edition
8. Gupta, S. C. (1981), Fundamentals of Statistics, Himalaya Publishing House

ECO-505 ECONOMTERICS-I

Objective: *Econometrics is mainly concerned with the empirical verification of economic theory. It requires a reasonable understanding of economic relationships and relevant statistical methods. Thus, the econometric theory becomes a powerful tool for understanding of applied economic relationships and for meaningful research in economics. This paper is devoted to equip the students with basic as well as advanced theory of econometrics and relevant applications of the methods.*

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Econometrics-I**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

UNIT-1 BASIC ECONOMTERICS

1.1 Nature, meaning and scope of econometrics

1.2 Simple and general linear regression model- Assumptions, Estimation (through OLS approach) and properties of estimators

1.3 Gauss Markov theorem

1.4 Concepts and derivation of R^2 and Adjusted R^2

UNIT-2 GENERALISED LEAST SQUARES (GLS)

2.1 Generalised Least Square estimation (GLS)

2.2 Functional Forms of Regression models: The log-linear model, Semilog model, Reciprocal model and the logarithmic reciprocal model

UNIT-3 PROBLEMS OF REGRESSION ANALYSIS

3.1 Heteroscedasticity: nature, test, consequences and remedial steps of problems of heteroscedasticity

3.2 Multicollinearity: problem, types, causes, consequences, detection and remedial measures

3.3 Autocorrelation: problem, causes, AR scheme, consequences, detection and remedies

UNIT-4 REGRESSIONS WITH QUALITATIVE INDEPENDENT VARIABLES AND DUMMY DEPENDENT VARIABLES

4.1 Dummy variable technique

4.2 Testing structural stability of regression models comparing to regressions,

4.3 Interaction effects, seasonal analysis

4.4 Piece-wise linear regression

4.5 The LPM Model

4.6 The Logit Model

4.6 The Probit Model

Reading List:

1. Jhonston J. (1991), Econometric Methods , McGraw Hill Book Co. London
2. Asteriou Dimitrious, (2006), Applied Econometrics, Palgrave Macmillan, New York
3. Gujrati D.N. (1995), Basic Econometrics, (2nd edition) McGraw Hill, New Delhi
4. Kmenta, J. (1977), Elements of Econometrics, (reprint edition) University of Michigan Press, New York.
5. Koutsoyiannis A. (1977), Theory of Econometrics (2nd ed.) The Macmillan Press Ltd. London.
6. Madalla G.S. (1997), Econometrics, McGraw Hill, New York.
7. Intrilligator, M.D. (1978), Econometric Methods, Techniques and Applications, Prentice Hall, Englewood Cliffs, New Jersey.

Pindyck, Robert S. and Daniel L. Rubinfeld,(1976), Econometric Models and EconomicForecasts, International Student edition, McGraw-Hill

ECO-504 MATHEMATICAL ECONOMICS-I

Objective: *A student of economics can make much headway in understanding the subject with basic mathematical logic. Mathematical economics has been accordingly designed to include various mathematical techniques/ methods/ models related to the different parts of economic theory. This course is designed to equip students to understand the micro economic concepts and theories which use mathematical tools and techniques to refine the verbal logic.*

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Mathematical Economics-I**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

I. Theory of Consumer Behaviour

Cardinal and ordinal utility maximization ; Slutsky equation, compensated demand functions, income, substitution and price effects ; Concept of elasticities- generalizations to n variable case. Separate and additive utility functions; homogeneous and homothetic utility functions ; constant elasticity of substitution(CES) and transcendental logarithmic utility functions ; duality theorem ; consumers surplus ; Theory of revealed preference and index numbers ; Linear expendituresystems.

II. Theory of production

Production function- homogeneous and non-homogeneous, Properties of production function; CES, VEX and trans-log production function. Simple derivation of short run and long run cost functions ; Modern approach to theory of costs; Cost function, constrained optimization of a producer ; Generalisation to n variable case ; Input demand functions ; Adding up theorem, Technical progress through production function.

III. Price determination in various markets

Price determination in perfect competition, monopoly, monopolistic competition, duopoly, oligopoly, and monopsony ; Pricing of factors of production ; Bilateralmonopoly.

IV. **Market equilibrium**- Marshallian and Walrasian equilibrium conditions; lagged market equilibrium; Multi-market equilibrium- general equilibrium, systems of Walrasand Debreau ; Conditions of stability for equilibrium.

Reading List:

1. Allen RGD (1974) Mathematical Analysis for Economists, Macmillan Press and ELBS, London.
2. Chiang, A.C (1986), Fundamental Methods of Mathematical Economics, Mac GrawHill, New York.
3. Henderson & Quandt, Micro Economic Theory, A mathematical approach, Mac GawHill, New Delhi.
4. Allen, RHD, (1976) Mathematical Economics, Macmillan, London
5. Arrow K.J., and M. Intrilligator, (Eds) (1982), handbook of Mathematical Economics, Volumes, I, II, III, North Holland, Amsterdam.
6. Hadley, G (1962) Linear Programming, Addison Wesley Publishing Co., Massachusetts.

ECO-514 MATHEMATICAL ECONOMICS-II

Objective: *A student of economics can make much headway in understanding the subject with basic mathematical logic. Mathematical economics has been accordingly designed to include various mathematicaltechniques/ methods/ models related to the different parts of economic theory. The paper covers important aspects of macroeconomic theories Growth theories based on mathematics and operational research.*

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Mathematical Economics-II**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

I. Macro-economic Models

Determination of income and fluctuations in income- Classical and Keynes macro system; Static and dynamic multiplier. Determinants of investment, accelerator, Trade cycle model of development of Samuelson and Hicks.

II. Growth models

Harrod problem; Neoclassical model of growth ; Solow and Meade growth models with technical progress ; Optimal growth ; and golden rule of accumulation.

III. Game theory

Concept of game- Two person zero-sum game, Payoff matrix, pure and mixed strategies. Maximin and Minimax solutions ; Saddle point solution ; Non-constant sumgame ; Prisoners' dilemma ; Linear programming- Primal and dual problem ; Simplex method.

IV. **Linear Programming application and Input-output analysis**

Transport and storage problems and other applications of linear programming ineconomics; Input-output analysis- Open and closed systems; Hawkins-Simon conditions ; Leontief's dynamic system ; Testing consistency of planning models.

Reading List:

1. Allen RGD (1974) Mathematical Analysis for Economists, Macmillan Press andELBS, London.
2. Chiang, A.C (1986), Fundamental Methods of Mathematical Economics, Mac GrawHill, New York.
3. Henderson & Quandt, Micro Economic Theory, A mathematical approach, Mac GawHill, New Delhi.
4. Allen, RHD, (1976) Mathematical Economics, Macmillan, London
5. Arrow K.J., and M. Intrilligator, (Eds) (1982), handbook of Mathematical Economics, Volumes, I, II, III, North Holland, Amsterdam.

CP-103 MANAGERIAL ECONIMICS

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Managerial Economics**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

1. Course Contents:

UNIT –I Basic Concepts and principles: Definition, Nature and Scope of Economics, Micro-Economics and Macro Economics, Managerial Economics and its relevance in business decisions. Fundamental Principles of Managerial Economics – Incremental Principle, Marginal Principle, Marginal Concept and Optimization, Concept of Time Perspective, Equi- Marginal Principle, Utility Analysis, Cardinal Utility and Ordinal Utility.

UNIT –II: Demand and Supply Analysis: Theory of Demand, Types of Demand. Determinants of demand, Demand Function, Demand Schedule, Demand curve, Law of Demand, Exceptions to the law of Demand, Shifts in demand curve, Elasticity of Demand and its measurement. Price Elasticity, Income Elasticity, Cross Elasticity, Indifference Curve Theory, Income and Substitution effects, Revealed Preference Approach and Demand Forecasting, Demand Estimation, Demand forecasting: meaning, significance and methods.

UNIT–III Production and cost Analysis: Production concepts & analysis; Production function, Types of production function, Laws of production: Law of diminishing returns, Stages of Production, Law of returns to scale. Cost concept and analysis: Cost, Types of costs, Cost output relationship in the short-run; Cost output relationship in the Long- run. Estimation of Revenue. Average Revenue, Marginal Revenue

UNIT –IV Market structures: Perfect and Imperfect Market Structures, Perfect Competition, features, Pure Competition & Perfect Competition, determination of price under perfect competition. Monopoly: Feature, pricing under monopoly, Price Discrimination. Monopolistic: Features, pricing under monopolistic competition, product differentiation.

UNIT –V National Income; Concepts and various methods of its measurement, Says Law of Market, Consumption, Keynes' Psychological Law of Consumption, Theories of Consumption, Investment, Decision to invest, Marginal Efficiency of Capital and Rate of Interest, Inflation, Causes and effects, Fiscal Policy, Monetary Policy,

Suggested Readings

1. Adhikary, M. Business Economics, New Delhi, Excel Books, 2000.
2. Baumal, W.J. Economic Theory and Operations Analysis, New Delhi, Prentice Hall Inc., 1996.
3. Chopra, O.P. Managerial Economics, New Delhi Tata McGraw Hill, 1995.
4. Keat, Paul G & Philips K.Y. Young, Managerial Economics, Prentice Hall, New Jersey, 1996.
5. Koutsoyiannis, A. Modern Micro Economics, New York, Macmillian, 1991.
6. Shapiro, Edward J. Macro Economic Analysis, Galgotia Publication, 2013.

MBA(FM)

MBA(FM)-1.4 Statistical Analysis

Objective : The objective of this course is to make the students learn the application of statistical tools and techniques for decision making.

Unit-I Data Source : Primary and Secondary, Primary data collection techniques- schedule, Questionnaire andinterview.

Univariate Analysis : An overview of central tendency, dispersion and skewness.

Unit-II Correlation and Regression Analysis : Two-variable cases.

Index Numbers : Meaning and types : Weighted aggregate indices- Laspeyre's and Paasch's indices; Laspeyres and Paasch's indices comparaed; Indices of weighted average of (price-quantity) relatives; Test of adequacy, Special problems- shifting the base; splicing overlapping index series; Uses and problems.

Unit-III Probability Theory : Probabilit- classical, relative and subjective probability; Addition and multiplicationprobability models; Conditional probability and Baye's theorem.

Probability Distributions : Binomial, Poisson and normal distributions; Their characteristics and applications.

Unit-IV **Sampling :** Sampling and sampling (probability and non-probability) methods; Sampling and non-sampling errors; Law of large numbers and Central limit theorem; Sampling distributions and their characteristics.

Statistical Estimation and Testing : Point and interval estimation estimation of population mean, proportion and variance; Statistical testing- hypotheses and errors; sample size; Large and small sampling tests- Z tests, T-tests and F-tests.

Unit-V **Non-parametric Tests-** Chi-sqauer tests; Sign tests; Wilcoxon Signed- rank tests; Wald-Wolfowitz tests; Kruskal-Wallis test.

Statistical Quality Control: Causes of variations in quality characteristics; Quality control-chart- purpose and logic; Constructing a control chart- computing the control limits (X and R charts); Process under control and out of control; Warning limits; Control charts for attributes- fraction defectives and number of defects; Acceptance sampling.

MBA(FM) 2.2 COMPUTER APPLICATION IN BUSINESS

Objective

The objective of this course is to provide an understanding of computers, computer operating system, and application of relevant software in managerial decision making.

UNIT-I Computer Hardware & Software: Computers system as information processing system, computer system, different types of computer systems, hardware options-CPU, input devices, output devices, storage devices, communication devices, configuration of hardware devices and their applications, Memory, Software, Different types software, Programming Languages.

UNIT II Modern Information Technology: Basic idea of Local Area Networks(LAN) and Wide Area Network(WAN), E- mail, Internet technologies, access services concept of a world wide web and internet browsing, Multi media.

UNIT III Introdution to Operating System: DOS, Windows-Windows explorer; Print manager, Control Panel; Paintbrush, Calculator, Desktop, My computer, Settings, Find, Run, UNIX, Word-processing; Introduction and working with MS-WORD in Ms-Office, Word basic commands, Formatting-text and documents, Sorting and Tables, Working with graphics, Introduction to Mail-merge.

UNIT-IV Spread Sheets: Working with EXCEL – formatting functions, chart features, working with graphics in Excel, Using worksheets and database in accounting, marketing, finance and personal areas.

Presenting with Power-Point: Power-point basics, cheating presentations the easy way, working with graphics in power-point, show time, effects and animation effects.

UNIT V Introduction to Accounting Packages: Preparations of vouchers, invoice and salary statements, Maintenance of inventory records, Maintenance of accounting books andfinal accounts, financial reports generation, Practice knowledge on Tally.

MBA(FM) 3.1 OPERATION RESEARCH

Objective

This course aims at developing an understanding of the applications of operation research techniques to business and industry

Course Inputs

UNIT I Operation Research: Concept and significance of operations research; Evolution of operations research; Steps in designing operations research studies; Operations research models and scope; Decision theory; Decision process; Decision making under the uncertainty and risk; Sensitivity analysis and decision trees.

UNIT II Linear Programming and its Applications: Graphic method and simplex method; Duality problem; Transportation problem; Assignment problem.

UNIT III Introduction to Other Types of Programming: Goal Programming, Integer Programming, Dynamic programming, Non-linear programming (introductory only)

Waiting Line Models: Waiters and services; mathematical distribution of queues, Basic models of queuing theory and applications, Single channel models.

UNIT IV Inventory Control: Deterministic models and probabilistic models.

Game Theory: Zero sum Game; Pure and mix strategies; Criteria of sharing strategies.

UNIT V Simulation: Application of simulation techniques, Monte Carlo approach.

Net-work Analysis: Introduction to PERT and CPM Application areas PERT and CPM Time Cost Trade off analysis, Shortest route problem.

MBA(FM) 3.4 PORTFOLIO MANAGEMENT

Objective

The objective of this course is to enable students learn various methods of building portfolios, evaluation and revision under various economic environment constraints

Course Inputs

UNIT I Portfolio Management: Meaning, importance, objectives and various issues in portfolio construction, revision of portfolio and evaluation

UNIT II portfolio Analysis: Estimating rate of return and standard deviationof portfolio returns; Effects of combining securities, Markowitz risk return optimization.

Single index Model: Portfolio total risk, portfolio market risk and unique risk; Sharpe's optimization solution.

UNIT III Capital Market Theory: Capital market line; Security market line; Risk

free lending and borrowing; Recent developments.

Factor Models: Albitrage pricing theory, principles of arbitrage portfolio; Two factor and multi factor models.

UNIT IV **Portfolio Construction:Techniques of portfolio construction**

Portfolio Performance Evaluation: measure of return risk adjusted measure of performance evaluation, market timing, evaluation criteria and procedures

UNIT V **Market Efficiency:**Concept, importance and status of Indian Capital market.

MBA(FM) 2.1 ACCOUNTING FOR MANAGERIAL DECISIONS

Objective

The objective of this course is to acquaint students with the accounting concepts, tools and techniques for managerial decisions.

Course Inputs

UNIT-I Introduction to Accounting: Management accounting as an area of accounting; objectives, nature and scope of financial accounting, cost accounting and management accounting; Management accounting and managerial decisions; Management accountant's position, role and responsibilities

Accounting Plan and Responsibility Centres: meaning and significance of responsibility accounting; Responsibility centers – cost center, profit center and investment center; objective and determinants of responsibility centers

UNIT II Managerial Costing and Break-even Analysis: Concept of managerial cost; Marginal costing and absorption costing; cost-volume-profit analysis; Break-even analysis; Decisions regarding sales-mix; make or buy decisions and discontinuation of a product line etc.

UNIT III Budgeting: Definition of budget; Essential of budgeting; Types of Budgets; functional, master etc. Fixed and flexible budget; Budgetary control; Zero-base budgeting; Performance budgeting.

UNIT IV Standard Costing and Variance Analysis: standard costing as a control technique; setting of standards and their revision; Variance analysis –meaning and importance, kinds of variance and their uses – materials labour and overhead variance; Disposal of variances.

UNIT V Contemporary Issues: Horizontal, vertical and ratio analysis; cash flow analysis.

Reporting to Management: Objectives of reporting; reporting needs at different management levels; Types of reports, models of reporting, reporting at different levels of management.

M. Phil Economics

ECO-612 RESEARCH METHODOLOGY & DATA MANAGEMENT TECHNIQUES

Objective

The objective of this course is to acquaint students with the Data Management Techniques

1. Introduction to Social Science Research, different types of research, the Research Process and Formulation of research design, Types of data- Primary & Secondary, Time-series and cross-section data. Data base of the Indian Economy. Preparation of Research Reports.

   Data Analysis- Descriptive statistics, regression and correlation analysis, Simple correlation, Rank correlation and multiple correlations, multiple regression analysis, Dummy variable analysis. Linear and non-linear and growth models,

2. Testing of Hypothesis: Z-test, t-test, Chi-square-test and F-test. Sampling in Social Science Research. Different Sampling Methods- Analysis of Variance- One way classification and two way classification, Randomized Block Design.

3. Functional units of a computer; Window Operating System, Managing files and folders, Working with MS word, MS Excel and MS Power Point, Using Internet, Software Packages for statistical analysis.

References:

1. Kothari, C. R., Research Methodology- Methods & Techniques, Wishwa Prakashan, New Delhi
2. Gupta & Kapoor, Applied Statistics
3. Jonston, J. (1972), Econometric Methods, Mc Graw Hill, Singapore
4. Gujrati, D.N. (1988), Basic Econometrics, Mc Graw Hill, Singapore, 2nd Edition. Pp 431- 432

EDUCATION (3-YEAR INTEGRATED B.Ed.-M.Ed.)

PC-1 Introduction to Philosophy of Education

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	Contact Hours 64

Course Objectives:

Enable the learners to:

1. *Concept, meaning, definition and aims of education*
2. *Meaning, functions and relationships of philosophy and education.*
3. *The major postulates of different schools of philosophies and their relevance for aims, methods, curriculum and role of teacher in an education system*

4. *Modern educational thought and thought of western thinkers and their relevance to education*
5. *Definition, nature and scope of social philosophy of education and its relationship with other science.*

Unit-I Introduction to Education and Philosophy

6. Concept, Meaning, Definitions and Aims of Education with reference to Different Context
7. Types, Process and Importance of Education
8. Meaning, Functions and Scope of philosophy
9. Relationship between Philosophy and Education
10. Educational Philosophy: Meaning, Nature, Scope and Functions

Unit-II Western school of Philosophy

11. Idealism, Naturalism, Pragmatism and Realism: School of Philosophy and its contribution to Education.
12. Eclecticism: Silent features and its Educational implications

Unit-III Contemporary / Modern educational thought:

13. Perennialism, Progressivism, Reconstructionism, Marxism: Features and their educational implications.
14. Existentialism and Humanism: Silent features and its Educational implications.

Unit-IV Educational Thoughts of Western Thinkers

15. Plato, Aristotle and Socrates, Rousseau, Frobel, Montessori, John Dewey and Paulo friere: Educational thoughts and its implication in present context.

Unit V- Social Philosophy of Education

16. Definition, nature and scope of social philosophy
17. Relation of social philosophy to other sciences
    - Sociology
    - Politics
    - Ethics

Internal Assessment

Note: -Each Pupil Teacher Educator has to submit one Assignment Record of the concerned paper to the Department dully counter signed by the Concerned Internal Examiner.

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PC-3 Sociology of Education

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	**Contact Hours 64**

Objectives:

Enable the learner to:

-Meaning, functions and relationship of Sociology and education.
-Structure of Indian society for initiating social engineering through education.
-Nature, Types and Characteristics of culture with a view to develop cohesiveness & tolerance in a heterogeneous society.
-The social ideologies and a critical analysis of these ideologies for the solution of social problems in India

Unit-1 Sociology as a frame of reference in Education:

18. Meaning of sociology and its various functions
19. Relationship between sociology and education.
20. Society as a system; Education and culture as sub-systems; their interrelationships
21. Education as an instrument of social change: Meaning, dimensions and types of social change; Role of education effecting social change and control; Social change influencing education

Unit-2 Education, Culture and Society

22. Education and culture: Meaning and elements of culture; Role of education for preservation, transmission and enrichment of culture; influence of culture on education, in general, and promotion of meaningful learning, in particular.
23. Education and Modernization: Meaning of modernization; Characteristics of modernized society; Adaptive demands of modernization and role of education;

Unit-3 Diversity, Inequality and Marginalization in Society

9. Understanding Indian Society with reference to diversities in Language, Culture, Religion, Socio-economic class, Ethnic group
10. Issues of Inequality in Society and their Socio-cultural and Educational Implications
11. Discrimination and marginalization as barriers for Universalization of Education
12. Role of Education, School and Teacher in addressing issues related to diversity, inequality and marginalization

Unit-4 Society in Contemporary India

13. Social Stratification-forms and function; caste and class; region and religion;
14. Types of Society-tribal, Agrarian; industrial, post industrial society;
15. Educational scenario of India: diversity in terms of educational opportunities religion, caste, class, gender, language, region and tribes;
16. Challenges in achieving universal elementary education, Demands of diverse social groups towards education;
17. Role of education in creating positive attitude towards diversity

Unit-5 Socio-cultural Context of Education

24. Social Purposivness of education. Understanding Indian society-with reference to multilingual and multicultural and other diversity, appropriate approaches for teaching young children in the context of diversity.
25. Process of socialization and acculturation of the child-critical appraisal of the role of school, parents, peer group and the community.
26. Education of socio-economically deprived groups based on gender, local (rural/urban), income differential and different disabilities as reflected in society.

Internal Assessment

Note: -Each Pupil Teacher Educator has to submit one Assignment Record of the concerned paper to the Department dully counter signed by the Concerned Internal Examiner.

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PSS-A 1: Pedagogy of Biological Science (Paper-1)

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	Contact Hours 64

Objectives

On completion of this course, the prospective teacher educators shall:

8. *State the nature and importance of Biological Science and its relevance in secondary school curriculum in context with recent curriculum reforms in School Curriculum.*
9. *Use various methods and approaches to teaching-learning Biological Science suitable for the secondary school classes.*
10. *Plan units" lessons in Biological Science using traditional and constructivist approaches for effective classroom transactions.*
11. *Develop and collect activities and resource materials for their use in enhancing quality of learning of Biological Science at the secondary level.*

Detailed Course Content

Unit 1: Biological Science in School Curriculum

11. Nature of Biological Science: Nature and Scope of Science and Biological Science in particular, Bio-science as a discipline, as a dynamic and expanding body of knowledge
12. Place of Biological Science in school curriculum, Importance of Biological Science in daily life,
13. Objectives of teaching-learning Biological Science at elementary and secondary school level,
14. Curriculum Reforms in Science Education: Rationale, objectives, principles, designs and materials in Science, recent curricular reforms at the National and State levels (NCF 2005).

Unit 2: Approaches and Methods of Teaching-learning Biological Science

15. Observation – Types, importance in Bio-Science, process, recording of observation
16. Experimentation: Experimentation under controlled conditions within laboratory and beyond laboratory situation; Process and limitations.
17. Problem Solving: Problem identification, formulation of hypotheses, collection of data, testing hypotheses and arriving at solution.
18. Demonstration-cum-Discussion
19. Project: Situation analysis, selection of the project, preparation of the project proposal, implementation of the project, evaluation and reporting.
20. Use of ICT for self-learning, collaborative learning Concept Mapping.

Unit 3: Planning for Teaching and Learning in Biological Science

21. Need for planning teaching-learning experiences in Biological Science
22. Identification of Concepts and unifying themes related to Biologica Science, inter-relation among various concepts in Biological Science
23. Designing of Year plan and Unit Plan in Biologica Science and its significance in understanding comprehensive nature of knowledge
24. Writing learning objectives for different content areas in Biological Science

25. Planning lessons based on behaviourist and constructivist approaches-5E model, ICON model considering learners with different pace,
26. Assessment of learning in classroom

Unit 4: Curricular Activities

27. Teaching-Learning Materials in Science: Preparation, collection, procurement and use of teaching-learning materials in Science like, Charts, Graph, Bulletin Board, Models, ICT materials like Filmstrips, Slides, Transparencies, TV, Audio and Video, Computer, and Internet;
28. Learning Activities – Science laboratory activities; Observing flora and fauna in their natural setting, Science Club, Science Seminar, Preservation of biological specimens for learning and building Biological Museum, Science Exhibition
29. Using Key Learning Resources for effective classroom transaction in Science

Sessional Work

Each prospective teacher educator is required to submit assignments on ***any two*** of the following:

- Preparation of year plan and unit plan for teaching Biological Science in any one class.
- Preparation of five lesson plans on any topic of Biological Science included in the Science textbook for the secondary schools.
- Developing five activities/experiments in Biological Science and prepare a brief report,
- Collection and preservation of biological specimens from the immediate environment (at least five, selecting minimum two each from preservable plants and animals/insects)

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

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PSS-A 2: Pedagogy of Biological Science (Paper-2)

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	Contact Hours 64

Objectives

On completion of the course the prospective teacher-educator shall:

- *Develop understanding about linkage among different concepts and themes in Biological sciences and also with real world/ life.*
- *Explore different ways to create learning situations for different concepts of Biological sciences for learners of different abilities*
- *Effectively use different activities and laboratory experiments for facilitating learning of Biological sciences*
- *Develop appropriate assessment tools for the evaluation of learning of different concepts of Biological sciences*
- *Examine different issues in Biological science and well as in pedagogical processes.*

Detailed Course Content

Unit 1: Learning Assessment in Biological Science

7. Learning indicators in Biological sciences and assessment of these learning indicators in the form of learning evidences/ outcome in classroom and laboratory
8. Construction of classroom tests and unit test.
9. Alternative strategies for assessment like assignments; reports and records (laboratory record, reports of field visits and excursion, Project work report); Portfolios and Rubrics; Preparation of learners‘ profile.
10. Recording and reporting of learning evidences/outcome: Marks and grades; Assessment as reflecting process to facilitate further learning.

Unit 2: Pedagogical Treatments in Biology

11. Pedagogical approaches: Behaviourist and Constructivist;
12. Strategies/Approaches: Problem solving, experimentation, project-based, cognitive conflict;
13. Content Analysis of Biological Science: Identification of major concepts, themes, criteria for assessment in respect of major concepts in school Biology content - Cell and its organization - Plant and animal kingdom - Environment and its protection - Principles of evolution - Principles of Genetics and heredity

Unit 3: Issues and Challenges in Biological Science

14. Development of Process skills
15. Language of Bio Science
16. Ethical aspects of BioScience
17. Innovations and Research in BioScience

Unit 4: Continuing Professional Development of Biology Teacher

18. Professional development programmes for teachers: In-service teacher training; Seminar, Conferences, Participation in professional learning communities.
19. Field visits of teachers to botanical garden, National parks

20. Collaboration with different schools, institutions of higher education and research in the field of Biology
21. Exploration of ICT based online platforms for sharing the ideas, methods, strategies and teaching learning resources.
22. Role of reflective practices continuing professional development

Suggested Activities

Each prospective teacher-educator is required to submit ***any two*** assignments from the following:

- Develop rubric for assessment of performance of any one unit of Bio-Science at secondary class
- Construction of unit tests for assessment of any two units in Bio-Science at secondary level.
- Content Analysis of any one area/chapter of Biological Science of a particular class
- Develop strategy for continuing professional development of Bio-Science teachers of secondary school

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course

Suggested Reading

Fraser, B. J. and Tobin, K. G. (Eds.).International handbook of science teaching (Part 1). Dodrecht, The Netherlands: Kluwer Academic.

Journal of Research in Science Teaching (Wiley-Blackwell) Science & Children. A peer reviewed journal

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RA -1 School Observation & Observing Children

Internal Assessment: 30

External Assessment: 70 Total Marks: 100

Unit- I: Introduction to School Observation

1. Concept and Meaning of Observation.
2. Needs and Importance of Classroom Observation In School Context During Practice Teachings
3. Development of Different Observation Tools (Questionnaire, Check List, Rating Scale)
4. Unit Planning, Lesson Planning, Time Table

Unit- II: Classroom Observation with Reference to Methodology

5. Class Room Arrangement (Physical Structure), Recapitulation of Previous Learning
6. Instructional Objectives, Methods of Teaching, Techniques of Teaching, Principles or Maxims of Teaching
7. Teaching Learning Material

Unit- III: Classroom Observation with Reference to Introduction

8. Different Introductory Techniques-Question Answer, Story Telling, Dramatisation, Using Audio Visual Aids, Approaches with Relating To Real Life Situation, Recapitulation

Unit- IV: Classroom Observation with Reference To Presentation

9. Communication Skills of teacher (Questioning, Explanation, Illustration With Example)
10. Work on Black-Board, Smart Board and other required TLM.
11. Teaching Point, Comprehension
12. Observation while using Different Educational Software, Courseware and Observing The Presentation Through ICT and other Technological Instruments
13. Reinforcement , Pupil Participation, Receiving Student Responses

Unit- V: Classroom Observation with Reference to Evaluation

14. Different type of test: Comprehension Test, Application Test, Essay Type, Objective Based Test, subjective test
15. Home Work and assignment

Note: - Each Pupil Teacher Educator has to observe 30 Lessons and will submit the Record to the Department dully counter signed by the Concerned Internal Examiner

Semester- I
PA -1 Hand on Experience for Curriculum Transaction
Internal Assessment: 15

External Assessment: 35 Total Marks: 50

Unit- I: Introduction to Hand on Experience

16. Concept And Meaning Of Hand on Experience
17. Development Of Different Hand on Experience Programs
18. Needs, importance and its Educational Implications

Unit- II: Curriculum Transaction

19. Concept, Meaning and scope Of Curriculum Transaction
20. Different Techniques of Curriculum Transaction
21. Needs, importance and its Educational Implications

Unit- III: Organization of Workshop Program

22. Concept And Meaning Of Workshop Program
23. Different Types of Workshops
24. Needs, importance and its Educational Implications

Unit- IV: Organization of Seminar Program

25. Concept And Meaning Of Seminar Program
26. Different Level and types of Seminars
27. Needs, importance and its Educational Implications

Unit- V: Organization of Project

28. Concept and Meaning of Project
29. Different types of Projects
30. Needs, importance and its Educational Implications

Note: -Each Pupil Teacher Educator Has to submit one Practical Record on The paper concerned to the Department dully counter signed by the Concerned Internal Examiner.

Semester- I

AA -1 Working With Community

Internal Assessment: 15

External Assessment: 35 Total Marks: 50

Unit- I: Introduction to Working With Community

31. Concept And Meaning Of Working With Community Program
32. Development Of Different Working With Community Program
33. Needs And Educational Implications

Unit- II: Working with In-service and Pre-Service Teacher Preparation Context

34. Concept And Meaning Of In-service and Pre-Service Teacher Preparation Context
35. Development Of Different In-service and Pre-Service Teacher Preparation Context
36. Needs And Educational Implications

Unit- III: Exposure Work Other Than School

37. Concept And Meaning Of Exposure Work Other Than School
38. Development Of Different Types of Exposure Work Other Than School
39. Needs and Educational Implications

Unit- IV: Thematic and Focused Area Work

40. Concept and Meaning of Thematic And Focused Area Work
41. Development of Different Level of Thematic And Focused Area Work
42. Needs and Educational Implications

Unit- V: Organization Study Tours and Field Trips

43. Concept and Meaning of Study Tours and Field Trips
44. Development of Different type of Study Tours and Field Trips
45. Needs and Educational Implications

Note:- Each Pupil Teacher Educator Has to submit one Practical Record on The paper concerned to the Department dully counter signed by the Concerned Internal Examiner.

PC-5 Introduction to Educational Psychology

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	Contact Hours 64

Objectives:

After completion of course, the prospective teacher educators will be able to:

-To develop understanding of the psychological bases of Education.

-To understand the Cognitive, Affective and Conative development of children.

-To develop the understanding of the theories of Personality and their use in the development of learner"s Personality and its measurement..

-To understand the Changing Concept of Intelligence and it"s applications.

-To understand the theories of Learning and their Utility in the Teaching Learning Process.

-To understand the Concept and Process of teaching.

Unit-I Introduction to Educational Psychology

-Concept, Nature and Scope of Educational Psychology.

-Methods of Educational Psychology- Introspection, observation, Experimental and Case study

-Relevance and importance of educational psychology to a teacher

Unit-II Growth and Development

Growth and Development: Concept, Principles, Sequential stages of Development- Specific Characteristics and problems of each Stages.

-Factors influencing development – genetic, biological, environmental and physical and their relative role.

Theories of development:

7. Piaget‘s Cognitive development
8. Freud‘s Psycho-sexual development
9. Erikson‘s psycho-social development
10. Kohlberg‘s moral development

Unit- III Theories of Learning:

Learning: Concept ,its Kinds , factors influencing learning. Theories of Learning:

-Trail and error Theory (Thorndike)

11. Operant conditioning (Skinner)

-Classical conditioning (Pavlov)

-Insightful learning (Gastalt)

-Social Learning (Albert Bandura)

-Constructivist Theory (Bygotsky)

-Therory of Instruction (Bruner)

12. Educational implications of above theories of learning

UNIT-IV Theories of Intelligence:

13. Nature and Theories of Intelligence-Guilford S.I model, Howard Gardner‘ - Theory of multiple intelligence:

-Measurement of Intelligence – Verbal, Non-Verbal, Paper Pencil-Performance, Individual and Group,

-Emotional Intelligence-concept and nature, Goleman‘s Theory of Emotional Intelligence and Triarchic Theory of Stenberg.

UNIT-V Motivation and Creativity

-Correlates of learning-Maturation. Aptitude, Attitude and abilities.

-Motivation- concept and types, Theories of Motivation-Maslow, Herzberg, Role of Motivation in Learning,

-Creativity – Nature , Process ,Identification ,fostering and Guiding Creative Children, Techniques for development of Creativity- Brain-Storming, Attribute listing.

References:-

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2. Mangal, S. K. (2002). *Advanced educational psychology*. PHI Learning Pvt. Ltd..
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4. Woodworth, R. S., & Schlosberg, H. (1954). *Experimental psychology*. Oxford and IBH Publishing.
5. Farnham-Diggory, S. (1978). *Learning disabilities: A psychological perspective*. Harvard University Press.
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9. Woolfolk, A. E. (1995). *Educational psychology*. Allyn & Bacon.
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15. Kraiger, K., Ford, J. K., & Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of applied psychology*, *78*(2), 311.
16. Entwistle, N. J. (2013). *Styles of learning and teaching: An integrated outline of educational psychology for students, teachers and lecturers*. David Fulton Publishers.
17. Olson, M. H. (2015). *Introduction to theories of learning*. Routledge.
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19. Campbell, F. A., Pungello, E. P., Miller-Johnson, S., Burchinal, M., & Ramey, C. T. (2001). The development of cognitive and academic abilities: growth curves from an early childhood educational experiment. *Developmental psychology*, *37*(2), 231.
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22. Henson, K. T., & Eller, B. F. (2012). *Educational psychology*. Dubuque, IA: Kendall Hunt.

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25. Pressley, M., & McCormick, C. (1995). *Advanced educational psychology for educators, researchers, and policymakers*. Harpercollins College Division.
26. Thorndike, E. L. (1913). *Educational psychology* (Vol. 2). Teachers college, Columbia university.
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28. Parsons, R., Hinson, S. L., &Sardo-Brown, D. (2000). *Educational psychology: A practitioner-researcher model of teaching*. Wadsworth Publishing.

Berliner, D. C., & Calfee, R. C. (2013). *Handbook of educational psychology*. Routledge

Internal Assessment

Note: -Each Pupil Teacher Educator has to submit one Assignment Record of the concerned paper to the Department dully counter signed by the Concerned Internal Examiner.

PC-9 Pedagogical Process and Practices

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	Contact Hours 64

Objectives:

-After completion of course, the prospective teacher educators will be able to:
-Understand the concept of Pedagogy and can explain the term, differentiate pedagogy from other allied concepts;
-describe different approaches of teaching namely behaviorism, cognitivism and
-Understand various approaches and methods of learning and teaching.

1. *State the importance of teaching learning materials and their management in classroom situation*
2. *Elaborate the processes of classroom management for promoting effective learning.*

-Appreciate the use of local resource for better teaching-learning process.
-Know the distinction between Assessment for learning and assessment of learning
-Find out the difference between Assessment, Testing, Measurement and Evaluation
-Acquaint with CBCS System (Credit Based Choice System)

Unit I – Concept of Pedagogy and recent trends:

-Concept, Functions, Determinants and kindred its concepts

-Relation with other teaching learning process (Andragogy)

-Understanding pedagogical Process and trends

-Concept of Critical Pedagogy

UNIT II- Approaches to Learning and Teaching:
-Approaches to learning and teaching: Subject-centred, Teacher-centred, Learner-centred, Competency based, Constructive approach
-Methods of Learning and Teaching: Effective methods of teaching and learning; Classification of Methods.
-Instructional methods- Lecture, Demonstration, Inductive and Deductive; Learner-centred methods- Play way, Project, Problem solving, Discovery
-Approaches to student learning: Behaviorism, Cognitivism and Constructivism.

UNIT III – Managing Teaching – Learning Process
-Management of group and individual learning situations, Time and Space Management, Sitting arrangement, Classroom discipline, Role of a Teacher as a manager;
-Facilitate learning Multi-level/Heterogeneous classroom
-Facilitate classroom learning, Learning beyond classroom, Linking classroom learning to real life experiences, Situated/Contextual learning
-Views of Piaget, Bruner and Vygotsky on learning

UNIT IV: Emerging Issues in Classroom learning
-Concept of Integration, Need and Relevance at different levels, Types and Process of integration;
-Introducing teaching learning materials in classroom, Need, Types and its management. Learning Beyond the text books
-ICT in learning, Conceptual framework, Relevance and tools of ICT
-Computer-Assisted Learning, Using Computer as a source of learning

UNIT V: Assessment in Teaching Learning
-Concept and importance of Assessment in teaching learning process, Difference between measurement and Evaluation
-Tools and Strategies of Assessment: Assessment of learning, Assessment for learning, Assessment as Learning
-Fundamentals of the tools and Techniques of assessment, Knowledge of construction of different types of test items
-Comprehensive and dynamic assessment procedures of Continuous & Comprehensive Evaluation, Credit Based Choice System

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Internal Assessment

Note: -Each Pupil Teacher Educator has to submit one Assignment Record of the concerned paper to the Department dully counter signed by the Concerned Internal Examiner.

RTS-1 Introduction to Educational Research

Semester-I	Credit-4
Marks 100 (Ext. 70+ Int.30)	Contact Hours 64

Objectives:

After completion of course, the prospective teacher educators will be able to:
Understand the concept of research and educational research.
Understand the types and methods of educat aional research,
Understand the steps involved in educational research, Review the educational research
Understand the use of different tools and techniques in educational research
Understand the role and use of statistics in educational research
Develop a research proposal

Unit I – Concept and Procedure of Educational Research

-Concept and Types of educational research .
-Steps and procedure of educational research
-Research design and Research Report

Unit II – Background and Review of Related Literature

-Background of the Study
-Operational Definition of the terms used
-Identification of a research problem- sources, criteria, selection, definition.
-Review of literature- Sources, Selection and finalization.
-Techniques of Review writing, Review in India and Review in Abroad
-Importance, Need and critical analysis of the Review

Unit III – Research Methodology and Procedure

-Statement Of the Problem, Rationale of the Study
- Methods, Objectives of the Study and Hypotheses
-Variables, Population and Universe
-Sample and sampling techniques, Scope and delimitation of the study
-Tools and Techniques of data collection,
Statistical Techniques used for data analysis ,Research Procedure

Unit IV – Analysis and Interpretation of Data

-Organization of Data, Editing the Data
-Classifying the data, Tabulating the data
-Analysis the data-Descriptive and Inferential
-Interpretation of data , Finding and Results

Unit V – Research Report and References Section

Research Report-

1. Format of a Research report
2. Cover page design and title page
3. Acknowledgement, Declaration of the researcher
4. Certification of supervisor and Plagiarism Certificate
5. List of Content, Tables and Figures

6. Main Body –Chapter 1 Background of the Study

Chapter-2 Review of related Literatures Chapter-3 Methodology and Procedure Chapter-4 Analysis and Interpretation Chapter -5 Summary and Conclusion Bibliography and Webliography Appendixes and Annexure

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2. Buronghs. G E R : *Design and analysis in educational research,*School of education,Birmingham,1971

3. Campbell, D T and Stanley, J.C.; *Experimental and quasi experimental designs in psychological research*.

4. Elward, A L *: Statistical analysis*,Holt Rinehart and Winston, Inc, New York,1969

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1. Fowler, E J Jr : *Survey research methods*, Sage Baverely Hills,1984

2. Garatte : H. E. *Statistics in psychology and education*, Vakil and sons,Bombay

3. Gay, L.R. *Educational Research: competencies for Analysers and Application*,Mc Millan, New York,1994

4. Glass, G. V. And Stanley, J. C:*Statistical methods in education and psychology*,Prentice hall India ,Englewood Cliffs,1984

5. Hopkins, D. A : *Teachers' guide to classroom research*,O. U. Press,London,1985

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2. Koul. L. : *Methodology of educational research* Vani educational books.New Delhi 1984

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9. Sukhia, S.P. Mehrotra, P. V.and Mehrotra, R. N. *Elements of educational research*,Llied Bombay,1965

10. Travwrs R. M. : *Introduction to educational research (3rd edition).*mc Millan company,New York,1969

6. Sprinthall, R. c. Schmulte, G. T. And siro is,L. Understanding educational research, Prentice hall Englewood cliffs.1991

7. Tucjman, B. W. Conducting educational research, Harcourt Brace,Ne York 1993

8. APA publication mnual ofAmerican PSYCHOLOGICAL association 4th Edn QPA , Washington DC 1994

Internal Assessment

Note: -Each Pupil Teacher Educator has to submit one Assignment Record of the concerned paper to the Department dully counter signed by the Concerned Internal Examiner

RTS-3

Self Development Skill- Meditation & Yoga, Arts & Crafts and Theatre.

Semester-I	**Credit-4**
Marks 100 (Ext. 70+ Int.30)	**Contact Hours 64**

Objective of the Course

-To help student- teachers develop life skills to understand self
-To develop the capacity for sensitivity, sound communication and ways to establish peace and harmony
-To develop the capacity to facilitate personal growth and social skills in their own students
-To enable student-teachers to recall and reflect on their own educational journeys and become conscious of factors that have shaped their aspirations and expectations
-To enable student-teachers to become more conscious of their responses to experiences, observations of life situations, as also of ideas and issues that arise in their minds, and to thus develop their capacity for reflection.

Unit 1: Self Concept
-What is self: Dimensions of individual self, Maslow‘s Hierarchy of Needs
-Self-identity and self-esteem
-Self acceptance: ability to see and recognize all aspects of one‘s own self without judgments
- either positively or negatively involves self understanding - a realistic awareness of one‘s strengths and weaknesses.

Unit 2: Meditation and Yoga
-What is Mediation, How to Mediate, types of Mediation, Benefits of meditation
-Misconceptions about Yoga Practice
-Different postures / asanas , Practice of Yoga for an integrated personality, Value of Yoga, Effects of Yoga

Unit 3: Art and Aesthetics
-Meaning, concept and significance, Difference between Education in Arts and Arts in Education
-Identification of different performing Art forms and artists
-Knowledge of Indian Contemporary Arts and Artists; Visual Arts based on the videos, Films and Documentaries selected for the purpose, Indian festivals and its Artistic significance.

Unit 4: Craft
-Meaning and Significance
-Knowledge of Indian Craft Traditions and its relevance in education (based on a set of slides, Videos Films, Documentaries selected for the purpose

Unit 5: Drama and Theatre
-Introduction to Drama, Meaning and relevance of drama to life today, Elements of Drama (Literary elements, Technical elements, Performance elements; Character, Plot, Theme, Dialogue, Convention, Genre, Audience)

-Forms and Styles of Theatre - Comedy and Tragedy; Solo performance, Mime, Melodrama, Musical theatre, Realism, Symbolism, Ballet and Dance, Street theatre, Folk theatre, etc
-Indian Folk and Street Drama, Regional folk theatre – Jatra , Nabaranga, Swang

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Jack H. Wilmore, David L. Costill, W. Larry Kenney.2011. 5th edition. *"Physiology of Sports and Exercise"*, Human Kinetics Publication

John E. Nixon, Ann E. Jewett.1980. *"An Introduction to Physical Education,* Thomson Learning 9th edition, London.

Krishnamurti J. (2000). *Education and significance of life*. Chennai, Krishnamurti Foundation India.

Krishnamurti, J. (1998). *On self- knowledge*. Chennai,

Krishnamurti Foundation India. UNICEF (2006): *Life skills modules-Adolescence education program*. New Delhi: UNICEF House.

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MDNIY. 2010. *"Yoga Teachers Manual for School Teachers*‖, New Delhi Morarji

Desai National Institute of Yoga, ―*Pranayama*‖, New Delhi Morarji Desai National

Institute of Yoga, ―*Yogasana"* , New Delhi

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(This material is also available on www.aeparc.org.www.ncert.nic.in)

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NCERT. 2015. *Yoga: A Healthy Way of Living, Secondary Stage*, New Delhi NCERT (2015).

Yoga: A Healthy Way of Living, Upper Primary Stage, New Delhi. NCTE. 2015. *Yoga Education-Bachelor of Education Programme, New Delhi.*

Swami Satyanand Saraswati. 2013. *"Asana Pranayama Mudra Bandha",* Bihar School of Yoga, Munger.

Internal Assessment
Note: -Each Pupil Teacher Educator has to submit one Assignment Record of the concerned paper to the Department dully counter signed by the Concerned Internal Examiner.

PA-2 Organization of Seminar on taught course

Internal Assessment: 15 External Assessment: 35 Total Marks: 50

Unit- I: Organization of Seminar on taught course

4. Concept and Meaning of Seminar on taught course
5. Needs and Importance of Seminar on taught course
6. Seminar on taught courses- PC-5, PC-9, RTS-1 and RTS-3

Unit- II: Seminar on taught courses-Educational Psychology,

7. Introduction to Educational Psychology
8. Growth and Developments, -Theories of Learning
9. Theories of Intelligence , - Motivation and Creativity

Unit- III: Seminar on taught courses-Pedagogical Process and Practice

10. Meaning & Concept of Pedagogy
11. Selected Pedagogies , - Assessment in Teaching Learning
12. Techniques of Assessment , -Assessment Tools and Role of feedback

Unit- IV: Seminar on taught courses-Introduction to Educational Research

13. Concept and procedure of Educational Research
14. Background and Review , -Methodology and Procedure
15. Analysis and Interpretation, -Research Report and References Section

Unit- V: Seminar on taught courses-Self Development Skills.

16. Self Deployment- Self Concept
17. Meditation and Yoga, -Art and Aesthetics
18. Self Deployment- Craft, -Self Deployment- Drama and Theatre

Internal Assessment

Note- Each Pupil Teacher Educator has to one internal Assignment and teach 10 Lessons (2 lessons each from PC-5,PC-9, RTS-1& RTS-3)and submit the Record to the Department dully counter signed by the Concerned Internal Examiner

Semester- II **Part-II** **C- Practical Course**

IA -1 Class Room Teaching Practices on Subject 1
Internal Assessment: 30 External Assessment: 70 Total Marks: 100

Unit- I: Instructional Objectives

19. Concept And Meaning Of Instructional Objectives
20. Different Types of Instructional Objectives
21. Needs, importance and its Educational Implications

Unit- II: Methods and Techniques

22. Concept And Meaning Of Teaching Methods and Techniques
23. Different types Teaching Methods and Techniques
24. Needs, importance and its Educational Implications

Unit- III: Teaching Aids

25. Concept And Meaning Of Teaching Aids
26. Different Types of Teaching Aids in Class room Practices
27. Needs, importance and its Educational Implications

Unit- IV: Teaching Skills

28. Concept And Meaning Of Teaching Skills
29. Different types of Teaching Skills in Class room Practices
30. Needs, importance and its Educational Implications

Unit- V: Model Lesson Plan

31. Concept and Meaning of Model Lesson Plan
32. Different types of Model Lesson Plan
33. Needs, importance and its Educational Implications

Internal Assessment

Note: -Each Pupil Teacher Educator Has to submit one assignment Record and teach & observe 15 Lessons each in Subject 1and submit the Practical Record concerned to the Department dully counter signed by the Concerned Internal Examiner.

Semester- II **Part-II** **C- Practical Course**

AA-2 Working In Services And Pre Service Teacher Preparation Context

Internal Assessment: 15 External Assessment: 35 Total Marks: 50

Unit- I: Concept of In Services Teacher Preparation contexts

34. Concept and Meaning of In Service Teacher Preparation Context
35. Development of Different Works with the contexts
36. Needs and Educational Implications of the contexts

Unit- II: Concept of Pre-Service Teacher Preparation Contexts

37. Concept and Meaning of Pre- Service Teacher Preparation Context
38. Development of Different Works with the contexts
39. Needs and Educational Implications of the contexts

Unit- III: Working with Elementary Teacher Preparation Context

40. Concept and Meaning of In service Teacher Preparation Context
41. Concept and Meaning of Pre service Teacher Preparation Context
42. Needs and Educational Implications of the contexts

Unit- IV: Working with Secondary Teacher Preparation Context

43. Concept and Meaning of In service Teacher Preparation Context
44. Concept and Meaning of Pre service Teacher Preparation Context
45. Needs and Educational Implications of the contexts

Unit- V: Administration and Govt.- Portfolios

46. Block Education Office and District Education Office Level
47. State Level. And National Level contexts
48. International Vision and Mission

Internal Assessment

Note: - Each Pupil Teacher Educator has to submit one Assignment record and one Practical Record on The paper concerned to the Department dully counter signed by the Concerned Internal Examiner.

PC 1: Introduction to Study of Education

Semester-III	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of the course, the prospective teacher educator shall:

- *Explain how education is an inter-disciplinary subject*
- *Analyse the discipline of education as an important sub-system of overall social-system*
- *Visualize the role of education in the changing socio-cultural contexts*
- *Suggest ways to address the challenges of school education*
- *State the use of various support systems for improving school education*

Detailed Course Content

Unit 1: Understanding Education

2. Meaning of Education: Derivational, Broad and Narrow, Eastern and Western views; Education as process: Bipolar, Tri-polar, Multi-polar, Lifelong; Agency - Formal/ Institutional, Informal/ Incidental and Non-Formal
3. Education as a Discipline: Attributes of a discipline (a community of person, an expression of human imagination, a domain, a mode of inquiry, a conceptual structure, a specified language, a heritage of literature, a network of communication, an evaluative and affective stance and an instructive community);
4. Importance of education as a discipline; Inter-disciplinary and Multi-disciplinary nature of education; Its relationship with other allied disciplines like philosophy, sociology, Psychology, Political science, History, economics, anthropology etc.
5. Aims of education: Determinants – philosophical, socio- cultural, political, economical, psychological; Individual and Social Aims; Aims according to Secondary Education Commission (1952-53), Education Commission (1964-66), NPE (1986), International Commissions on Education (Learning to Be & Learning the Treasure Within)

Unit 2: Education and Knowledge

6. Knowledge : Concept, characteristics and types
7. Knowledge generation : Meaning, process and strategies
8. Role of education in knowledge generation by linking:
    - School knowledge with life outside
    - Content knowledge with pedagogy knowledge
    - Knowledge on action with knowledge on reflection and outcome
    - Experiential knowledge with empirical knowledge
    - Theoretical knowledge with practical knowledge
    - School Knowledge with community knowledge
    - Universal knowledge with contextual knowledge

Unit 3: Education and Society

9. Society as a system: Attributes of a system; Importance of society as a system - Meaning, Structure (Groups, Norms, Values), Functions (Adaptation, Goal attainment, Integration, Patent pattern maintenance); Subsystems of society and their interrelationship
10. Importance of Education as a sub-system: Its components and relationship with other sub-systems; Education as a system: Levels - Elementary, Secondary, Higher Secondary and Higher Education and their interlinkages
11. Social institutions: Educational, Economic, Political, Religious and Family; School as a social institution and formal agency of education- Purpose , Functions (Conservation and Progressive), Stake holders' roles
12. School Activities: Curricular and other curricular-Components, Mode of planning and organization; Resource requirements- Material, Infrastructural, human and technological with reference to their sources and utilization
13. School-community inter-face: Importance, Aspects of inter-face strategies for strengthening their inter-relationship; their roles in building learning communities

Unit 4: Education in Changing Contexts

14. Understanding emerging contexts in Indian society with reference to linguistic, cultural and ethnic diversities, globalization, privatization, liberalization and digitization.
15. Imperatives of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)
16. Concern for equity and equality in education: Challenges of marginalization and gender disparity.
17. Transformation agenda for school and teacher education as envisioned in NPE - 86, NCF - 2005 and NCFTE – 2009 and NCTE Regulation 2014

Sessional Work

The prospective teacher-educator shall undertake ***any two*** assignments of the following:

g) Preparation of a write-up comparing the aims of education as proposed by different national and international commissions and committees.

h) Prepare a report on an interview made with an NGO engaged in education activities, preferably on school –community interface activities

i) Observation of different activities in schools of urban and rural areas and prepare a report of similar and peculiar activities (both social and educational) highlighting their educational significance.

j) Preparation of a paper for seminar presentation on issues of equality and equity in the context of universalization of elementary education in Indian context : Role of school and community

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course

Suggested Readings

of education. Routledge.

Beyer. L.E. (Ed), (1966) *Creating Democratic Classroom: The Struggle to integrate theory and Practice*, New York, Teachers College Press.

Broudy, H.S. (1977), *Types of Knowledge and Purpose of education*, In R.C. Anderson, R.J.,

Bruner, J.S. (1966), *The Culture of Education*, Cambridge, M.A., Harward University Press

Butchvarov, P. (1970), The concept of Knowledge, Evanston, illions, North Western University Press.

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Debra Heyes, Martin hills, Pam Chistie and Bob Lingard (2007). *Teachers and schooling: Making a difference,* Allen and Unwin, Australia

Delors, Jaques et al. (1996). *Learning: The treasure within – Report to UNESCO of the International Commission on Education for the Twenty-first Century*. Paris: UNESCO.

Freire, Paulo (1970). *Pedagogy of the oppressed*. New York. Continuum

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Naik, J.P. (1975) Equality, quality and quantity: The elusive triangle of Indian Education, allied Publications, Bombay

NCERT (2005) *National Curriculum Framework*, New Delhi.

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Peters, R.S. (1967), The concept of education, Routledge, United Kingdom.

Peters, R.S. (ed), (1975). *The Philosophy of Educatiopn*, Oxford University Press, London.

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Slatterry, Patrick and Dana Rapp. (2002). *Ethics and the Foundations of education- Teaching Convictions in a postmodern world*. Allyn & Bacon

Spiro, W.E. Montanaque (eds) Schooling and acquisition of knowledge (PP. Hillsdale, NJ Erlbaum)

Wall, Edmund (2001). *Educational Theory: philosophical and political perspectives*. Prometheus Books

Winch, C. (1986). *Philosophy of human learning*. London: Routledge.

Winch. C. (1st Edn). (1996). *Key Concepts in the philosophy*

PC 9: Language across Curriculum

Semester-III	Credit-2
Marks 50 (Ext.35+Int.15)	Contact Hours 32

Objectives

On completion of the course, the prospective teacher educator shall:

1. *Identify the language backgrounds of students and facilitate their movement from home / regional language to standard language.*
2. *Analyze the nature of classroom discourse and devise strategies to improve communication skills of students.*
3. *Develop the appropriate skills of reading and writing among the learners and facilitate reading writing connection.*
4. *Envision their role as facilitators of learners" language enrichment irrespective of the subjects they teach.*

Detailed Course Content

Unit 1: Language Background of Learners

18. Varied language contexts of the learners – dialect, regional varieties and standard language; significance of first language in learning
19. Home language Vrs School Language – Transmission and movement: challenges and strategies
20. Understanding multilingual context -Challenges and strategies

Unit 2: Language in Classroom

21. Nature of classroom discourse and significance of language
22. Communication skills – promotion of oral skills through questions, discussion, sharing and interaction
23. Language across various disciplines and subjects – humanities and science; Role of language in ensuring optimum learning in subject areas

Unit 3: Reading-writing connection

24. Reading in different content areas for information and data gathering, critical understanding; Strategies for developing reading skills such as scanning, skimming, in-depth reading, note making
25. Reading-writing connection in different content areas – Use of note making for preparing a write-up, use of information gathering for summarizing,
26. Writing for various purposes – preparing report, writing paragraph, explanatory notes, expansion of ideas, presenting information in various forms such as flow-chart, diagram, pie-chart, histogram
27. Process writing – generating / gathering ideas, drafting, revising and finalizing

Sessional Work

Each student-teacher is required to submit assignment on ***any one*** of the following:

1. Preparation of a report on language diversities of learners in a secondary grade with strategies to address the challenges.

2. Devising an action plan for developing the components (sub-skills) of reading / writing skill of the learners at the secondary level

3. Expansion of an idea / ideas from the secondary level texts and presentation of the same in the form of flow-chart / pie-chart / tree diagram

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course

Suggested Readings

Daniel, Larsen–Freeman (2010). *Techniques and principles of language teaching (2nd Edn.).* Landon: Oxford University Press.

Kumar, Krishna (2008). *The child"s language and the teacher – A handbook*. New Delhi: National Book Trust.

Lightbown, P.M. and Spada, N. (1999). How languages are learned. Oxford: Oxford University Press.

RTS 1: Introduction to Research Methods

Semester-III	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of the course the prospective teacher educator shall:

- *Clarify the conceptual issues related to educational research*
- *State the scope of Educational Research.*
- *Explain the knowledge generation process in historical perspective.*
- *Understand and explain the variety of research approaches.*
- *Understand the relevance of different approaches.*
- *Understand the variety of research methods - Design, sample, tools and data analysis techniques).*
- *Prepare a research proposal.*
- *Understand the application of statistics.*

Detailed Course Content

Unit 1: Research in Education: Conceptual Issues

28. Educational research : Meaning, purpose and areas; Classification by purpose : Basic, Applied and Action Research – their characteristics
29. Research paradigm in education : Quantitative, Qualitative and Mixed – their characteristics
30. Quantitative approaches: Survey, Correlational, Causal-Comparative, Experimental, Single-Subject research
31. Qualitative Approaches: Case Study, Ethnography, Phenomenological, Grounded Theory, Hermeneutic, Historical and Narrative
    (*Fundamental characteristics of the approaches to be dealt at this stage*)

Unit 2: Research Problem, Sampling and Tools

32. Identification of Research Problem: Criteria, and sources; Review of related literature; Problem specification– Formulation of objectives and hypotheses; Types of Hypothesis-Null and Directional or Alternative Hypothesis
33. Sampling: Population and Sample; Sampling Techniques for Qualitative Research (Theoretical sampling, critical case sampling, incidental sampling and sensitive case sampling) and Quantitative Research (Probability Sampling, Simple Random Sampling, Stratified Random Sampling, Systematic Sampling, Multi-Stage Sampling) and Non-Probability Sampling (Cluster Sampling, Incidental Sampling, Purposive Sampling, Judgmental Sampling, Snowball Sampling, etc.); Adequacy and Representativeness of a sample; Measures of sampling error and sampling distribution of a measure.
34. Tools and Techniques of Research: Interview- structured and unstructured; Observation– participant and non-participant; Questionnaire and Opinionnaire; Rating scale and Checklist; Tests- Teacher-made and Standardized, Socio-metric techniques, Projective techniques, Focused Group Discussion, Reflective Dialogue, Anecdotal records, Portfolios and Rubrics

(*Discussion of the tools and techniques shall be made on their development, uses and limitations*)

35. Characteristics of the tools: reliability, validity and usability

Unit 3: Designing a Research Proposal

36. Conceptual framework, Need and Importance; Components of a Research Proposal
37. Introduction: Rationale emerging from the review of related literature, Emerging Research Title, Specification of the statement of the title
38. Research questions, Objectives, Hypotheses, Operational definitions of the key terms to be used, Delimitations (as contrast to limitations).
39. Method of Study
    - Study approach/design
    - Population and Sample
    - Instrumentation - Tools and techniques
    - Procedures: For data collection and data analysis
40. Expected Outcomes of the Study/Emerging Theses
41. Time Schedule and Financial Requirements

Unit-4: Basic Descriptive Statistical Treatment for Data Analysis

1. Basic concepts: Scales of Measurement– Ordinal, Nominal, Interval and Ratio; Measures of Central tendencies and Variability; Percentiles and Percentile Ranks; Standard Score
2. Probability: Normal Probability Curve and its Properties, Deviation from normality and underlying causes
3. Correlation: Concept, Computation and Interpretation of Linear correlation, Product Moment Correlation, Rank Correlation, Biserial Correlation, Point Biserial Correlation, Tetrachoric, Phi Correlation and coefficient of contingency, Coefficients of Determination and Alienation.
4. Concept of Multiple and Partial Correlation, Linear Regression (Bivariate only)

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** assignments of the following:

- Develop a research proposal for investigation of any educational problem
- Critical analysis of any standardized research tool based on its preparation and validation
- Preparation of frequency distribution, plotting of various graphs, calculation of various measures of central tendency and variability, and computation of skewness and kurtosis on a given set of data.
- Computation of various parametric and non-parametric statistics on a given set of data
- Develop a trend report based on the review of literature on any educational issue.
- Application of various analysis techniques on the given qualitative data
-

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course

Suggested Readings

Cohen, L., Lawrence, M. and Keith, M. (2007). *Research methods in education* (4th Edn.). London: Routledge Kegan Paul.

Creswell, John W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. New Delhi: Sage Publication.

Creswell, John W.(2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th Edn.). London: Pearson Education.

Ferguson, G.A. and Takane,Y.(1989). *Statistical analysis in psychology and education* (6th Edn.). New York: McGraw Hill.

Gay,L.R., Mills, G.E., and Airasian, P.W. (2014). *Educational research: Competencies for analysis and application* (10th Edn.). London: Pearson Education.

Glass, G.V. and Stanley, J.C. (1970). *Statistical methods in education and psychology*. Englewood Cliffs, New Jersey: Prentice Hall.

Graziano , M and Raulin, Michalel (1980). *Research methods, A process of inquiry*. New York: Harper and Row.

Keeves, John. P (Ed.) (1990). *Educational research methodology and measurement: An international handbook*. New York: Pergamon Press.

Kerlinger, F.N., and Lee, H.B. (2000). *Foundations of behavioral research* (4th.Edn.). New York: Wadsworth/Thomson Learning.

Lovell, K and Lawson, K.S. (1970). *Understanding research in education*. London : University of London.

Tuckman,B.W.(1972). *Conducting fundamental research*. New York:Harcourt Brace Javonovich Inc.

Van Dalen, D.B. and Meyer, W.J. (1979). Understanding educational research. An introduction. New York: McGraw Hill

PSS-B Pedagogy of Social Science (Paper-1)

Semester-III	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives:

On completion of the course the prospective teacher educator shall:

1. *Develop understanding of the nature of environmental science at primary level and social science at Upper Primary Level as integrated area of study.*
2. *Identify, prepare and collect different teaching-learning resource materials.*
3. *Use the teaching-learning resources effectively in the classroom.*
4. *Examine the prevailing pedagogical practices in classroom which facilitate learning.*
5. *Acquire basic knowledge and skill to analyse and transact the curriculum effectively following wide ranging teaching – learning strategies.*
6. *Make pedagogical analysis of the concepts in both the curricula.*
7. *Develop lesson plans by integrating it with life situations for effective teaching learning.*

Detailed Course Content

Unit 1: Environmental Studies and Science at the Elementary Level

42. Concept and importance of Environmental Studies at Primary Level; Environmental Studies as an integration of Science and Social Studies; Significance of Environmental Studies; Emerging Issues and Implications for Primary Education
43. Nature of Science and importance of Science at Upper Primary level
44. Scientific knowledge, scientific thinking, scientific methods
45. Aims and objectives of teaching Science; NCF–2005 imperatives on learning Science

Unit 2: Social Science Education

46. Meaning, nature and scope of Social Science
47. Importance of Social Science education at Upper Primary level
48. Components of Social Sciences at Upper Primary level: History, Political Science, Economics and Geography; Interrelationships among the subject components of Social Science
49. Objectives of teaching Social Sciences at Upper Primary Level

Unit 3: Approaches and Methods

- Approaches – Transmission, Learner-centered, , Process-based , Interactive, Discovery; Activity-based Approach
- Methods of teaching-learning Science/EVS: Observation, Experimentation, Field Trip, Demonstration, Survey, Problem Solving, Project
- Methods of teaching-learning History and Political Science: Story-telling, Narration-cum-discussion, Field trip, Project, Dramatization
- Methods of teaching Geography and Economics: Observation-cum-discussion, Project

Unit 4: Learning Resources, Planning & Assessment

- Learning Resources: textbooks, work books, reference books; Local resources in Science and Social Science and their use

- Key Resources: Assessing progress and performances, Monitoring and giving feedback, Local and community resources, Using pair work, Using group work, Using questioning (both by teacher and learners) to promote thinking, Talk for learning and Involving all
- Organizing Science Exhibition, Science Club, Science Quiz, Science Corner, Science Laboratory, Science Museum
- Historical Maps, Charts, Pictures, Models, Timeline; Geographical Models, Graphs, Maps, Atlas, Globe; Resource room for Social Science

- Planning Lessons: Yearly, Monthly plans; Planning for each lesson- Steps, lesson planning formats
- Learning Assessment: Tools and Techniques of assessment;
- Construction of different types of test items; Recording of the results of assessment and providing feedback; Using the results of assessment for improvement of learning in Science and Social Science.

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- Preparation of year plan and unit plan in Social Science
- Preparation of 2 lesson plans in Social Science one based on contents of elementary school curriculum
- Preparation of an assessment framework in any one unit in Social Science
- Prepare a paper on any one issue of Social Science Education and present it in seminar
- Visit any of the professional organizations and prepare a report on the in-service professional development programmes that they undertake for Social Science teachers

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Knopf, Carretero M., and Voss, J. F. (Eds.) (1994). *Cognitive and instructional processes in history and the social sciences*. Hillsdale: Lawrence Erlbaum Associate.

Chaudhary, K. P. (1975). *The effective teaching of history in India*. New Delhi: NCERT.

Dhamija, N. (1993). *Multimedia approaches in teaching social studies*. New Delhi: Human.

George, A. M. and Amman, M. (2009).*Teaching social science in schools: NCERT"s new textbook initiative*. New Delhi: Sage.

Ghate, V.D. (1956). *Teaching of history*. Bombay: Oxford University Press.

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Graves, N.G. (1982). *New source books for geography teaching*. Longman. Hall,

David (1976). *Geography teacher*. London: Unwin Education Books.

Huckle, J. (1983). *Geographical educational reflection and action.* London: Oxford UniversityPress. James,

T. H., Arthur,J. and Hunt, M. (2001). *Learning to teach history in the secondary school: A companion to school experience*. London: Routledge Falme.

Kent, A. (Ed.) (2000). *Reflective practice in geography teaching.* London: Paul Chapman Publishing Ltd.

Kochhar, S. K. (1970). *Teaching of political science*. New Delhi: Sterling Publishers.

Kuhn, T. S. (1970). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Lewis, B. (1975). *History: remembered, recovered, invented*. New York: Simon and Schuster, Inc.

Mehlinger, Howard D. (Ed.) (1981). *UNESCO Handbook for the teaching of the freedom struggle in India and Pakistan*. New Delhi: Penguin India.

Morrey, D. C. (1972). *Basic geography*. London: Hien Manns Education Books.

Smith, M. (2002).*Teaching geography in secondary schools : a reader*. London: Taylor& Francis.

NCERT.(2006). *National focus group position paper on teaching social sciences.* New Delhi: NCERT.

Root, M. (1993). *Philosophy of social sciences*. Oxford: Blackwell.

TESS India (2014). *KeyResources. ttp//www.tess-india.edu.in*

Sartori, G. (ED.) (1984). *Social science concepts: A systematic analysis*. New Delhi: Sage Publications.

Trigg, R. (1985). *Understanding social science: A philosophical introduction to the social sciences.* Oxford: Basic Blackwell.

UNESCO.(1965). *Source book for geography teaching*. London: Longman.

Verma, O. P. (1984). *Geography teaching*. New Delhi: Sterling Publication.

Walford, R. (1981). *Signposts for geography teaching*. London: Longman.

Wilkins, E. J. (1979). *Elements of social science: A philosophical introduction to the social sciences.* Oxford: Basic Blackwell.

RTS Pr.1: Dissertation(Part-I)

Semester-III	Credit-2
Marks 50 (Internal)	Contact Hours 64

Objectives

On completion of this part of the dissertation, the prospective teacher-educator shall:

- *Identify the area of research and specify the problem for conducting research.*
- *Complete a thorough review of the related literature on different aspects of the selected problem for research*.

Activities

Identification of the Problem: Preparing a dissertation on any educational problem after following the methods of Educational Research is one of the important activities of the Programme. During this semester, the prospective teacher educators are exposed to the basics of Educational Research (RTS-I) which provides the basis for initiating the research project at this stage.

As a first step of dissertation work, identification of the problem for research after following the basics of research methodology has been stipulated in this semester. As such activities related to Dissertation Practicum during this semester shall comprise the following:

1. **Identification and Specification of the Problem -** After the review of the research literatures, the prospective teacher educator need to focus on a specific problem area giving proper justifications based on review of literature. The problem for the research has to be specified with proper statement of the problem following international standards (preferably APA

standards). Along with the statement of the problem, the researcher needs to specify the variables (independent, dependent, category etc.) involved in the problem.

2. **Review of Related Literature –** Keeping a few educational issues in mind, the student shall go through the related literatures, specifically articles from quality referral research journals, books and original work of reputed researchers in the area(s) of interest. At least 10 articles from international journals or books and 10 from Indian sources need to be reviewed. A report, at least 5 to 8 pages (A-4 size with 12 font letters and 1.5 inter-liner spacing), need to be submitted by each student.

Each candidate is expected to present the final specification of the problem of research supported by the review of research in the seminar for further modification and finalization.

Criteria for Assessment

Sl. No	**Activity**	**Marks**
1.	Problem Identification and Specification	20
2.	Review of Related Literature	30
TOTAL		**50**

RTS Pr.II Research Seminar

Semester-III	Credit-2
Marks 50(Internal)	Contact Hours 64

While participation in seminar activities for the students in this programme shall be a regular feature across the semesters, involvement in research seminar is an essential requirement as required under the _Research, Tools & Self Development (RTS)' component. The research seminar is essentially meant to help the students to focus on their respective area of research through probing, sharing and developing their research project.

Objectives

The prospective teacher-educator shall:

- *Develop ability to share the acquired knowledge and understanding specific to their area of research*
- *Share the different dimensions of research with peers and faculty members*
- *Prepare research based paper and improve it with intensive peer deliberation*

Mode of Organization

- Depending on the number of students, the institution shall decide on the number and duration of research seminars to be conducted so that each student shall get opportunity of presenting his/her research proposal on its three aspects viz. (i) the rationale of the topic emerging from related literature, (ii) method of research, and (iii) mode of analysis and discussion of results.

Other topics related to the areas relevant to the research may also be included for deliberation in the research seminar.

- Presentation of papers, participation in the seminar and preparation of the seminar reports shall be the three basic components of the seminar activities which shall constitute the basis of assessment. Every student may be given opportunity to prepare seminar report.
- Attendance in the research seminars by a student shall not be below 90 percent.
- The criteria of assessment as specified below may further be refined by the respective institutes.

Criteria of Assessment

Activity	Marks
Quality of the Seminar paper	20
Mode of presentation	15
Extent and quality of participation	07
Quality of Seminar Report	08
TOTAL	**50**

PSS Pr.II –School Internship-3

Classroom Transaction and Related Activities

Semester-III	Credit-4
Marks 100(Internal)	Contact - 6 weeks

The major thrust of the school internship programme, among other closely related activities like school exposure and exposure to multi-cultural contexts in schools, is to broaden the visions and improving the performance capabilities of the prospective teacher-educator on the classroom transactions to enhance the quality of teaching-learning process. While engaged in improving the classroom performance as a teacher, the prospective teacher-educator needs to be efficient in several related activities like planning the academic activities for one academic session, preparation of lesson plans on a regular basis, developing, collecting and managing resources (materials, activities and human) for teaching and learning in and out of classroom. Besides developing these abilities as professional teachers, these activities during this part of the school internship are intended to prepare prospective teacher-educators for mentoring the student-teachers in their basic roles as effective classroom teachers.

Objectives

After completion of this course, the prospective teacher-educator shall:

- *Develop professional capabilities and sensibilities as an effective teacher and maintain sustained engagement with learners and teachers of schools.*
- *Acquire required skills and competencies to cater to diverse needs of the learners in schools*
- *Apply the theoretical understanding developed through various perspective and pedagogic courses in the actual classroom practices for enhancing quality of teaching and learning.*
- *Internalize the role of a teacher and a teacher-educator – as a facilitator of learning, classroom manager, resource mobilizer and manager, innovator, evaluator of learner performance, planner and organizer of other curricular activities, mentor and counselor for children and practicing teachers, developer and evaluator of curriculum text books and other TLMs etc.*

Organization

The activities during this internship programme shall be conducted in three phases as follows:

I. Preparatory Activities,
II. Activities during Classroom Transaction,
   a. Teaching-Learning Activities
   b. Other Related Activities
III. Follow up Activities.

I. Preparatory Activities

Prior to conduct of teaching-learning activities in the classroom, the following preparatory activities shall be completed:

- Orientation of the prospective teacher-educators,
- Sharing meeting with the teachers and headmasters of the cooperating schools in the institution and working out the programme details for the internship

- Demonstration lessons by the faculty members followed by post-demonstration discussion
- Criticism lessons by the student-teachers(one lesson by each student-teacher in any one of the methods opted) under the supervisory support of the method teachers, attended by all prospective teacher-educators of the method concerned
- Placement of prospective teacher-educators in cooperating schools for internship activities.

II. Classroom Transaction Activities

Each prospective-teacher educator shall have to perform two categories of interrelated activities in the classroom and school: Teaching-learning activity as per the time table of the school, and other related activities for facilitating learning.

a. Teaching-Learning Activities

- Preparation of lesson plans along with the required TLMs by the prospective teacher-educator in his/her concerned pedagogy subject for conducting teaching-learning transactions with the students of the allotted class.
- Delivery of practice lessons by the prospective teacher-educator with supervisory support and feedback from faculty members. Each shall deliver 20 lessons in the concerned school subject he/she offers, excluding the criticism lesson. Out of these 20 lessons, 30% (6 nos.) shall be delivered in the upper primary classes (Classes VI to VIII) and the remaining 70 % (14 nos.) lessons in the secondary classes (Classes IX and X).
- Observation of five peer-lessons and recording of the performance with authentication by the concerned supervisors.
- Feedback session in the Teacher Education Institution after each spell of ten-day practice teaching to be attended by all prospective teacher-educators for sharing their experiences.

b. Other Related Activities

Activities related to promote learning like the ones indicated below shall be conducted by each prospective-teacher educator: Each has to perform ***at least 04(four) activities*** including the items marked by _**‘.

- Preparing scheme of lessons in the subject teaching in the class**
- Preparation of TLMs, Learning Activities and model test items**
- Preparation of wall magazine/news bulletins
- Participating in classroom beautification activities
- Taking arrangement classes when required
- Organizing and participating in school literary and recreational activities
- Conducting quizzes, debates song and drawing competitions in the classroom
- Organizing of and participating in science exhibition, science fair, science club/nature study club/eco club activities, Mathematics Melas, Art and Craft exhibitions etc.
- Innovative teaching- learning activities

III. Follow up Activities

- Presentation of innovative and creative work done by the prospective-teacher educator during internship.
- Suggestions and feedback from the teachers and Heads of the cooperating schools for further improvement of the internship activities

- Sharing of prospective-teacher educators‘ internship experiences in the institution and their feedback on overall organization of internship programme for future action.

Attendance

- The minimum attendance of each student-teacher for school internship programme shall be 90%

Assessment of Internship Performance

The classroom transaction activities and the follow up activities shall be assessed internally as per the following criteria.

Criteria for Assessment of Internship and Records

Activities	Marks
1. Assessement of classroom teaching and other school activities rated by the headmaster and the teachers of the school.	20
2. Assessment of Lesson Plan Record	15
3. Peer assessment of the lessons	10
4. Assessment of lessons delivered as per the plan by the faculty members	25
5. Assessment of other related activities (5× 4)	20
6.Presentation and participation in follow up activities	10
TOTAL	**100**

Each Teacher Education Institution shall prepare a detailed plan on school internship programme for Classroom Transaction and Related Activities in consideration of the activities indicated above sufficiently in advance of commencement of the activities.

The assessment, which is entirely internal, may be conducted preferably by a team of faculty members specifically designated for the purpose.

PSS Pr. IV Interaction with Community

Semester-III	Credit-1
Marks- 25 (Internal)	Contact Hours- 32

As education has become one among the essential needs for living for every individual, schools need to maintain close liaison with the communities in its neighborhoods for ensuring enrolment, retention and providing education of high quality. The prospective teachers as well as teacher- educators are required to be well informed regarding the socio-economic-cultural status and needs of the communities nearby the schools and ways to interact with community members including the parents regarding their mutual efforts on a continuous basis for creating an enabling school climate for ensuring quality education for their children. .

Objectives:

After the completion of this programme, the prospective teacher-educator shall:

- *Acquaint himself/herself with the factors working within the society, community i.e. knowledge of social realities that have bearing on school and education.*
- *Arouse his/her interest in the processes of social and economic reconstruction of the community.*
- *Develop awareness on the educational and social issues and needs of the community*
- *Identify and plan for using community resources, both material and human, for enriching the quality of school education*

The students (prospective teacher-educators) may spend two weeks at a stretch during the Semester 3 in the identified villages/communities and/or in locations decided by the institute/department. Separate activities may be planned every year.

Interaction Strategies

Discussion, Rally, Competitions (Debates) Posters and Banner displays Working in community setting, Mass movement, *Nukkad* Performances, Local action group formation, surveys, interviews, action research, case study, dissemination of success stories etc**.** may be employed for more meaningful interaction.

Suggested Activities

- micro planning of a school community relationship along with the survey on educational status of the community
- study of the nature of community participation in a elementary/secondary school activities
- survey of community resources for participation in scholastic and co-scholastic activities of a school
- educational survey of urban slums
- report on social customs, traditions and practices and their bearings on education of the children of the community in the selected localities
- survey of a village/town with at least 20 households to study the socio-economic and educational status of the inhabitants
- study of food habits of 10 houses, 5 each of urban and rural area and suggest balanced diet
- tree plantation programme in the campus/nearby village
- survey of parent‘s attitude towards education of their children
- organization of campus beautification programme witb community participation
- identification of problems of parents with respect to education of their children

- conducting awareness programmes in the community – like Environment conservation, tree plantation, watershed management, health programmes, like vaccination, polio drop etc.
- survey of AIDS awareness, electoral awareness, road safety, human rights, women rights, literacy programmes etc. in the community
- cleanliness drives in the community and awareness about its needs
- training of community on some simple vocations for self-employment
- training of community in First Aid
- organizing national programmes like _Swatchha Bharat Abhiyan', _Padhe Bharat, Badhe Bharat', _Beti Bachao, Beti Padhao', _Kaushal Bharat, Kushal Bharat' in the community

Many more such exercises could be conceived and can be conducted individually or in groups under the supervision of faculty members.

Assessment Criteria

Prospective teacher educators are required to complete at least 2 (TWO) activities as suggested above or otherwise and submit the report which shall be evaluated internally by a committee constituting of at least 3 faculty members.

The performance of the prospective teacher-educators shall be assessed holistically and marks shall be awarded out of the total 25 marks based on degree of involvement of the candidate in selection, strategy building, participation and the quality of the report.

PSS Pr. V Discourse with Other Related Agencies

Semester-III	Credit-1
Marks- 25 (Internal)	Contact Hours- 32

There are several institutions and organized social groups situated and functioning in the catchment areas of the school having potential for supporting school education in various ways, both formal and informal manners. Examples of such institutions and organizations are Banks, Post Office, Hospitals/Health Centers, Panchayati Raj Institutions, Agricultural farms, Self-help Groups, Youth Clubs and the like. This programme aims at raising the awareness levels of prospective teacher- educators, school functionaries and the concerned institutions and organized groups regarding their roles and the ways in promoting quality of school education

Objectives

After the completion of this programme, the prospective teacher-educator shall

- *Gather intimate knowledge of the structure and functioning the institutions/organizations and their sphere of activity.*
- *Explore the scope of collaboration of local institutions/organizations with the developmental and academic activities (both curricular and other curricular activities of the schools.*
- *Develop a tentative plan of action with the local institutions/agencies/social groups for their collaboration with school activities*

Interaction Strategies

Observation, Interview, Individual and Group Discussion, Case Study, Video recording

Suggested Activities

- Survey of activities of local NGO/ Club/ community center/ Self Help Group/ Panchayat/ press/ TV channels/ Community radio etc. and their implications for education
- Visit to Anganwadi Centers and interaction with SHG in the locality to study their functioning.
- Focus group discussion of the members of any institution/organization on their functioning and scope of collaboration with the schools
- Preparation of report on the developmental activities of different organizations where the students and teachers can be involved for a social cause thus enhancing their learning.
- Developing a document of inter-organizational collaboration in developing school development and students‘ learning.

Several such other activities for encouraging discourses with related agencies at the local level can be conceptualized at the respective teacher education institutions/department.

Assessment Criteria

Prospective teacher educators, individually or in groups, are required to have discourse with any 2 (TWO) activities as suggested above or otherwise and submit the report which shall be evaluated internally by a committee constituting of at least 3 faculty members.

The performance of the prospective teacher-educators shall be assessed holistically and marks shall be awarded out of the total 25 marks based on degree of involvement of the candidate in selection, strategy building, participation and the quality of the report.

PC-II Philosophical Perspectives of Education

Semester-IV	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of the course the prospective teacher-educator shall:

- *Explain the structure of Philosophy in terms of its elements and their relationship*
- *Explain the inter-relationship between Philosophy and Education*
- *Understand the Indian Philosophical traditions and their implications for life and education*
- *State the basic postulates of different western Philosophies and their implications for education*
- *Understand the contributions of educational thinkers to educational thought and practice in western and eastern countries*
- *Analyze different issues in Educational Philosophy and workout the strategies*

Detailed Course Content

Unit 1: Philosophy and Education

- Philosophy : Meaning, nature and function (Western and Eastern view points)
- Structure of philosophy : Metaphysics, Epistemology, Axiology (Ethics and Aesthetics) and Logic
- Philosophical methods : Contemplation, Speculation, Enquiry and Analysis
- Philosophy and Education : Their Interrelationship; Educational Philosophy – Emergence, meaning, nature, functions and scope

Unit 2: Indian Philosophical Traditions

- Vedic Philosophy - Concept of Chaturashram and Purusartha
- Vedanta Philosophy – Features; Education in Upanishadas
- Philosophy of Jainism and its contributions to education
- Philosophy of Budhism and its contributions to education

Unit 3: Western Philosophical Traditions

- Idealism, Naturalism, Pragmatism and Realism : Their basic philosophical postulates and implications for Education
- Eclecticism and its educational implications
- Contemporary / modern educational thought : Essentialism, Perennialism and Progressivism – Features and their implications for education
- Existentialism and Humanism : Salient features and their implications for education

Unit 4: Great Educational Thinkers

- Plato, Aristotle and Socrates – Relevance of their educational thoughts in the present context
- Rousseau, Froebel, Montessori, John Dewey and Paulo, Friere – Their educational ideas and experiments, and the present relevance
- Gandhi, Tagore, Sri Aurovinda, and Vivekananda – Their educational thoughts and experiments, and their relevance in the present India

- Dayananda Saraswati and J. Krishanamurthy – Their contributions to educational thought and practice in the present India

(Discussion be made with reference to aims of education, curriculum, teaching- learning pedagogy, role of teacher and discipline

Sessional Work

Every prospective teacher-educator shall undertake *any two* of the following:

- Preparation of an appraisal report on inculcation of values through curriculum and pedagogy in Government and private-managed schools in Odisha
- Preparation of a write-up on essence of Indian Philosophical traditions and its relevance to present educational scenario in India
- Preparation of seminar paper on contextual relevance of Paulo Friere's educational ideas to present Indian education
- Review of the text titled ―The Pedagogy of the Oppressed‖ by Paulo Friere

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Amaldass, A. (2001). *Introduction to Philosophy.* Chennai: satyaNilayam Publications. Brubacher,

J. (1962). *Modern Philosphies of Education*. McGraw-Hill Co.

Butler, J.D. (1968). *Four Philosophies and their Practice in Education and Religion* (3rd Ed.) New York: Harper and Row Publisher.

Chakravarthy, D.K. (2000). *Fundamental Questions of Epistemology and Metaphysics.* New Delhi: Omsons Publications.

Chaube, S.P., and Chaube, A. (2007). *Philosophical and Sociological Foundations of Education.* Agra: Vinod PustakMandir.

Deota, N.P. (2012). *Effective Leadership Qualities.* Germany: Lap Lambert Academic Publishing. Deota,

N.P. (2012). *Kaleidoscopic Views on Education*. Germany: Lap Lambert Academic Publishing.

Dewey, J. (1963). *Democracy and Education*. New York: Mac Millan & Co.

Kabir, H. (1961). *Indian Philosophy of Education*. Bombay: Asia Publishing House

Park, J. (Ed.) (1968). *Selected Readings in the Philosophy of Education (3rd Ed.)*. London: The MacMillan Company.

Radhakrishnan, S. (1953). *History of Philosophy: Eastern and Western* (Vol. I and II). London: George Allen & Unwin Limited.

Sharma, R.N. (2000). *Textbook of Educational Philosophy.* New Delhi: Kanishka Publishers & Distributors.

Smith, P.G. (Ed.) (1970). *Theories of Value and Problems of Education.* London: University of Illinois Press.

Thakur, A.S. (1977). *The philosophical Foundations of Education.* New Delhi: National Publishing House.

RTS-5 Self Development

Semester-IV	Credit-2
Marks 50 (Ext.35+Int.15)	Contact Hours 32

Objectives

On completion of this course, the prospective teacher educator shall:

- *Elaborate the different dimensions of self-development and different goal setting behaviour of an individual thereof.*
- *Explain the strategies for personal development in work place thereby improving professional competence.*
- *State the characteristics development of self-development from early childhood to youth.*
- *Realize the ways of personal development through development of self-awareness*.

Detailed Course Content

Unit 1: Understanding Self-Development

- Concept, importance , objectives and dimensions- knowledge and awareness, self-esteem/self-identity, dreams and aspirations, self-analysis and assessment
- Goal setting and self-development: Developing competence, achieving autonomy, developing purpose, developing integrity, managing emotions, developing matured interpersonal relationships
- Personal development in work place- work-life balance, time management, stress-management, social relation management and counseling.
- Self-development and professional competence: indicators of professional competence, self-development facilitating professional competence

Unit 2: Self-Development across the Life Span

- Self-awareness during infancy: sensory motor feedback and self awareness, contingency cues and self-awareness, visual self-recognition, milestones in self-development during the first 2 years of life
- Developmental changes in self-feelings and self-concepts during childhood adolescence and youth
- Adolescence identity crisis: Ericksons stages of Psycho-social development and crisis resolution in self identity
- Self concept during adulthood.

Unit 3: Self-Awareness and Personal Development

- Personal development: meaning, characteristics, uniqueness
- Ways to improve personal development- Methods and learning programmes
- Self-awareness for Personal Development: self-analysis of personal strengths, weaknesses, opportunities and threats, self-reflection and self-criticism as means of self- awareness
- Techniques of personal development:

Sessional Work

The prospective teacher-educator shall undertake ***any one*** of the following:

- Preparation of a report on personal development in work place relating to any profession.

- Prepare a seminar presentation on crisis of self-development among the secondary school learners and strategies to resolve.
- Preparation of a set of activities for personal development elementary school children.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Agochiya, Devendra (2010). Life Competencies for Adolescents-Training Manual for Facilitators, Teachers and Parents, Sage Publications Pvt. Limited, New Delhi

Bandura, A. (1982). Self-efficacy and mechanism in human agency. *American Psychologist,* Bandura, A.

(1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice Bandura, A. (1993).

Perceived self efficacy in cognitive development and functioning.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

Dalal, A.S. (ed) (2001). *A Greater Psychology – An Introduction to the Psychological Thoughts of Sri Aurobindo*. Puducherry, Sri Aurobindo Ashram Pub.

Krishnamurti, J. (1998). *On Self- knowledge*. Chennai, Krishnamurti Foundation India. Krishnamurti, J. (2000). *Education and Significance of Life*. Chennai, Krishnamurti Foundation India.

Schneider, F.W., Gruman, J.A. & Coutts, L.M. (Eds.) (2012). *Applied Social Psychology- Understanding and Addressing Social and Practical Problems* (2nd Edn). New Delhi: Sage Publications.

Sherfield, R.M.; Montgomery, R.J.; & Moody, P.G. (Eds.) (2009). *Cornerstone- Developing soft skills* (4th Edn). New Delhi: Pearson Education

Swami Vivekananda (1988). *Selections from the complete works of Swami Vivekananda*. Mayavathi: Advaita Ashrama.

UNESCO (1996). *Learning the Treasure within –Twenty First Century Education*. UNESCO Education Commission Report.

UNICEF (2006). *Life skills modules-Adolescence Education Program*. New Delhi: UNICEF.

Venkateshamurthy, C. G. & Govinda Rao, A.V. (2005). *Life skills education training package.* Mysore: R.I.E..

TEC-I Perspectives in Teacher Education

Semester-IV	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of the course, the prospective teacher-educator shall:

- *State the importance of pre-service and in-service teacher education in respect of growing demands for quality school education.*
- *Describe the development of teacher education in India during post independence period.*
- *Specify the characteristics, needs and challenges of teacher education at the elementary and secondary level.*
- *Elaborate the visions for teacher education in response to the emerging demands of the changing scenario of school education.*
- *State the importance of continuing professional development of teachers and the efforts made so far in this direction through different national and state programmes.*
- *Use various methods and approaches appropriately in curriculum transaction in teacher education courses.*

Detailed Course Content

Unit 1: Understanding Teacher Education

- Teacher Education : Concept, Importance (with reference to teaching profession and quality education), Components (Pre-service and In-service)
- Development scenario in India: Post-independent scenario with reference to the recommendations of Secondary Education Commission (1952-53), The Education Commission (1964-1966), National Policy on Education, 1986 / 92, POA, 1990,NKC,2009 on Teacher Education system
- Envisioning Teacher Education in response to emerging demands of school education; Bases of envisioning – NCF, 2005, NCFTE, 2009, RTE Act 2009, Justice Verma Commission, 2012, MHRD (GoI), 2012

Unit 2: Pre-service Teacher Education Programme

- Pre-service teacher education: Meaning, Importance, Objectives and Modes (face-to- face and distance)
- Stage specific programmes – Pre-school, Elementary and Secondary and Higher Secondary Teacher Education Programmes with reference to duration, curriculum, staffing pattern, assessment etc as per NCTE Regulations, 2014
- Stage specific Teacher Education Institutions in Odisha – Preschool , Elementary (ETEIs, DIETs, BITEs), Secondary and Higher Secondary (Govt. Training Colleges, CTE, IASEs) with reference to their structures and functions
- Addressing issues in PSTEP in Odisha with reference to institutional facilities, enrolment to the programmes, human resources, curriculum development and transaction processes, linkages with support institutions

Unit 3: In-service Teacher Education Programme

- In-service teacher education: Meaning, importance and objectives in the context of Continuing Professional Developmenty (CPD)
- Types of programme – Subject-based (content and pedagogy) and theme-based with reference to their objectives, duration,components, planning and organization (assessment of training needs, structuring training components and developing course materials)
- Approaches and modes of organizing CPD: Approaches- self study, participatory (workshops, panel discussion, FGD etc); Modes – face-to-face and distance/open learning (OER) with reference to their objectives, advantages and limitations
- Addressing challenges in CPD in Odisha with reference to planning, organization, collaboration, programme quality, assessment and feedback; importance and role of professional learning communities for CPD; role of professional organizations for professionalism and professional ethics

Unit 4: Management and Support Services

- Management structures and their functions at elementary and secondary levels in Odisha – SME Department, DTE&SCERT, Teacher Education Institutions (Elementary and Secondary)
- Support organizations: National level – MHRD, NCERT, NUEPA, NCTE. and UGC; State level – SCERT, OPEPA, OMSM, BSE, ELTI and Unicef (Odisha Office) with reference to their roles and functions
- Challenges and issues relating to – governance system, human resource, collaboration among the stakeholders, job opportunities and recruitment, service conditions etc.

Sessional Work

A student-teacher shall undertake ***any two*** of the following activities.

- Preparing a report on the programme for developing professionalism in primary teacher training institution through field visit.
- Developing a strategy suggesting reforms in secondary teacher education programme with reference to NCF - 2005 and RMSA.
- Preparation of a course material for meeting the needs of a teacher in any subject at the secondary level.
- Conduct of a team teaching programme in teacher education institute and reporting on its impact.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Beck, Clive & Clark Kosnik Albany (2006): *Innovations in teacher education: A social constructivist approach.* London:State University of York.

3Cohen Louis, Minion Lawrence & Morrison, Keith (2004). *A guide to teaching practice* (5th Edn.). London and New York: Routledge Falmer..

Darling Harmmond, Linda and Bransford, John (2005). *Preparing teachers for a changing world.* Son Francisco: John Wiley & Sons.

Day, C. and Sachs, J. (Ed.) (2004). *International handbook on the continuing professional development of teachers.* Maidenhead: Brinks Open University Press.

Furlong John (2013), *Education: An anatomy of the discipline*. London: Routledge.

Govt. of India (1953). *Report of Secondary Education Commission*. New Delhi.

Govt. of India (1986/1992). *National policy of education*. New Delhi: Dept. of Education, MHRD. Govt.

of India (1996). *Report of Indian Education Commission (1964-66).*. New Delhi.

Herne Steve, Jessel John and Griffith, Jenny (2000). *Study to teach: A guide to studying in teacher education*. London and New York: Routledge Falmer..

Korthagen, Fred A.J.et al. (2001). *Linking practice and theory: The pedagogy of realistic teacher education.* New York: Lawrence Erlbaum Associates.

Loughran, John (2006). *Developing a pedagogy of teacher education : Understanding teaching and learning about teaching.* New York: Routledge.

Miyan, Mohammad (2004). *Professionalisation of teacher education*. New Delhi: Mittal Publications.

Mukhopadhyay, Sudesh and Anil Kumar, K (2001). *Quality profiles of secondary schools*. New Delhi: NIEPA.

NCERT (1997). *Code of professional ethics for teachers.* New Delhi.

NCTE (1998). *Competency based and commitment oriented teacher education for quality school education: Pre-service education*. New Delhi.

NCTE (1998): *Policy perspectives in teacher education*. New Delhi. NCTE

(2009). *Curriculum framework of teacher education*. New Delhi.
NCTE (2014). *Norms and guidelines of teacher education programme*. New Delhi.

NCTE. (1998). *Policy perspective in teacher education: Critique and documentation*. New Delhi.

Reimers, Eleonora Villegas (2003). *Teacher professional development: An international review of the literature.* Paris: IIEP,UNESCO.

Sahoo,P.K.et al (Eds.) (2010). *Professionalism in teacher education*. New Delhi, Concept.

Siddiqui, M.A. (1993). *In-service education of teachers*. New Delhi: NCERT.

Singh L.C. (Ed 1990). *Teacher education in India*. New Delhi: NCERT.

Yadav, M.S. and Lakshmi, T.K.S. (2003). *Conceptual inputs for secondary teacher education: The instructional role.* New Delhi: NCTE.

PSS-2 Pedagogy of Physical Science (Paper-2)

Semester IV	Credit-4
Marks 100(Ext. 70+ Int.30)	Contact Hours 64

Objectives

On completion of this course, the prospective teacher-educator shall:

- *State nature and importance of Physical Science at secondary school level*
- *Plan learning designs based on problem situations, enquiry and projects to facilitate learning of Physical Science*
- *Realize his/her role as a facilitator enhancing Physical Science learning in the real classroom situation*
- *Explore different ways of creating learning situations considering learning needs and context of the learner*
- *Use learning resources as per the learning needs*
- *Familiarize with various tools and techniques of assessing physical science learning*

Detailed Course Content

Unit 1: Nature and Scope of Physical Science

- Nature and Scope of Physical Science at secondary and higher secondary levels
- Place of Physical Science in secondary school curriculum: Place and importance; Correlation of Physical Science with other school subjects
- Aims and objectives of teaching learning Physical Science at secondary level; Specification of learning objectives

Unit 2: Planning of Facilitating Learning in Physical Science

- Need for planning teaching-learning experiences in Physical Science
- Identification of Concepts and unifying themes related to Physical Science, inter-relation among various concepts in Physical Science
- Designing of Year plan and Unit Plan in Physical Science and its significance in understanding comprehensive nature of knowledge
- Planning lessons based on behaviourist and constructivist approaches - 5E model, ICON model

Unit 3: Learning Resources in Physical Science

- Laboratory as a leaning resource: Structure, design, organization and maintenance of the laboratory
- Improvisation of teaching aids
- Different forms of ICT and their application in teaching and learning Physical Science
- Integration of ICT in teaching-learning processes of Physical Science

Unit 4: Learning Assessment in Physical Science

- Learning indicators in Physical sciences and assessment of these learning indicators in the form of learning evidences/ outcome in classroom and laboratory
- Construction of classroom tests and unit test.
- Alternative strategies for assessment like assignments; reports and records (laboratory record, reports of field visits and excursion, Project work report); Portfolios and Rubrics; Preparation of learners‘ profile.

- Recording and reporting of learning evidences/outcome: Marks and grades; Assessment as reflecting process to facilitate further learning.

Sessional Work

A prospective teacher-educator shall undertake ***any two*** of the following activities:

- Preparation of a yearly plan in Physical Science for any one grade at secondary school level
- Preparation of 2 lesson plans in Physical Science- one based on behaviourist and another on constructivist approach
- Preparation of an assessment framework in any one unit in Physical Science 4. Debate(choose any one topic from unit
- Preparation of a report based on observation of any one programme for capacity development in Science teaching of secondary school teachers

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Alsop,S., Hicks, K. (2007). *Teaching science: A handbook for primary and secondary school teachers*. New Delhi: Kogan Page.

Bennett, Judith (2003). *Teaching and learning science : A guide to recent research and its applications*. London: Continuum.

Carin, A and Sund, B. R. (1964). *Teaching science through discovery*. Columbus Ohio: Charles E. Merrill Books Inc.

Martin, R., Sexton,C., Wagner, K. and Gerlovich, J, (2000). *Science for All children : Methods for constructing understanding.* London: Allyn and Bacon,.

Millar, Robin (1984). *Doing science : Images of science in science education*. London: The Falmer Press,.

Nathan S Washton (1967). Teaching Science Creatively, Saunders Company, London.

NCERT (2000). *Position paper of national focus group (NFG) on teaching of science.* New Delhi: National Council of Educational Research and Training (NCERT).

NCERT(2011). *Pedagogy of physical science* (Part I&II). New Delhi: NCERT.

Novak, D. J. and Bob Gowin, D. (1984). *Learning how to learn*. Press Syndicate of the University of Cambridge, Ohio.

SSC-1 School Education: Systems, Structures and Functions

Semester IV	Credit-4
Marks 100(Ext. 70+ Int.30)	Contact Hours 64

Objectives

On completion of the course, the prospective teacher-educator shall:

- *Develop insights into nature and types of education systems prevalent in India;*
- *Understand the systems involved in the development of school education;*
- *Appreciate the role of various structures of school education;*
- *Appreciate the role of different structures of school education;*
- *Develop critical understanding of commissions, National Curriculum Frameworks, policy papers and different thrust areas for school education.*

Detailed Course Content

Unit 1: Introduction to School Education

- Definition and Meaning of School Education
- Aims and Objectives of School Education in the present context
- Nature of instructional system in school education
- School and Classroom as social system; Role of teacher as an agent of bringing social change through schooling – success and failure in the present context
- The Symbiotic relationship of School and Community

Unit 2: School Education System

- System Characteristics: Concept of organization systems – meaning, elements of a system- Resources, procedures, data/information, intermediate data, processes; System characteristics- Outputs and inputs, Processors, Control, Feedback, Environment, Boundaries and interfaces; Types of systems- Physical and abstract, Open and closed; School as an open system
- Types of schools by management prevalent in the country: Government, Government- aided, Private; Religious minority schools; Tribal schools; Model schools; Common School System - Concept and goals, Neighborhood Schools; Kothari Commissions recommendations, Implementational drawbacks
- Teacher preparation systems for different levels of schooling (Pre-schools, Elementary, Secondary and Senior Secondary schools)
- Specific roles played by national education policies and curriculum frameworks for systemic improvement at school level

Unit 3: Structure of School Education

- Segmentation of school structure according to levels, boards, medium, and ownership
- The structure of pre-primary, elementary, secondary and senior-secondary. Evolution of school structure in India after Independece: from {Lower Primary(3yrs)+ Primary (2yrs)+UP(2yrs)+Secondary (4yrs)} to the present structure of { Primary (5yrs)+UP(3yrs)+Secondary (2yrs) + Higher Secondary (2yrs)}
- Comparison of School Boards (CBSE, ICSE, STATE BOARDs)across India
- Common School System – Concept; Historical background, Need and importiance in Indian Context; Recommendation of Kothari Commission, Reasons of non-implementation of the recommendation.

Unit 4: Functions of School Education

- The functioning of the school system as a whole; The effectiveness and efficiency of school functioning – Internal and External; Indicators of internal efficiency of school functioning (Retention and Dropout rates, promotion rate, grade repetition rate, grade survival rate, transition rate)
- Different stake holders and their roles in the functioning of the schooling: Principal/ Head teacher, teachers, parents, students, School administration, Community
- The different latent functions of school:
  - Socialization: personal identity and social conduct, school as an instrument of social change
  - Enculturation: transmission of cultural norms and values, national identity and citizenship roles; Aculturation: pluralism, the school's role in pluralistic society
  - Values through school education: Personal, social, artistic, political, religious, spiritual, intellectual, moral and economic
  - Education for Environment Protection and Pollution control

Sessional Work

Every prospective teacher-educator shall undertake *any two* of the following:

- Collection of evidences of different systems of education
- Develop a report of school functionaries
- Group work for preparation of paper on education curriculum frameworks and national education policies.
- Group discussions on: education through ages, socialization and Culturization.
- Seminar presentation on the role of teachers in school system in different types of schooling
- Case Study of a particular type of school

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Chagla,M.C. (1966). *Education and the nation*. NewDelhi: Allied Publishers,.

Chakrabarti, M. (1997). *Organization of school education*. New Delhi: Concept Publishing Company,

Ghosh, S.C(2007). *History of education in India*. New Delhi: Rawat Publications,.

Malhotra, P.L., Parakh. B.S., and Misra, C.H.K. (1986). *School education in India: Present status and future needs*. New Delhi: NCERT.

Mohanty, J. (2004). *School management: New trends and innovations*. New Delhi: Deep & Deep Publications..

Mohanty, J. (2008). *Studies in school education*. Deep & DeepPublications, Pvt. Ltd. New Delhi. Singha, H.S. (1991). *School education in India: Contemporary issues and trends*. New Delhi: Sterling Publishers.

RTS Pr.1: Dissertation(Part-II)

Semester-IV	Credit-2
Marks 50 (Internal)	Contact Hours 64

Objectives

On completion of the course in this semester, the prospective teacher educator shall

- *Finalize the research proposal for the identified problem.*
- *Develop the tools for the study.*

Activities

The activities concerned with the dissertation work in this semester have been divided into two parts: Finalization of the research proposal and construction/adoption of tools for the study.

3. **Finalization of Research Proposal –** The proposal needs to be prepared and presented in the research seminar. The proposal shall include the rationale for the study (emerging from the reviews of related literature), objectives and hypotheses, the method with specifications of participants (sample), tools, procedure of data collection and data analysis. The draft proposal shall be finalized after being shared in research seminar.

4. **Development/Adoption of Tools** - Following the provisions in the research proposal, the researcher shall construct the tools with guidance of the mentor faculty member and after discussion on it in the seminar the tools need to be finalized. If the researcher intends to use available tools suitable for the study, those tools need to be modified for adoption. In either cases, the tools need to be finalized after try out and necessary item analysis.

Assessment Criteria

Activity	Marks
1. Preparation of Research Proposal	
➢ Preparation of Research Proposal	15
➢ Seminar presentation and finalization	10
Total	**25**
2.Development of Tools	
➢ Tool development/adaptation	15
➢ Presentation of the tools and their modification	10
Total	**25**
GRAND TOTAL	**50**

TEC Pr.1: Internship in Teacher Education Institutions

Semester-IV	Credit-4
Marks 100 (Internal)	Duration- 6 weeks

Objectives

On completion of this programme the prospective teacher-educator shall:

- *understand his / her roles as teacher-educator, after observing an analyzing the activities of the teacher-educators in the teacher education institutions (elementary and secondary)*
- *involve himself / herself actively in various activities and processes of a teacher education institution and perform multiple roles of a teacher-educator.*
- *transact the teacher education curriculum and organize related activities effectively.*
- *experience continuing professional development programme after assessing the needs of the in-service teacher.*

Activities to be performed in TEIs

1. **Pre-service Teacher Education Activities**
   i. Observation of classroom teaching (in D.El.Ed. and B.Ed. classes) and other pedagogic practices of the teacher education institutions to which the candidate is attached and preparation of a report.
   ii. Delivery of 10 lessons in D.El.Ed. and B.Ed. courses (at least 5 in each course) under the supervision of the mentor concerned
   iii. Participation in seminar discussions and other curricular activities in teacher education institutions to be assessed by a group consisting the mentor and the faculty of the concerned TEIs.

2. **In-service Teacher Education Activities**

Observation of at least one programme (with the help of a predesigned observation schedule prepared at their TEI) of capacity building programme (CPD) being conducted in the DIET/CTE/IASE and interaction and discussion with the resource persons and participants te on the processes of need assessment, programme design, conduct of the programme and follow up activities, and preparation of a report.

3. **Overall Experiences in the TEIs**,

Each prospective teacher educator is required to prepare a comprehensive report on the following:

- Institutional profile of the TEIs to which he/she was attached
- The details of activities conducted and participated in the TEIs

- A reflective journal on the activities (preservice, inservice, curricular and other curricular activities and overall institution functioning)

Assessment of Internship Activities

The performance of each prospective teacher-educator in the aforesaid internship activities shall be assessed internally by a group of faculty including the mentor(s) as would be decided by the institution. The marks for each activity are as follows:

Activity	Marks
1.Pre-service Teacher Education Activities	
i. Sharing of classroom observation report	10
ii. Lesson plans and delivery of lessons (in D.El.Ed. and B.Ed. classes) by the concerned mentors	10+10
iii. Participation in Seminar and other activities	10
Total	**40**
2. In-service Teacher Education Activities	
i.Observation report of the programme(s)	**30**
3.Sharing of Report on the overall experiences in the TEIs visited	**30**
TOTAL	**100**

PC-7 Contemporary Concerns in Education

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of the course, the prospective teacher-educator shall:

- *Realize the concerns and challenges in the contemporary school education in India.*
- *Develop insight into the areas of concern in right based education.*
- *Understand the problems in conceptualizing and ensuring quality education.*
- *Acquire comprehensive vision of global concerns in the different areas of current educational scenario*.

Detailed Course Content

Unit 1: Concerns in School Education

- Universalization of School Education: Meaning, dimensions and issues
- Common School System: Concept, needs and challenges, Kothari Commission's recommendations,
- Equity and Equality in Education: Different forms of inequity and discriminatory practices in education based on Socio-economic disadvantages (Gender, Caste, Religion)

–Characteristics and Concerns; Strategies to address the concerns

- Management Concerns: Public Private Partnership (PPP) mode in school management and its impact on quality of education; Total Quality Management (TQM) of education – Major tenets, processes and limitations

Unit 2: Rights Based Education

- Human Rights Education: Concept, Dimensions, Current status and future challenges
- Human Right-based Approach to Education: Millennium Development Goals of Education, Dakar World Declaration of Education for All, Sustainable Development Goals; 4-A Approach to Education for All – Availability, Accessibility, Acceptability, and Adoptability
- Right to Education Act, 2009 and Universalization of Elementary Education- Provisions for access, opportunities and quality for basic education
- Challenges in the implementation of the RTE Act, 2009

Unit 3: Quality Concerns in Education

- Quality Education: Concept; Learner and Learning- centric education
- Factors influencing Quality Education: Quality of Learners, Learning Environment, Content and Learning Materials, Processes of Learning and Teaching, Learning Outcomes
- Initiatives and Strategies: Decentralized planning, Innovative materials and pedagogic practices Capacity building of teachers; Community involvement with reference to their effectiveness and limitations

- Use of ICT: ICT friendly materials and their utilization in classroom transaction, enhancing teacher ability and preparedness, and their attitude towards ICT use; provisions for smart classroom

Unit 4: Global Concerns in Education

- Education and Sustainable Development: Meaning and dimensions, role of Education in facilitating sustainable development; SDG Goals for Education (Goal 4 and its dimensions)
- Education for a multilingual and multicultural society; Mother tongue based multilingual education – Issues of transition and quality
- Open Education Resources: Concept, global participation, professional learning communities through OERs, Self and peer evaluation through OERs,
- Life skill education: Concept, importance and objectives; Core life skills (WHO); Strategies facilitating life skills; National Skill Development Framework
- Education in disturbed areas : Forms of disturbance – natural disaster, conflict, terrorism and insurgency, and their consequences; addressing these issues through education with reference to disaster management; Peace education

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- Preparation of a paper on types and quality of school education available in Odisha (either Elementary or Secondary)'
- Observing any two types of schools providing opportunity for disadvantaged learners and developing a paper comparing the facilities and practices in theses schools with main stream schools.
- Case study of a school developed in PPP mode in the state.
- A seminar paper on challenges of implementation of the provisions of the RTE Act for ensuring quality elementary education.
- Developing a scale for assessing the quality of education in an educational institutions clearly defining the indicators of quality education.
- Case study of a multilingual school assessing the effectiveness of the MLE interventions.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Durru-Bellat, Marie (2004). *Social inequality in school and educational policies*. Paris: International Institute of Educational Planning, UNESCO.

Govt. India. (1992). *National policy on education 1986: Programme of action 1992*. Faridabad: Government of India Press.

Nambissan, G. B., and Srinivasa, R. S. (2014). *Sociology of education in India: Changing contours and emerging concerns*.

Govt. of India (1954). *Report of the Secondary Education Commission* New Delhi: Ministry of Education and Social Welfare.

Department of School Education and Literacy (2011). *Sarva Shiksha Abhiyan: Framework for implementation based on the Right of Children to Free and Compulsory Education Act 2009.*. New Delhi:Ministry of Human Resource and Development.

Govt. of India (2009). *Framework for implementation of Rastriya Madhyamik Shiksha Abhiyan*. New Delhi: Ministry of Human Resource and development.

Govt. of India (1966). *Education and National Development*: *Report of the Education Commission, 1964-66.* New Delhi: Ministry of Human Resource Development.

Kashyap, S. C. (1994). *Our Constitution: An introduction to India's Constitution and Constitutional law*. New Delhi: National Book Trust, India.

Khan, M. I., & Sharma, S. R. (1993). *Equality and education: With special reference to women*. Delhi: Kanishka Publishers Distributors.

Govt. of India (1993). *Learning Without Burden : Report of the National Advisory Committee*. (1993). Ministry of Human Resource Development, Government of India, New Delhi.

Naik, J.P. & Syed, N. (1974). A Student‘s History of Education in India, MacMillan, New Delhi.

Naik, J.P.(1977). *Education commission and after*. New Delhi: A.P.H Publishing Corporation NCERT

(1986). School education in India: Present status and future needs, New Delhi: NCERT. NCERT (2006).

National curriculum framework, 2006. New Delhi: NCERT.

Sadgopal, A. (2010). Right to Education vs Right to Education Act. *Social Scientist*, *38*(9/12), 17- 50.

Tomasevski, Katarina (2004). *Manual on rights-based education: Global human rights requirements made simple.* Bangkok: UNESCO.

UNESCO & UNICEF (2007). *A human rights-based approach to education.* Paris: UNESCO.

UNESCO (2011). *Contemporary issues in human rights education*. Paris: UNESCO.

UNESCO.(2004). *Education for All: The Quality Imperative*. EFA Global Monitoring Report. Paris.

UNESCO.(2014). *Teaching and learning: Achieving quality for all- . EFA Global Monitoring Report.* Paris: UNESCO.

Unicef (2000). *Defining quality of education.* New York: United Nations Children‘s Fund. UNO

(2015).*Getting started with the sustainable development goals*. New York: Sustainable Development Solutions Network, United Nations.

UNO (2016). *The sustainable development goals report*. New York: United Nations. World

Bank, (2004). *Reaching the Child: An Integrated Approach to Child Development*.

RTS-2 Advanced Research Methods

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course the prospective teacher-educator shall:

- *Understand the characteristics, forms, utility and limitations of different types of experimental research designs in education*
- *Discriminate non-experimental designs from the experimental designs and differentiate different non-experimental designs in educational research*
- *Use various quantitative and qualitative techniques of data analysis for appropriate analyses of data.*
- *Understand the process involved in synthesizing the results and research reporting*.

Detailed Course Content

Unit 1: Experimental Research Designs

- Experimental Research: Key characteristics of experiment – Matching versus Randomization; Types of variables, Control of extraneous variables; Manipulation of the treatment conditions, Outcome measures and group comparisons; Steps in conducting experimental research
- Threats to internal and external validities;
- Designs of Experimental Research: Purpose and principles, research design as variance control, criteria of research design
- Types of Research Design: Between Group Designs - True experiments (pre- and post- test, post-test only and Solomon four-group), Quasi-experimental Designs (Non- equivalent control group, Time series and Counterbalanced) and Factorial Designs; Within Group Designs – (Repeated measures and Single subject)

Unit 2: Non-experimental Research Designs:

- Non-Experimental Research: Concept, Basic differences between experimental and non-experimental research; Self-selection and non-experimental research; Large and smaller scale non-experimental research; Testing alternative hypotheses; Evaluation of non-experimental research – values and limitations.
- Correlational Designs: Concept, use and characteristics; Types – Explanatory and Prediction designs; Steps in conducting Correlational research; Evaluation and ethical issues.
- Survey Designs: Concept, use and characteristics; Types – Cross-sectional and Longitudinal designs; Steps in conducting survey research; Tools and techniques of survey – Questionnaire and Interviews; Evaluation and ethical issues.
- Mixed Methods Designs: Concept, use and characteristics; Types – Convergent Parallel, Explanatory Sequential, Exploratory Sequential and Embedded designs; Steps in conducting Mixed Methods study; Evaluation and ethical issues.

Unit 3: Quantitative and Qualitative Data Analysis

- Inferential Statistics: Logic of inferential process, Cause and Effect relation, Single Cause, Multiplicity of Causes; Testing hypothesis- Null or Directional, Qualitative & Statistical Difference and Relationship Testing; Testing significance of Difference between Means and other Statistics, t-test,
- Analysis of variance: Assumptions, Computation of the F-ratio, ANOVA involving one and two factors, ANCOVA (simple treatments only)
- Non-parametric tests of significance: Chi- Square Test, Median Test, Sign Test, and Mann Whitney U-test
- Qualitative Data collection: Process - Observation, Interviews, Documents, Audio-visual materials; Tools for collecting qualitative data – Observation schedules, Interview schedules, Check lists ; Steps in qualitative data collection; Validity and reliability of qualitative data.
- Techniques of qualitative data analysis-Content Analysis, Classification, Categorization, Triangulation, Frequency and Percentage Analysis, Trend Analysis, Utilization of Corroborative evidences
- Utilizing Software Packages for quantitative analysis (Use of SPSS, MS Stats, MS Excel) and qualitative analysis (Use of Anthropack,. AltraVista etc.)

Unit 4: Writing of Research Report & Synthesizing Research

- Writing of Research Report: Types of reports – Empirical Studies, Literature Reviews, Theoretical Articles, Methodological Articles, Case Studies, other types; Manuscript Structure and Content
- Mechanics of Reporting: Organization - Chapters/Sections, Length, Headings and sub-headings, Seriation; Writing Style – Continuity in Presentation of Ideas, Economy of expression, Precision and clarity, Linguistic devices. Crediting Sources – Importance, Direct quotations, online materials, Citing references in text; Styles of writing Bibliography and References; APA Publication Styles.
- Ethical considerations in quantitative and qualitative research: Accuracy, credibility, confidentiality, transparency, honesty, originality, protecting authenticity against plagiarism.

Sessional Work

Every prospective teacher-educator shall undertake *any two* of the following:

- Prepare a research proposal using any one of the experimental designs stating the appropriate quantitative analysis to be used in the experiment.
- Develop a seminar paper on non-experimental designs of research in education.
- Prepare a paper comparing relative advantages and limitations of quantitative data analysis
- Conduct content analysis on any selected educational article and prepare a report.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

American Psychological Association (2010). *Publication manual of the American Psychological Association* (6th Edn.). Washington,DC: American Psychological Association

Best, J.W., & Kahn, J.V. (2009). *Research in education.* New Delhi: Prentice Hall of India Pvt. Ltd.

Creswell, J.W. (2011). *Educational research : Planning, conducting, and evaluating, quantitative and qualitative research*. New Delhi : PHI learning Pvt. Ltd.

Flick, U. (2012). *An introduction to qualitative research.* London: Sage Publication.

Fox, D.J. (1969).*The Research process in education.* New York: Holt Rinchart and winstoninc.

Gay, L.R., Mills, G.E., and Airasian, P. (2009). *Educatinal research. competencies for analysis and applications.* New Jersy: Merrill and Pearson.

Keeves, J. P. (Ed.) (1990).*Educational research methodology and measurement: An international handbook.* New York: Pargamon Press.

Kerlinger, Fred N., Lee, Howard B. (2000). *Foundations of behavioural research.* New York: Thomson Learning.

Lichmen, M (2006). *Qualitative research in education*. London: Sage Publication

Lovell, K., and Lawson, K.S. (1970).*Understanding research in education.* London : University of London.

Singh, K.(2001).*Methodology and techniques of social research.* New Delhi: Kanishka publishers.

Travers, R.M.(1969).*Introduction to educational research.* London: Macmillan Publishing co.

Wiersma, W. (2000). *Research methods in education*. New York: Allyn Bacon.

Theme-based Specialization

TS-1:Educational Management and Leadership

Educational Management

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course, the prospective teacher-educator shall:

- *Explain the concept, principles, processes and techniques of educational management.*
- *Describe the structural framework of education at the central and the state levels.*
- *State the policies and processes of educational management adopted after NPE 86*
- *Apply the concepts, techniques and process of educational management in school situation*
- *Specify the resources and the process resource management*

Detailed Course Content

Unit 1: Introduction to Educational Management

- Meaning, importance, nature and principles
- Educational Management vrs Educational Administration and Educational Governance
- Forms of Educational Management (in terms of objectives and functions): Democratic and Authoritarian, Centralized and Decentralized
- Functions : Institutional efficiency and effectiveness; operational autonomy and flexibility; effective decision-making; ensuring performance standards and accountability; exercising control and authority; strengthening monitoring mechanism; promoting research and development

Unit 2: Educational Management: Structure and Functions

- National Level : MHRD and various Departments, CABE, NCERT, NUEPA, NCTE
- State Level : Education Departments, Directorates and other specialized structures – OPEPA, OMSM, ELTI, BSE, SIEMAT, SRC, NKC Centre for Development Studies, Gopabandhu Academy of Administration and Madhusudan Accounts Training Institution
- District Level : Zilla Parisad and District Planning Board, DEO, DIETs,
- Sub-district Level : BEO, Gram Panchayats, CRCs
- Grassroots Level Institution, SMC / SMDC, Community

Unit 3: Institution-Based Management

- Institution-Based Management : Concept, importance and characteristics
- Processes : Need identification and prioritization, Augmentation of available resources, Planning, Implementation, Monitoring and Feedback, Revision and Finalization
- Role of different stakeholders in institution-based management
- Issues and Strategies

Unit 4: Management of Resources

- Resource and their Types: Human, Material, Financial and Time as Resources.
- Human Resource Management: Personnel management; Selection Recruitment, Induction and Training; Staff development; Performance Appraisal.
- Management of Physical Resources: Types of Physical Resource and their management.
- Financial Management: Resource mobilization- source and mode, Utilization of resources- types (recurring and non-recurring, plan and non-plan)
- Office Management: Meetings – Objectives, types of meetings, planning for a meeting, meeting agenda, minutes of meeting, management of records

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- Prepare a paper on efforts of the central and state government of Odisha for reformation in educational management
- An analysis of the functioning of any DIET of your state towards the development of school education.
- Preparation of a paper on the Impact of Decentralization on Educational Management for seminar presentation
- Develop a plan for performance appraisal of academic staff for improving quality of instruction

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Anthony, N.F. (1981) *Management competencies and Incompetence"s* Canada: Addison Wesley Publishing Company, Inc.

Arnole, H.J and Feldman, D.C. (1988*) Organizational Behaviour*, New York: McGraw – Hill Book Company

Azad,J.L. (1973) Educational Financing in India, New Delhi. Sterling Publishers,. Blaug, Mark(1972): *An Instruction to Economics of Education.* Allen Lane

Burton, W.H. and Brueckner, L.J (1955) *Supervision – A Social Process*, U.S.A Appleton –Century Crofts, Inc.

Desai , D and Other (1970) *School management and change*, Baroda: M.S University.

Drucnker, F.B (1985) Management – Tasks, Responsibilities and Practices, New Delhi: Allied Publishers Pvt. Ltd.

Eric, H. and McMohan, A. (eds) (1986) The Management of Schools, London: Kogan Page.

Etziono, A. (1972). *Modern organisation*, New Jersey: Prentice Hall Inc. Eye, G.G and Flippo, E.B (1884) *Personnel Management*. New York: McGraw Hill, Inc.

Hersey, P. and Blanchard, K.E (1978) *Management of Organizational Behavior*, New Delhi: Prentice Hall of India.

Kast and Rosenweig (1974) *Organizational and Management Systems Approach*, Tokyo McGraw Hill.

Khanna, S.S (2000) *Organizational Behavior*, New Delhi: Chand and Company NIEPA. (1986). *Educational management in India*. New Delhi: NIEPA,.

Padmanabham, C.B.(1998). *Educational financing and structural adjustment policies in India*. Delhi: Common Wealth.

Pareek, H., Rao, T.V and Pestonjee, D.M (1981) *Behavioral process in organization*, New Delhi: Oxford and B.M Publishing Co.

Prasad, L.M. (2001) *Principles and practice of management*, New Delhi: Sultan Chand and Sons. Rao V.K.R.V. (1961). *Education and human resource development.* New Delhi: Applied Publishers.
Scalan, B. and Keys, D. (1983) *Management and organizational behavior*, New York: John Wiley and Son.
Sharma, M. (1986) *Systems approach: Its application in education*, Bombay: Himalaya Publishing House.
Shein, E (1974) *Organizational Psychology*, New Jersey: Prentice Hall of India Pvt. Ltd.
Stoner, J.A.F. and Wankel, S. (1987) *Management*. New Delhi: Prentice Hall of India.
Singh, B. (ed)(1967). *Education as investment*, Delhi: Meenakshi Prakashan. Sri Prakash, (1994). *Expenditures on education.* New Delhi: NIEPA.
Strauss, G. and Sayles, L.R. (1985) *Personnel: The human problems of management*. New Delhi: Prentice Hall of India.
Tripathi, P.C., and Sayles, L.R. (1991) *Principles of management*, New Delhi: Tata McGraw Hill.

Theme-based Specialization

TS-2: Educational Policy and Planning

P.1:Educational Policy

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of the course, the prospective teacher-educator shall:

- *Explain the importance of developing a policy in education,*
- *Relate the policy with the existing education scenario.*
- *Appreciate the roles of various bodies in structuring educational policy.*
- *Critically look into the educational policies in India.*
- *Address positively to the policy challenges in education.*

Detailed Course Contents

Unit 1: Formulation of Education Policy

- Policy: concept, importance and characteristics; Process of policy making; methods and approaches in developing policy.
- Educational policy: Meaning, need and objectives.
- Major considerations in developing education policy: social, cultural, political and economic
- Policy making bodies in Education: MHRD, CABE, UGC, NCERT, NUEPA, NCTE, State Education Departments, and SCERTs
- Role of educational policies with reference to structure, curriculum (content and pedagogy), management of school and teacher

Unit 2: Implementation of Education Policies.

- Role of various national bodies in Policy implementation: MHRD, NCERT, NUEPA, NCTE
- State level bodies in policy implementation: State Education Departments and Directorates, SCERTs, TEIs
- Monitoring Policy Implementation: MHRD, UGC, NAAC, NCTE
- Issues and concerns in policy formulation in respect of school and teacher education
- Issues in policy implementation in respect of school and teacher education

Unit 3: Educational Policies in India

- Significance of National Policy on Education in education system ofIndia
- National Policies on Education: NPEs of 1968, 1986/92, and POA-1992 with reference to the provisions therein.
- Contributions of NPEs to School Education and Teacher Education
- NPE with reference to socio – cultural – economic contexts of India and envisioning future education policy

Unit 4: Understanding Policy Challenges in Education

- Challenges of Universalisation of Elementary Education (National Policy on Education,

1986)

- Challenges of Universalisation of Secondary Education.
- Challenges of quality and regulation in higher Education.
- Rights and Entitlements under the Right to Education ACT 2009

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:.

- Preparation of a paper on the needs process of developing a state policy on education and present it in a seminar.
- Developing a paper on the modalities of developing the National Policy on Education, 1986.
- Develop an analytical essay on comparing the major areas of focus in the NPEs of 1968 and 1986.
- Preparation of a grid comprising the roles of different organizations at the state and national level in developing a policy in education.
- Preparation of a data based analysis on the role of the NPE 1986 in the development of UEE .

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Batra, Sunil (2003). School inspection to school support. In Neelam Sood (ed) *Management of school education in India*, Delhi:NUEPA.

Jha, Praveen , Das, Subrat, Mohanty, S. S., Jha, N. K. (2008). *Public provisioning for elementary education in India*. New Delhi: Sage.

MHRD (2011). *Sarva Shiksha Abhiyan: Framework for Implementation based on the Right to Free and Compulsory Education Act, 2009*. New Delhi:Department of School Education and Literacy.

NCERT(2006). *Educational satistics of India*. New Delhi: NCERT.

NUEPA (2008). *Elementary education in india: Progress towards UEE*, DISE data 2006-07 Patnaik, P.

(2007). *Alternative perspectives on higher education in context of globalization.* at http://www.nuepa.org/ Download/ FirstFoundationdaySpeech.pdf

Pratichi India Trust (2009). *The Pratichi Education Report II: Primary Education in West Bengal:Changes and Challenges.*

PROBE Team (1999). *Public report on basic education in India*, and *PROBE Revisited* (2011). New Delhi: Oxford University Press.

Raina, V (2007) Integrating work and education: Contemporary education dialogue (Vol 4:1), pp72- 87.

Tilak J B (2004). *Higher Education between State and the Market* presented in UNESCO Forum on Higher Education available at portal.unesco.org/education/tilak/colloquium.

Theme-based Specialization

TS-3: ICT in Education

P.1: Foundations of Educational Technology

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course, the prospective teacher-educator shall:

- *Differentiate various terminologies associated with educational technology*
- *Appreciate the emergence and evolution of various educational media*
- *Explain various approaches to educational technology*
- *Describe the integration of technology for pedagogy, assessment, administration and Continuing Professional Development (CPD)*
- *Analyse and apply principles and practices associated with technology enhanced learning*
- *Critically evaluate ICT related policies and plans*
- *Assess various problems and issues related to information and communication technologies and its integration in education*

Detailed Course Outline

Unit 1: Historical and Conceptual Basis

- Meaning and nature of Educational technology, Instructional technology,Information and communication technology Definitions, scope, functions/objectives of educational technology; Approaches to educational technology - Physical science (media approach), Communication (audio visual approach) , Cybernetics (system approach)
- Behaviouristic Approach: Programmed instruction and teaching machines, individualized approach to instruction – Keller plan & IPI, Computer assisted instruction
- Cognitive Approach: Information processing model, information theory, simulation, artificial intelligence, computer based instruction
- Instructional design approach – task analysis, instructional design theories – Gagne, Bruner, constructivist approach, discovery, inquiry

Unit 2: Instructional/Learning Design & Models and Process

- Instructional Design: Meaning and Need; Implication of learning theories for instructional design
- Theory of multiple intelligences and its implications for instructional design; Developing a personal learning theory; Types of Learning and learning styles
- Instructional Design Models: ADDIE Model, System model, ASSURE Model and ARCS Model
- Instructional Design Process in ADDIE: Analysis- need, target, task, and topic/content; Design- define objectives, sequencing, instructional methods, delivery strategies, evaluation strategies; Develop- content, story board,courseware, authoring tools and interactivity, and interface; Implement – installation, deliver and distribution, managing learner activities; Evaluation – purpose, models of evaluation, evaluating reaction, learning, behaviour, result.

Unit 3: Integration of ICT in Education

- Characteristics of digital learners
- Need and importance of digital Literacy
- ICT: Relationship between ICT, culture and learning
- Technology and pedagogy: Techno pedagogical content knowledge (TPCK); Open Source Software and Management; Approaches and strategies to integrating ICT in teaching and learning; ICT and Universal design for Learning (UDL)-multiple means of providing learning experience, multi means of representing learning, multiple means of engaging learners
- Technology and assessment: Electronic assessment portfolio – concept, types, e-portfolio tools –Mahara; Technology assisted continuous assessment: role of LMS; Online and offline assessment tools – rubrics, survey tools, puzzle makers, test generators, reflective journal, question bank; Learning analytics and feedback

Unit 4: Technology Integration: Policies and Trend

- Emerging Trends: Increased online access and connectivity, Mobile access- ubiquitous computing, Free and Open Source Software (FOSS), Convergence of Hardware and software, Technological sophistication and affordability, Digital assistive technologies.
- Problems and Issues: Equity issues and the digital divide Social; ethical, and security issues; Limitations of technology integration; the impact of technology integration; Technology dependence and learner autonomy.
- ICT Plans/schemes, policies, curriculum and standards;
- New initiatives: Digital India; e-basta; e-Pathasala; e-pg-pathasala; e-library; NROER; Vikaspaedia
- Current and Future Trends: Emerging role for augmented and virtual reality in education; Learning analytics and education; Personalized learning spaces; Digital badging and games; BYOD and digital citizenship; 3D printing and its educational application;

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- Seminar presentation on approaches to educational technology.
- Seminar presentation on Evolution of Educational Media.
- Evaluating multimedia CD ROMs using standard criteria and study the multimedia evaluation reports available at www.teem.org.uk/
- Comparative study of ICT syllabus of school education and teacher education of various organizations.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Andrew M. St. Laurent. (2004).*Understanding Open Source and Free Software Licensing*. Oreilly: Cambridge

Bharihok, Deepak. (2000). *Fundamentals of Information Technology*. Pentagon Press: New Delhi

Evant, M: The International Encyclopaedia of Educational Technology.

Gwen Solomon, Lynne Schrum. (2014). *Web 2.0 How-to for Educators* (2nd Edn.). ISTE.

Govt. of India (2004, 2010). *ICT@schools scheme*. New Dehi: Ministry of Human Resource Development.

Govt. of India (2012). *National ICT policy for school education in India.* New Dehi: Ministry of Human Resource Development (URL*: ictschools.gov.in)*

Govt. of India (2014). *State report cards on ICT implementation*. New Dehi: Ministry of Human Resource Development (URL: MHRD.gov.in).

Howard Pitler, Elizabeth R. Hubbell, and Matt Kuhn. (2012).*Using Technology with ClassroomInstruction That Works* (2nd Edn.). Denver: ASCD.

Jane Hunter (2015).Technology Integration and High Possibility Classrooms: Building from TPACK

Katherine Cennamo, John Ross, Peggy Ertmer. (2013).Technology Integration for Meaningful Classroom Use: A Standards-Based Approach. AU:Wadsworth.

Kumar, K.L.(2010). *Educational technology*. New Delhi: New Age India Ltd.

W.J. Pelgrum and N. Law (2003). *ICT in education around the world-Trends, problems and prospects*. UNESCO: Paris

Theme-based Specialization

TS-4: Environment Education

P.1: Environmental Awareness

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course the prospective teacher-educator shall:

- *explain the causes for environmental hazards and pollution*
- *elaborate the causes for environmental degradation*
- *appreciate the steps taken to protect the environment in daily life and*
- *encourage the learners for being proactive for protection of environment*
- *analyze the environmental issues and policies in India*
- *appreciate the international efforts for protection of global environment*

Detailed Course Content

Unit 1: Understanding Environmental Challenges

- Environment: Meaning, importance (man and environment relationship), components (biotic, abiotic)
- Global Environmental Problems: Major problems (pollution and degradation related) and their typescauses (natural and man-made), effects with reference to developing countries, Climate change, global warming, ozone depletion, acid rain, el-nino, season change, deforestation, greenhouse effect,
- Types of Environmental Pollution: Air/atmosphere, water/marine, sound, soil; Causes – Physical, natural, industrial, human behavior, population, nuclear, thermal; Prevention and corrective measure
- Types of Environmental Degradation – soil erosion, land slide; Causes, prevention and corrective measures

Unit 2: Global Concerns for Environment Safety and Protection

- UN Conference on Human Environment (Stockholm Conference)
- Nairobi Conference, 1982
- Bruntland Conference, 1983
- Earth Summit, 1992 at Rio: Features of Rio Declaration, Major achievements
- UN Convention on Climate Change
- Provisions in the MDGs and SDGs

Unit 3: Environment Movements in India- Policies and Programmes

- Environmental movements: Silent Valley Movement, Chipko Movement, Narmada Bachao Andolon, Movement against Tehri Dam Construction, Niyamgiri Movement
- Acts and Policies: Environment (Protection)Act,1986; National Environment Tribunal Act, 1995; National Environmental Policy,2006, Wild Life Act, 1972; The Air (Prevention and Pollution) Act,1981; , Water Act 1974,
- Provisions and Programmes for Environment Protection under Five Year Plans

Unit 4: Environment Management

- Environment Management: Concept, need and objectives
- Dimensions of Environment Management:
- Measures for conservation of flora and fauna, conservation of non-renewable resources
- Protection of environment, preventive measures

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- Preparation of a report on environmental crises and their causes in the context of Odisha
- Conducting a survey on environmental pollution of any one locality
- Preparation of a report on the initiatives taken in the country for environmental impact assessement
- Preparation of a paper on the important features of Rio Declaration and its major achievements.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Agarwal, S.P. and Aggarwal, J.C. (1996). *Environmental Protection, Education and Development*. New Delhi: New Concepts.

Joy, P., & Neal, P. (1994). *The handbook of environmental education*. London: New Fetter Lane.

Kelu, P. (2000). *Environmental education: A conceptual analysis*. Calicut: Calicut University.

Kumar, A. (2009). *A text book of environmental science*. New Delhi: APH Publishing
Meerut: R.Lall Books Depot.
Publications.

Reddy, P. K., & Reddy, N. D. (2001). Environmental Education. Hyerabad: Neelkamal

Sharma, B. L., & Maheswari, B. K. (2008). Education for Environmental and Human value.

Sharma, R. A. (2008). *Environmental education*. Meerut: R.Lall Books.

Sharma, R. G. (1986). *Environmental education*. New Delhi : Metropolitan Book

Sharma, V. S. (2005). *Environmental education*. New Delhi: Anmol publication.

Singh,Y. K. (2009). *Teaching of environmental science*. New Delhi: APH Publishing

Theme-based Specialization

TS-5: Guidance and Counselling

P.1: Guidance and Counselling Services in Schools

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course, the prospective teacher-educator shall:

- *Understand the need, objectives and scope of guidance*
- *Appreciate the role of guidance programme in schooling system*
- *Develop acquaintance with different techniques of group guidance*
- *Recognize the role of guidance in attaining the goals of education*
- *Understand the process of assessment for guidance and counselling in schools*
- *Aware of the contribution, role and function of the school guidance committee*
- *Justify effective planning and organization of guidance programmes in schools*

Detailed Course Content

Unit 1: Guidance, Education and Curriculum

- Guidance: need, scope, principles
- Relation of guidance with education; integration of guidance and curriculum:
- Importance of guidance at various levels of schooling
- Types of guidance programme – socio-personal, educational and vocational: aims and objectives at different stages of schooling and group guidance techniques
- Relationship between guidance and counselling

Unit 2: Essential Services in Guidance Programme

- Types of guidance services: Orientation, Information services, Student appraisal and Individual Inventory, Counselling, Referral, Placement and Follow-up
- Types and sources of information
- Methods of dissemination of information
- Significance of Research & Evaluation in guidance programme
- Conditions essential for planning and organization of guidance programmes in schools
- Resources for organizing guidance services

Unit 3: **Assessment for Guidance and Counselling**

- Importance of assessment in guidance and counselling
- Tools and techniques of psychological testing
- Non-testing techniques: observation and interview,; sources of information: anecdotal record, cumulative record, academic reports, , sociometry and portfolio assessment

- Integration of information from different sources

Unit 4: Guidance for students with special abilities and Needs

- Students with special abilities and needs-concept and identification process
- Guidance for students who are gifted and creative
- Guidance for socially and economically disadvantaged and delinquent students
- Guidance for students with physical impairment
- Guidance for students cognitive impairment
- School guidance committee: constitution, roles and functions
- Role of teachers, administrators parents and other personnel of the community

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- Conduct a survey of the problems that are most prevalent in schools, which need immediate attention of a guidance counselor and prepare a brief report
- Prepare a detailed outline of a class talk on need for guidance services in schools
- Prepare a list of resources required for setting up a guidance-oriented curriculum.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Anand, S.P (2007). *Guidance in school*. Bhubaneswar: Global Printers,

Bhatnagar, Asha and Gupta, Nirmala(Eds.) (1999). *Guidance and counselling: A theoretical prospective* (Vols.I & II). New Delhi: Vikas.

Brown, D. and Brook L.,(Eds).(1990). *Career choice and development*. San Francisco: Jossey Bass.

Gibson, R.L. and Mitchell, M.H. (1986). Introduction to guidance. New York: Macmillan.

Gladding, Samuel T. (1996). Counselling: A comprehensive profession, Prentice Hall Inc. of India.

Nayak, A.K. (1997). *Guidance and counsel*ling. New Delhi. APH Publishing House.

Sharma, R.N. and Rachana Sharma(2004). *Guidance and counselling in India*. New Delhi: Atlantic Publishers and Distributors.

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Theme-based Specialization

TS-6: Preschool Education
P.1: Pre-School Education

Semester-V	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course the prospective teacher educators shall:

- *Understand the need and significance of pre-school education*
- *Understand the policy perspectives on pre-school education in India and world*
- *Appreciate the co-existence of plurality and diversity of childhood in contemporary Indian society*
- *Understand the linkage between pre-school and primary education*
- *Critically examine the contribution of educationists on pre-school education*
- *Reflect on the strategies of assessment of children at pre-school Stage*
- *Develop strategies for developmentally appropriate practices*

Detailed Course Content

Unit 1: Pre-School Education: Policy and Perspectives

- Concept, significance and objectives of Pre-school education; ECCE, ECE, ECCD
- ECE in India: Policies and Programmes in National Policy on Education (NPE, 1986) and POA (1992), National Plan of Action for Children, 1992 and 2005; National Curriculum Framework (2005); Quality Standards of ECCE (MW&CD)-2013, Constitutional Provisions (Revised Art.45)
- ECE in Global Perspective: United Nations Convention on Rights of the Child (UNCRC, 1989), Millennium Development Goals (2000) and Global Monitoring Report (UNESCO) 2007 focusing on ECCE – concerns and issues
- Right to Education Act, 2009, emerging positions of early childhood and the young child in the current five year plan

Unit 2: Contributions of thinkers and educationists on Pre-school Education

- Contributions of Indian Educationists to Pre School Education – (Mahatma Gandhi, Rabindranath Tagore, Gijubai Badheka, TarabaiModak)
- Contributions of western Educationists to Pre School Education – (Friedrich Froebel, Maria Montessori, Jean Piaget)

Unit 3: Linkage between ECE and Primary Education

- Concept,Importance of linkage between ECE and Primary school
- Strategies of linkages:Location,Programme and curricular and management
- Pressures on Pre-schoolers.Organisation of school Readiness programme

Unit 4: Curriculum and Pedagogy for Early Childhood Education

- Curriculum for School Readiness – physical, cognitive, socio-emotional dimensions; characteristics of learning experiences and approaches

- Developmentally appropriate practices: theme-based, holistic, joyful, inclusive – meaning, rationale and practical implications in specific contexts; story-telling, puppetry, musical and rhythmic exercises, dramatization, role-play, art activities, indoor and outdoor play, field trips and explorations as methods in primary and early primary stages – meaning, rationale, selection criteria, method of transaction
- Local specific community resources – human and material & their integration in curricular activities; preparation & use of learning and play materials.

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following::

- Case study of Anganwadi/ pre-school centers
- Study of present status of ECCE in State/Region/District
- Collection of information on infrastructure of ECCE centers and comparison with NCERT minimum specifications (1992)
- Reflection on literature on equality ECCE services of one western country (internet, journals)
- Writing of journal articles on different issues on ECCE
- Survey of play materials and comparing with the socio-cultural set-up
- Survey of child rearing practices in different cultures

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Aggarwal, J.C. and Gupta, S. (2007). Early Childhood Care and Education (Ist Ed.). Shipra Publications, New Delhi.

Economic and Political Weekly (2006). Child Development – Overcoming Persistent Under-Nutrition. XLI (12), March 25-31, New Delhi: A Sameeksha Trust Publication.

Government of India (1986). National Policy on Education, Department of Education, New Delhi.

Govt. of India (2005). National Plan of Action for Children, 2005: Department of Women and Child Development, New Delhi

Mishra, R.C. (2005). Early Childhood Education Today, Prentice Hall Publisher

MWCD (2013).National Early Childhood Care and Education (ECCE) Policy.Govt of India, New Delhi

MWCD (2013).National ECCE Curriculum Framework.Govt of India, New Delhi

MWCD (2013).Quality Standards of ECCE.Govt of India, New Delhi

Myers, R. G (1995). The Twelve Who Survive: Strengthening Programmes of Early Childhood Development in the Third World, Ypsilanti, Mich., High/ Scope press.

National Council of Applied Economic Research (2001). Concurrent Evaluation of ICDS -National Report. New Delhi.

NCERT (2005). Position Paper of the National Focus Group on Early Childhood Education, NCERT, New Delhi.

NCERT (2005).National Curriculum Framework, NCERT, New Delhi

NCERT (2005).Position Paper on National Focus Group on ECE, NCERT, New Delhi

NCERT (2015).Exemplar Guidelines for Implementation of Early Childhood Care and Education Curriculum, NCERT, New Delhi

Pugh, G. (1996). Contemporary Issues in Early Years: Working Collaboratively for Children (2nd Ed.) National Children's Bureau, London.

Seefeldt, Carol (1990). Continuing Issues in Early Childhood Education, Merrill Publishing Company, Columbus, Ohio.

Sood, N (2003). Planning and Management of Early Childhood Education: A Case of Himachal Pradesh. Occasional Paper 32, New Delhi: National Institute of Educational Planning and Administration.

Swaminathan, M. and Daniel, P. (2000). Activity-based Developmentally Appropriate Curriculum for Young Children, Indian Association for Pre-school Education, Chennai.

Swaminathan, Mina (1998). The First Five Years: A Critical Perspective on Early Childhood Care and Education in India.

UNESCO (2002). Integrating Early Childhood into Education: the Case of Sweden. Paris,(UNESCO Policy Brief on Early Childhood, 3).

UNESCO (2006). Cross-national Compilation of National ECCE Profiles. Geneva:UNESCO International Bureau of Education.

UNESCO (2007). Strong Foundations: Early Childhood Care and Education, Paris, UNESCO.

UNESCO (2007): Strong Foundations: Early Childhood Care and education. Paris.

World Bank (2004). Reaching Out to the Child: An Integrated Approach to Child Development. New Delhi, Oxford University Press.

World Bank (2007). EFA Global Monitoring Report – Early Childhood Care and Education. Washington D. C. World Bank.

RTS Pr.1: Dissertation (Part-III)

Semester-V	Credit-2
Marks 50 (Internal)	Contact Hours 64

Objectives

On completion of the course in this semester, the prospective teacher educator shall

- *Complete data collection*
- *Conduct data analysis*
- *Interpret the result*

Activities

The activities concerned with the dissertation work in this semester have been divided into three parts: Data Collection, Data Analysis, and Data Interpretation, Discussion and Drawing Conclusion.

Criteria of Assessment:

The distribution of marks on the three activities is as follows:

Activity	Marks
1.Data Collection	20
2.Data Analysis	15
3.Data Interpretation, Discussion and Drawing Conclusions	15
TOTAL	**50**

The faculties of the Teacher Education Institutions along with the Supervisors / Mentors concerned shall assess the performance of the Teacher Educators in the aforesaid aspects out of the suggested marks and award the consensus mark out of 100 marks to each Prospective Teacher Educator in this regard.

While assessing the dissertation at the pre-submission stage the following aspects are to be examined.

- *Logical organization of the chapters and sub-chapters*
- *Approved reporting format and style*
- *Approved letter font used*
- *Approved style of preparing references*
- *Systematic arrangement of Appendices*
- *Appropriate and sequential presentation of graphs and charts in the dissertation*

However, any alternative appropriate procedure of such assessment may also be devised at the institution level and adopted for the purpose.

TS Pr.1 Theme Area Practicum I

Semester-V	Credit-2
Marks 50 (25+25) (Internal)	**Contact Hours 64**

Rationale

The prospective teacher educators' needs to realistically understand the policies, practices and issues associated with the theme based specializations of their choice in the real field/institutional context. For this, they need to have direct situational experience and sharpen their understanding of the theoretical knowledge acquired from their area of specializations. This course is designed in keeping with the above rationale and with an intention to help students integrate theory and practice.

Objectives

On completion of this course, the prospective teacher educator shall:

- *Acquaint himself/herself with the activity/programme related to their theme based specialization.*
- *Develop insight into the actual functioning of the elements acquired in the areas of specialization through direct observation and experience in the areas of action.*

Organization

The practicum shall be organized by attaching the prospective teacher educators to different schools/teacher education institutions, computer laboratories and other agencies engaged with activities related to the theme based specialization with a view to study issues in real context.

Each prospective teacher educator has to choose one issue related to each paper of his/her theme specialization for this practicum. Thus, ***during the Vth Semester***, ***one has to complete theme specific practicum on two issues***, selecting one from each of the two themes of specialization under the guidance and active supervision of a teacher educator/practitioner.

Necessary orientation to students shall be provided before organizing the activities.

Programme for Conducting Practicum

Programme for one thematic issue (tentative)

i.Orientation for the programme:	To be done during the classroom interaction in the respective theme specialization course.
iii. Visit to the Practicum Site and preparation of the report:	One week

Prior to visit the practicum sites, a detailed plan of action should be developed by the prospective teacher educator through peer interaction and guidance of the mentor teacher educator. This plan of action may undergo modifications during the thematic practicum.

The final programme of action actually conducted should be enclosed to the report (to be countersigned by the head of the institution/organization).

- ✓ Duration for Practicum on one issue w.r.t. to one theme specialization - 1(one) week
- ✓ **Total duration for Practicum on Theme Specialization (*on two themes*) – 2 (two) weeks**

Assessment Criteria

- **For each Theme (or issue)**
  - For the detailed programme of action: … … 5 marks
  - Quality of engagement in the Field Work: … 10 marks
  - Quality of the Report ..... 10 marks

Total (for One Theme): … … 25 marks

Suggested Activities (Themes)

Sl. No.	Theme Specialization (Paper-1)	Suggested Activities
1.	**Educational Management**	1. Field visit to RMSA/SSA office at block/district/state level to collect and review the records of annual work plan and budget. 2. Study the structural and functional setup of management in school for elementary/secondary education of state government.
2.	**Educational Policy**	1. Visit to SCERT/SIE; RMSA/SSA Office State departments of Education, NCERT, NUEPA, CBSE, BSE and related institution for collection of relevant information on planning and implementation of policies 2. Interaction with stakeholders about gaps in planning and implementation of policies.
3.	**Foundations of Educational Technology**	1. Plan and develop e-content for any one approach like MOOC/E-learning/Flipped learning /Blended Learning. 2. Assessment of e-learning practices in secondary and higher secondary schools.
4.	**Environmental Awareness**	1. Assessing the levels of Environmental Awareness of students and teachers in schools and its impact on building a healthy sense of environment protection in and out of school campus. 2. Visit to Pollution control board, forest department, NGOs and agencies working in the area and collection of information about planning and implementation of different activities
5.	**Guidance and Counselling Services in Schools**	1. Observe the processes followed in providing guidance to student teachers in DIETs/ TEIs and explore the possibility of improving the process. 2. Visit to State/Central/Private schools and analysis of available programme for career awareness and counselling of students.
6.	**Pre-School Education**	4. Analysis, reflection and reporting about the physical, and human resources available and being used in Anganwadis for promoting pre-school education. 5. Visit to NTT /PSTE institution, collection of relevant information, and reflection on activities organized, assessment processes, student teachers profile etc.

The activities (themes) for the Theme Practicum during the Vth Semester listed here are suggestive. The concerned Insttitute/ Teacher Educator(s) can formulate other activities(themes) relevant to each of the thematic specializations.

TEC-II Issues and Research in Teacher Education

Semester-VI	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course, the prospective teacher-educator shall:

- *Reflect on the problems and issues in teacher education.*
- *Explain various approaches to teacher development.*
- *Identify the issues in conducting research in teacher education*

- *Realize the major areas of research in teacher education.*
- *Explain the mechanisms of quality assurance in teacher education*.

Detailed Course Content

Unit I: Problems and Issues in Teacher Education

6. Challenges in professional development of teachers w.r.t. school education
7. Issues related to enhancing teacher competence, commitment and teacher performance.
8. Maintaining and implementing standards in teacher education – admission policies, staffing pattern, qualification and mode of recruitment and service conditions of teacher educators.
9. Teacher empowerment and motivation: issues and concerns
10. Unplanned growth of teacher education institutions

Unit II: Perspectives of Teacher Education

11. Teacher Development: concept, factors influencing teacher development – personal and contextual.
12. Teacher Expertise – Berliner's stages of development of a teacher.
13. Approaches to teacher development – self-directed development, co-operative or collegial development, change- oriented and staff development.
14. Different organizations and agencies involved in teacher education- their roles, functions and networking.
15. Preparation of teachers for various disciplines i.e. art, craft, music, and physical education - existing programmes and practices.

Unit III: Issues in Conducting Research in Teacher Education

16. Methodological issues of research in teacher education- direct versus indirect inference, generalizability of findings, laboratory versus field research, scope and limitations of classroom observation
17. Availability of Resource Support: Types of resources for research – Literature, Online resources, guidance for research, funding for research
18. Resource Centers: NCERT, NUEPA, CSIR. University Libraries and Resource Centers, SCERT, IASEs – Available resources, Roles in promoting research
19. Research on pedagogical approaches in teacher education including classroom processes.
20. Programme evaluation of in the area of teacher education.

Unit IV: Major Areas of Research in Teacher Education

21. The Continuum of Teacher Education: Initial teacher education; professional qualifications and experiences; the career entry phase, including induction and probation; Continuing professional development, including current needs (individual, school, system), current provision; Developing professional learning communities; Standards of teaching, knowledge, skill and competence across the continuum
22. Teaching in a Changing Society: Teaching for diversity, inclusion and special educational needs; Teaching for social capital; Teaching for citizenship and moral development; Developing creative, lifelong learners; Using ICT for teaching, learning and assessment; Places and spaces for learning, including virtual learning environments and multimodal texts..
23. Pedagogy: Effective teaching of literacy and numeracy; Integration of subject themes and cross curricular working; Whole school curriculum policy development and evaluation; Assessing for learning/formative assessment; Pedagogic approaches and perspectives on learning
24. Teaching as a Profession: Perceptions of teacher professionalism; Perceptions of the role of the teacher; Self-regulation in the teaching profession; Collegiality in teaching; Entry criteria; The development of teaching as a profession (national and international trends); Progression paths in teaching (national/international trends)
25. Core Education Principles and Policy Issues: The changing context of /governance/patronage/ethos; Supply of, and demand for, teachers; Partnership within education; The potential for re-conceptualization of the education system towards an improved teaching and learning experience

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

- A critical appraisal of researches in areas of teacher education
- Critical review of at least one in-service teacher education programme conducted in the institution or in any nearby teacher education institution.
- Preparation of a list of possible research topics on teacher education contextual to the state specifying the need for each study.
- Development of a paper specifying the efforts for teacher empowerment programme in the teacher education institution.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Canon, L. & Monin,L.(1978). *A guide to teaching fanciness*. London: Mtehner.

Coomb, A.W.et al.(1974). *The profession education of teachers: A humanistic approach to teacher training*. Boston: Allyaon & Becon Inc.

Gage,N.L.(1963). *Handbook of research on teaching*. Chicago: Rand McNally College Publishing Co.

Joyee, B. & Showers, B.(1983).*Power in staff development through research on training*. Alexandria Virginls: ASCD.

Sikula, J., Buttery, T.J., and Guyton,E. (1998). *Handbook of research on teacher education* (2nd Edn.). New York: Simon & Schuster Macmillan.

SSC 2: Emerging Scenario in School Education (Elementary)

Semester-VI	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course the prospective teacher-educators shall:

- *Understand the historical development of elementary education in India*
- *State the various programmes and strategies for UEE*
- *Explain the roles of Central and State bodies in elementary education*
- *Reflect upon the impact of decentralization in elementary education*
- *Reflect upon various concerns and challenges related to elementary education*.

Detailed Course Content

Unit 1: Elementary Education: Developmental Perspectives

26. Elementary Education: Meaning, importance and objectives
27. Indigenous system of Elementary Education in India before the British rule
28. Elementary Education scenario during the British rule : Recommendations of Wood's Dispatch, Hunter Commission, Hartog Committee and Sargent Committee.
29. Elementary Education scenario during Post-independence period : Constitutional Provisions, Recommendations of the Education Commission (1964-66), Common School System, National Policy on Education 1968 and 1986/92, Acharya Ramamurthy Committee (1990), Recommendations of Saikia Committee 1997
30. Constitutional Provisions for Elementary Education: Art 45, 21A, 42nd, 73rd and 86th Amendments of the Constitution, RCFCE Act,2009

Unit 2: Programmes and Strategies for UEE

31. Universalization of Elementary Education : Concept, objectives and rationale
32. Programmes and Strategies : Operation Blackboard, SOPT, PMOST , MLL, Mid Day Meal, Free Supply of Books and Uniforms, Scholarship for Girls and SC / ST children – their concepts, objectives and impact
33. SSA – Objectives, focus area, implementation strategies; role of OPEPA in Odisha for quality enhancement in elementary education; SSA Framework of Implementation after the RTE Act,2009 – Principles of revamping SSA activities laid down by Anil Bordia Committee, Major features of modified implementation strategies
34. Strategies for Quality Education at Elementary Stage: Adoption of constructivist approach, Activity-based classroom transactions; Use of community resources in meaningful learning, Important features of curriculum at elementary level: Relevance. integration, flexibility, contextuality and plurality

Unit 3: Governance and Planning in Elementary Education

35. Elementary Education under Five Year Plans – Targets, Provisions and priorities
36. Role of Central Government : Policy formulation, financial provisions for states, matching grants, centrally sponsored schemes, role of MHRD (school education and literacy department), CABE, NCERT, RCI under the Ministry of Social Justice and Empowerment, Ministry of Women and Child Development, Ministry of Tribal Affair, Ministry of Minority Affair

37. Role of State Government : S & ME Department, Directorates (Elementary, TE and SCERT, SIEMAT, SIET, ELTI, BEO, DIET and other monitoring agencies), Women and Child Development Department, SC and ST Development Department – their functions
38. Decentralisation of Elementary Education : Role of Panchayat Raj Institutions (Zila Parisad, Grampanchyat) PTA, MTA, SMC, NGOs, Civil Society and Advocacy Groups – their importance, area of concern and functions
39. International support Agencies : UNICEF, UNESCO, World Bank and WHO

Unit 4: Concerns and Challenges of UEE

40. Achievement of UEE in terms of universal access, retention and success
41. Quality concerns– Classroom processes, learning achievement, teacher preparation and teacher performance
42. Challenges related to inclusive education, mainstreaming and multilingualism
43. Issues related to assessment with reference to CCA implementation
44. Issues related to the implementation of the RTE Act, 2009: Admission in age appropriate grades, Special Training, No detention policy, Role of Local Authority, Community involvement, Ensuring quality education

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

6. Preparation of a report on the impact of any intervention for UEE using survey method.
7. Preparation of an appraisal report on the functions of local bodies in elementary education and the constraints faced.
8. Preparation of a report on implementation of the RCFCE Act.
9. Prepare a seminar presentation on the impact of CCA practices on quality learning performance at elementary level.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Coombs P.H.(1985). *World crisis in education: The view from eighties.* Oxford University Press, New York.

Delors, Jaques et al. (1996). *Learning: The treasure within – Report to UNESCO of the International Commission on Education for the Twenty-first Century*. Paris: UNESCO.

Dreze, Jean, and Sen, Amartya (2002). *India: Development and participation*. New Delhi: Oxford University Press.

Duggan, R. C. and Pole, C. J. (1996). *Reshaping education in the 1990s: Perspectives on primary schooling.* London: Falmer Press.

Faure E. and others (1973). *Learning to be: The world of education today and tomorrow*. Paris:UNESCO.

Govt. of India (1966). *Education and National development*: *Report of the Indian Education Commission (1964-66).* New Delhi: Department of Education.

Govt. of India (1986/1992). *National policy of education 1986/92*. MHRD, Deptt. of Education.

Govt. of India (1993). *Education for all: The Indian scene*,New Delhi: Department of Education, Ministry of Human Resource Development.

Govt. of India (2001). *Sarva Shiksha Abhiyan: Framework for implementation* New Delhi: Department of School Education and Literacy, MHRD.

Govt. of India (2005). *National plan of action for children 2005*. New Delhi: Department of Women and Child Development.

Govt. of India (2011). *Sarva Shiksha Abhiyan: Framework for implementation –Based on the Right of Children to Free and Compulsory Education Act 2009*.New Delhi: Department of School Education and Literacy, MHRD.

Gupta, V.K and Gupta , Ankur (2005). *Development of education system in India*. Ludhiana: Vinod Publication.

Jha, J. and Jhingran, D. (2002). *Elementary education for the poorest and other deprived groups: The real challenge of universalisation.* New Delhi: Centre for Policy Research.

Kumar K (2004), *What is worth teaching?* (3rd Edn.) New Dewlhi Orient Longman.

Kurrian, J. (1993) Elementary Education in India, New Delhi: Concept Publication.

Malhotra, P.L. (1986) School Education in India : Present status and Future Needs, NCERT, New Delhi.

MHRD (2001): Convention on the Right of the child. New Delhi.

Mukherjee, S.N. (1964). *Education in India, today and tomorrow*. Baroda:Acharya Book Depot.

Naik, J.P. (1965) *Elementary education in India: The unfinished business*. Bombay: Asia Publishing House.

NEUPA (2014). *India: Education for all – Towards quality with equity*. New Delhi.

Pathak,Avijit (2002). *Social implications of schooling*. New Delhi: Rainbow Publishers.

Prakash, V.(Ed.) (1997). *Teacher empowerment and school effectiveness at primary stage.* New Delhi: NCERT,.

Rajput, J.S. (1994). *Universalisation of elementary education: Role of the teacher*. New Delhi: Vikas Publishing House

Rao. V.K (2007). *Universatisation of elementary education*. New Delhi: Indian Publishing House:

Rawat, D.S.et al. (1981). *Universalisations of elementary education*. New Delhi: NCERT.

Report of the Delors Commission, UNESCO, 1996

Sinha, A. (1998). *Primary schooling in India*. New Delhi: Vikas Publication.

Walia, J.S. (1998). Modern Indian education and its problems. Jalandhar: Paul Publishers,.

World Bank (1997). *Development in practice: Primary education in India*. Washington DC: The World Bank.

SSC 3: Emerging Scenario in School Education (Secondary & Senior Secondary)

Semester-VI	Credit-4
Marks 100 (Ext.70+Int.30)	Contact Hours 64

Objectives

On completion of this course the prospective teacher-educator shall:

- *Describe the historical development of secondary education in India.*
- *Explain various programme and strategies for quality improvement of secondary and senior secondary education.*
- *Explain the national and state support mechanism for effective governance of secondary and senior secondary education.*
- *Elaborate the pedagogic approaches for enabling learning enrolment in classroom at the secondary and senior secondary level facilitating quality learning.*
- *Reflect upon the issues and challenges in secondary and senior secondary education and the strategies to address those.*

Detailed Course Content

Unit 1: Developmental Perspectives

4. Secondary Education – Structure, scope and functions
5. Status of secondary education during British Period
6. Secondary education during post independence period: Recommendations of Secondary Education Commission (1952-53) and the Education Commission (1964-66) with reference to structure, aims, curriculum and evaluation.
7. Provisions in the National Policies on Education 1968, 1986 / 92 in respect of Secondary and Senior/Higher Secondary Education.

Unit 2: Programmes and Strategies

8. Universalization of Secondary Education : RMSA – purpose, structure and interventions
9. Secondary education for accelerating Human Resource Capital, Knowledge Society, Skilled Manpower and Progressive Society
10. Vocational Education at the secondary stage: Importance - Recommendations of the Education Commission (1964-66) and NPE 1986/92; Objectives, implementation strategy and assessment
11. Vocational education at the senior secondary stage: Importance (Recommendations of the Education Commission (1964-66), Adisheshiah Committe Report, 1978 and NPE 1986/92), objectives; National Vocational Education Qualification Framework (NVEQF); Institutional arrangements, implementation strategies; Issues and challenges in Odisha.

Unit 3: Governance and Plannnig

10. Role of Central Government: MHRD, CABE, CBSE, NCERT, CIET, NIOS, IGNOU, Ministry of Social Justice and Empowerment, RCI, Ministry of Tribal Affairs and Ministry of Minority Affairs.

11. State level Support Mechanism- Department of School and Mass Education, SC&ST Development Department, SCERT, SIET, SIEMAT, SIOS; District Level mechanism– DEO, BEO, SMDC, PTA; Role of Local and Civic bodies and NGOs

12. Secondary Education under Five Year Plans – Targets, Provisions and Priorities.
13. Support from International Agencies : UNICEF, UNESCO, World Bank and WHO

Unit 4: Issues, Challenges and Strategies

- Access, enrolment, retention, achievement, equity and equality (education of girls, disadvantaged and children with diverse needs)
- Quality concerns in Secondary and Higher Secondary education – infrastructure, classroom processes, teacher profile, teacher preparation and teachers' professional development
- Enabling learning environment, classroom processes, learning assessment with reference to CCA and teacher quality - Use of Technological Pedagogical Content Knowledge (TPCK)
- Skill Development: Life skills and Vocational –Scope, Objectives and Strategies
- Monitoring and Sustainability of programmes

Sessional Work

Every prospective teacher-educator shall undertake ***any two*** of the following:

14. Preparation of a seminar presentation on post-NPE '86 scenario in India: Programmes for quality improvement in secondary education.
15. Preparation of a survey report on vocational education at the senior secondary stage in Odisha: Status, issues and strategies.
16. Preparation of a write up on utility of TPCK in transaction of lessons
17. Survey of current monitoring practices in secondary education in Odisha and suggestion of alternative and viable strategies.

The topics for the sessional work listed here are suggestive. The concerned teacher educator(s) can add other projects/topics relevant to this course.

Suggested Readings

Chopra, R.K.(1993). *Status of teachers in India*. New Delhi: NCERT.

Coombs P.H. (1985): *World crisis in education: The view from eighties*. Oxford University Press, New York.

Faure E. and others (1973). *Learning to be: The world of education today and tomorrow*. Paris: UNESCO.

Govt. of India (1953). *Report of the Secondary Education Commission*. New Delhi: Department of Education.

Govt. of India (1966). *Education and National development*: *Report of the Indian Education Commission (1964-66).* New Delhi: Department of Education.

Govt. of India (1986/1992). *National policy of education 1986/92*. MHRD, Deptt. of Education.

Govt. of India (1993). *Education for all: The Indian scene*,New Delhi: Department of Education, Ministry of Human Resource Development.

Govt. of India (1993). Education for all: The Indian scene. New Delhi: Department of Education, Ministry of Human Resource Development.

Govt. of India (2005). *Universalisation of secondary education : Report of the CABE Committee.* New Delhi: MHRD.

Govt. of India (2010). Govt. of India (2005). *Framework for implementation of Rashtriya Madhyamik Shiksha Abhiyan.* New Delhi: MHRD.

Gupta, V.K and Gupta , Ankur (2005). Development of education system in India. Ludhiana: Vinod Publication.

Jayapalan, N. (2005). *Problems of Indian education*. New Delhi : Atlantic.

Mukhopadhyay, S. and Anil Kumar, K. (2001). *Quality profiles of secondary schools*. NIEPA, New Delhi.

National Research Council (2002). *Knowledge economy and postsecondary education: Report of a workshop.*Committee on the Impact of the Changing Economy on the Education System.

- Graham and N.G.Stacey (Eds.). Cener for Education, Division of Behavioral and Social Sciences and Education. Washington, D.C.: National Academy Press.

Sujatha, K & Ravi G (2011). Development of secondary education in India. New Delhi: Shipra Publication

Sujatha, K & Ravi G (2011). Management of secondary education in India: Quality, programme and administration. New Delhi: Shipra Publication.

Tilak, J B G (2008). Financing secondary education in India. New Delhi: Shipra Publication

TS Pr.2 Theme Area Practicum II

Semester-VI	Credit-2
Marks 50 (25+25) (Internal)	**Contact Hours 64**

The rationale, objectives, organization and the assessment criteria for the conduct of _TS Pr.2 Theme Area Practicum' during the VIth Semester are nearly same as detailed for Theme Area Practicum (Paper-1) for the Vth Semester.

The exemplars of activities under each Theme Specialization course are shown in the table below.

Suggested Activities (Themes)

Sl. No.	Theme Specialization (Paper-2)	Suggested Activities
1.	**Educational Leadership**	*3.* Visit any School/TEI and observe the leadership qualities of the head of institution and its teachers/teacher educators. *4.* Analyse the content and processes of any teacher education programme (pre-service or in-service) in respect of the elements of educational leadership inbuilt in such programme.
2.	**Educational Planning**	3. Visit any block/district level office of the SSA/RMSA and analyze the process of preparation of the Annual Work Plan &Budget. 4. Visit any School/TEI and explore the processes followed in preparation of academic, resource and financial planning for the institution.
3.	**Content Design & e-Learning**	*6.* Analyze the e-contents available in elementary (CAL schools) or in secondary schools/ TEIs and their use for learning. *7.* Discuss with teachers of elementary schools or teacher educators in TEIs regarding their experience in MOOC programme.
4.	**Environmental Education**	4. Assessing the state of Environmental Education in secondary schools including the curricular inputs, transactional strategies and the application of the learnt concepts in real life situations. 5. Study the school – community relationships in their efforts in their joint effort to fight environmental pollution (like maintenance of personal and environmental cleanliness, garbage disposal management, tree plantation, etc.)

5.	**Counselling Processes and Strategies**	3. Exploring the existence and possibility of providing career counselling to student teachers in DIETs/ TEIs in a planned manner through individual and group counselling. 4. Identify the socio-educational problems of underachievement and conduct counselling some such identified underachievers for improvement in their learning performance.
6.	**Pre-School Teacher Education & Research**	5. Develop a list of training inputs for the in-service pre-school teachers (Anganwadi workers) through observations of classroom processes and consultation with stakeholders. 6. Visit any PSTE programme/Institution and prepare an evaluation report on the programmes and processes followed in the training of pre-school teachers.

The activities (themes) for the Theme Practicum during the VI th Semester listed here are suggestive. The concerned Insttitute/ Teacher Educator(s) can formulate other activities (themes) relevant to each of the thematic specialization.

English

Course No : Eng 434

Course Title: Computer Application in Literary Studies

Objective: The paper introduces students to the basic ideas about Computer hardware andsoftware, and application of different programmes necessary for academic writings.

Expected Outcome: The students will learn to prepare html texts, and bibliographydatabase as required for research in literary studies.

Credit Load: 5 credit hours

Course Contents:

Unit I: **Computer Fundamentals**—Brief History of Computer, Types of Computers. Hardware and Software. System Operating Software and Application Software. Basics of DOS. Windows operating systems—Windows 98/2000.Word Processor operations—Microsoft Word. Menu-based DBMS on windows—Microsoft Access.

Unit II: **Internet basics**. Concept of e-book, e-gine and e-library. Search Engines. URLs on Literature. Basics of HTML page designing

Unit III: **Practical**: The practical shall cover Windows 98/2000, Microsoft Word, Microsoft Access, Web page designing using HTML, locating literature websites on the World Wide Web, through links and search engines.

Unit IV: **Project**: The Project will be either the creation of an author or area-based bibliography database using Microsoft Access with 500 or more records or the collection of material on an individual author using the resources from the Net.

Scheme of Examination:

Unit I and II: Semester-end university examination of 50 marks to be done externally. The Examination will be of 90 minutes duration and will comprise objective andshort-

answer type questions.

Unit II and IV: The practical will be of 30 marks weightage and the project will carry 20marks. These will be conducted internally.

Course Number: **Eng 612**

Credit Load: 4 Credit Hours

Elective A

Course Title: **Textual Criticism & Theory of Literary History**

Objective: The students will be introduced to the theory of textuality, reading, and issues ofliterary historicity.

Expected Outcome: Students will learn to pursue scholarship based on theory of textuality,reading, and issues of literary historicity.

Course Contents:

Unit I: Textual Criticism: Aims of Textual Criticism, Critical Editing and Establishing the Text, Critical Editions/Definitive Editions, Function of Bibliography Unit II: The History of the Book: Beginnings of the Book; The Codex; Papyrus, Parchment and Paper; Printing; The Digital Revolution; Dawn of the e-Book.Unit III: Stephen Greenblatt's "What is the History of Literature?"
Unit IV: The Nature of Literary Change

Scheme of Evaluation:

The Units shall carry a total of 100 marks, out of which 40 marks shall be by way of Internal Assessment in the form of written test and home assignment. The written test will be of 60 minutes duration carrying 20 marks. The home assignment will carry a weightage of 20 marks.

Division of Marks :(For the Semester-end University Examination)

The Semester-end University Examination shall be of 3 hours duration, carrying 60marks. Four long- answer type questions (to be answered in 1000 words each), carrying 15 marks each. There will be one long-answer type question from each unit with an alternative: **15x 4 = 60**

Recommended Reading:

James Thrope ed. *The Aims and Methods of Scholarship in Modern Languages and*

Literatures. New
York: MLA, 1963.
David Perkins, *Is Literary History Possible?* Baltimore: Johns Hopkins, 1993.
Ralph Cohen ed. *New Directions in Literary History*. Baltimore: Johns Hopkins, 1974. Simon Eliot and Jonathan Rose eds. *A Companion to the History of the Book*. Malden, MA:
Blackwell, 2007.
David B. Hall, *Cultures of Print: Essays in the History of the Book*. Amherst: University of Massachusetts Press, 1996.

Course No : Eng 433 Course Title: Contemporary Novel

Course Objectives: This paper covers English Novel of the Contemporary times. It aims to familiarize students with

- The different literary forms, genres and modes of narratives of the Twenty first Century.
- The social and political concerns of writers of the current century.
- The moral and ethical implications of the literary writings.

Credit Load: 5 credit hours

Course Contents:

Unit I:	Ian McEwan:	*Saturday*
Unit II:	Kazuo Ishiguro:	*Never Let Me Go*
Unit III:	Richard Powers:	*The Overstory*
Unit IV:	Victor LaValle:	*Destroyer*

Recommended Readings:

50. Mary Shelley: *Frankenstein*
51. Michel Foucault: "What is Enlightenment?"
52. Amitav Ghosh: *The Great Derangement*
53. Margaret Atwood: *Oryx and Crake*

Course Learning Outcome (CLO): At the end of the course studentswill be familiar with English novels written during the Twentyfirst Century. They will be able to understand
CLO1. The different literary forms, genres and modes of narratives of the Twentyfirst Century.
CLO2. The social and political concerns of writers of the current century.
CLO3. The moral and ethical implications concerns of literature.

Scheme of Examination:

The units shall carry a total of 100 marks, out of which 20 marks shall be by way of internal assessment in the form of written test and seminar/home assignment. The written test will be 60 minutes duration. The semester-end university examination shall be of 3 hours duration, carrying 80 marks.

Division of Marks: (For semester-end university examination)

k) Four long- answer type questions(to be answered in 1000 words each), one each from the 4 units with alternatives : **16x 4 = 64**

l) Two short-answer type questions (to be answered in 500 words each), carrying 8 marks each. There will be one short-answer type question from each unit, out of which the candidates shall answer any two. **8x2 = 16**

Course No: Eng 434 Course Title: Research Methodology and Computer Application in Literary Studies

Course Objectives: This paper will introduce students to

- The basic principles of research methodology.
- Fundamentals of computer application and digital technology in literary research.
- Writing research papers, editing and publishing.

Credit Load: 5 credit hours

Course Contents:

Unit I: **Research Methodology and Publication Ethics**

MLA Style Sheet
Fundamentals of Research: Selecting a topic, Conducting Research, Compiling a Working Bibliography, Evaluating Sources, Taking Notes, Plagiarism, Outlining, Writing Drafts, Language and Style, Guides to Writing
Research and Publication Ethics, Identifying Research Misconduct and Predatory Publications

Unit II: **Computer Fundamentals and Internet Basics** — Functional Units of a Computer, Windows Operating System, Word Processing.—Microsoft Word, Editing and Formatting of a Document; Working with Tables, Creating and Printing a Presentation, Producing a Slide Show; Editing and Formatting Worksheets; Performing Basic Calculations, Working with Charts; Creating a database file using Menu-based Windows Software, Using the Internet and the World Wide Web, Mobile Applications Basics of DOS. Menu-based DBMS on windows—Microsoft Access.

Concept of e-book, e-library, Internet Archive, Open Library, Search Engines, URLs on Literature, Basics of HTML web page designing

Recommended Readings:

1. *MLA Handbook*, Seventh and Eighth Edition

Course Learning Outcome (CLO): At the end of the course students will be familiar with Research Methodology and Computer Application in Literary Studies. They will be able to

CLO1. Apply the basics of research methods to writing a research paper.
CLO2. Use technology for research.
CLO3. Develop proficiency in editing and publishing.

Scheme of Examination:

Unit I and II: Semester-end university examination will be of 50 marks of 90 minutes duration and will comprise objective and short-answer type questions.

The practical will be of 20 marks and the project will carry 30 marks. These will be conducted internally. The Project will be a Review of Literature on a research topic specific to an author or area. Students will create a bibliography database using Microsoft Access with 250 or more records to be submitted as both hardcopy and softcopy.

M.Sc Food Science

Course Code: FS-521 (2CH)	Course Name: ENTERPRENUERSHIP DEVELOPMENT PROPOSAL
Pre-requisite: None	Co-requisite: None

Programme Education Objectives

PEO1	Understand the nature and basic concepts of **Entrepreneurship Development Proposal** Relating to the **M.Sc. in Food Science**
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Evaluation shall be done by members. Students should be assigned marks for presentation skill based on following Criteria:

Sl.No.	Topics	%Marks
1	Report Writing	**60**
	-subject knowledge	**(20)**
	-disease management	**(20)**
	-cause and diet requirements	**(20)**
2	PPT presentation	**40**

It is for building (or reinforcing) skills in project development and execution, decision-making, individual and team coordination, approach to problem solving, accounting, marketing and resolving conflicts, etc. The programme has end to end approach. Carefully calibrated activities help the participants to explore and discover their own potential and both activities and facilitation play a critical role in enhancing team performance. Experiential Learning (EL) helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their own enterprise and turn job creators instead of job seekers. This is a step forward for "Earn while Learn" concept. Experiential Learning is an important module for high quality professional competence and practical work experience in real life situation to Graduates.

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Entrepreneurship Development Proposal**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Course Code: FS-524 (2CH)	Course Name: INDUSTRIAL TOUR REPORT
Pre-requisite: None	Co-requisite: None

Programme Education Objectives

PEO1	Understand the nature and basic concepts of **Industrial Tour Report** Relating to the **M.Sc. in Food Science**
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Industrial Tour should be compulsorily carried out by students at least for 1 week. The Industrial Tour should be planned to make students acquaint with different sectors of Food Processing Industries (viz. Bakery, fruits and vegetables, snacks, meat processing, etc). The students should be shared with the detailsof industries being visited to and given an assignment to collect the basic details of the types of products and technicalities related to it.

Formats for Study Tour or Educational Tour Report and For Its Evaluation:

1. Name of the student:
2. Reg. No and Roll No. :
3. Name of the plant (address):
4. Period of Tour:

Place	Date and Time	Organization	Learning Outcomes

Evaluation shall be done by members. Students should be assigned marks for Industrial Tour based on following Criteria:

Sl.No.	Topics	%Marks
1	**Tour report Evaluation**	**50**
2	Technical knowledge related to products	**20**
3	Presentation of Tour Report with Pictures in	**30**

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Industrial Tour Report**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

M. Sc FOOD SCIENCE AND NUTRITION

Course No: FSN. 424 **Advanced Human Physiology** **4CH**

Objective: To develop the skills on role of human body parts sustainable life.

Learning Outcome:

- Students will have a thorough understanding the normal function within living creatures.
- The students will know the importance of mechanical, physical, and biochemical function of humans and serves as the foundation of modern medicine.

UNIT-I: Reticulo-endothelial system: functions, classification. Lymphatic System: functions, circulation. Circulatory system: blood, composition of blood cells, development & function of blood cells, blood clotting, blood grouping and

hemoglobin, Heart: anatomy, cardiac cycle, blood pressure and factors affecting blood pressure.

UNIT-II: Respiratory system: anatomy, physiology and mechanism of respiration, regulation of respiration. Digestive System: anatomy of gastrointestinal tract and accessory organs. Digestion& absorption of foods, regulation of appetite Role of liver, pancreas, gall bladder

UNIT-III: Excretory system: anatomy, and function of kidney, formation, composition and excretion of urine. Role of kidney in water, electrolytes & acid base balance. Endocrine glands: structure & function, mode of action of hormones.

UNIT-IV: Reproductive system: Structure& function of male & female reproductive organs. Physiological changes in pregnancy. Lactation, Post parturition changes. Nervous System: anatomy and functions of brain, spinal cord, nerves,organization of central nervous system Musculoskeletal system: anatomy & function.

References:

30. Human Physiology. VolI &II -C.C.Chatterjee, Medical Allied agencies
31. The Human Body-CH.best&NB. Taylor.1989, ASI publication House
32. Text book of Medical Physiology-AC.Guyton, WB sounders
33. Medical laboratory technology-KL. Mukherjee. Tata Mcgrawhill
34. Ross & Wilson Anatomy & Physiology in Health & illness-KJW.Wilson&JS.Ross 1987, Churhill Livingstone.
35. Text book of Physiology-volI & II-AK.Jain, Avichal Publishing Co. New Delhi.
36. Review of Medical Physiology-WF. Ganong, Lange medical Publication

FSN-514a. Community Health Management

Objective: To develop the skills on the medical and clinical sciences which focuses on the maintenance, protection and improvement of the health status of population groups and communities as opposed to the health of individual patients.

Learning Outcome:

- Students will have a thorough understanding to the organization and management of services that are planned with and provided in the community, not in health facilities.
- The students will know the importance of Overall management of community health services, needs of their assessment and situation analysis.

UNIT-I: Health: concept, definition, dimension & determinant of health, positive health, health situation in India, concept of disease, causation (Agent, host, environmental factors) concept and control & prevention, modes of intervention, Health Indices: fertility, indicator, vital statistics, mortality, morbidity & demographic indicator, Human development Index, Reproductive health index.

UNIT-II: Health Care: Concept of health care, level of health care, changing concept, elements & principles of health care, health for all, national strategies, health care delivery system (primary health care) health care services & system, agencies (Govt. and Private) in delivery health care services, health programmes in India.

UNIT-III: Health needs & problem: Health needs & problems related to sanitation & environment, personal hygiene, pollution, health needs of special groups-women, infants, children, adolescents, geriatric health needs & problems, problems related to communicable (malaria, cholera, typhoid, chicken pox, measles, mumps, influenza, hepatitis, poliomyelitis, tuberculosis) & non communicable (heart disease, hypertension, cancer, diabetes, obesity) diseases. Newer diseases.

UNIT-IV: Health planning &Management: Health planning, health needs & demands, objectives, targets & goals, planning cycle, Health management: methods & techniques, health planning in India, Five year plans & health system in India. Health information: requirements, components, sources of health information, health regulation & acts, health legislation. Health Education: adoption of new ideas & practices, content & principles of health education, audio-visual aids in health education.

References:

29. Primary Health Care Vol I –III, P.R.Dutt, Gandhigram Institute of Rural Health & Family Welfare Trust, Ambathurai.
30. A Text Book of Community Health for Nurses, R.K.Manelkar, Vora Medical Publications, Mumbai.
31. Essentials of Community Health Nursing- K.Park M/S Banarasidas Bharat Jabalpur.

32. Text Book of Preventive & social Medicine- K. Park . M/S Banarasidas Bharat, Jabalpur.
33. Text Book of Public Health and Social Medicine- A.N.Ghei Lakshmi Book Store, New Delhi.
34. A Hand Book of Social & preventive Medicine- Y.P.Bedi, Atmaram & Sons, New Delhi.
35. Community Health in the United States- John D. Porterfield- Voice of American Forum-Lectures.
36. The Concept of Health- Donald A.read- Hobrook Press Inc, Boston.
37. Principles of Health Science- K.L.Jones, L.W. Shainberg & C.O. Byer- Harper & Row Publishers, New York.
38. Encyclopedia of Health & Nutrition- Anmol Publications New Delhi.
39. Health Promotion in Public- A. Bhatia, Anmol Publications, New Delhi

Course No: FSN. 514 c (Elective) c. Institutional Food Management 4CH

Objective: To develop the skills on the principles of catering management, be aware of the differing methods of food service and implications for the nutritional quality and safety of food.

Learning Outcome:

- Students will have a thorough understanding to study the history of hospitality, career opportunities and the different areas of hospitality.
- The students will know the importance to support practical management skills, such as scheduling, hiring, wage and salary regulations, safety in the workplace and job performance evaluation.

UNIT-I: Introduction to Food Service Systems: Evolution of the food service industry. Broad categories of catering services; commercial and Institutional. Characteristics of the various types of food service units – Canteens, Hostels, Hospitals and Restaurants. Scope for food and nutrition services in hospitals- importance of nutritional care and foods service in hospitals.

UNIT-II: Principles of Institutional food Management: Management functions. Management tools: Tangible, Intangible tools. Management Process: Tools of Management**,** Management of resources, (money, space, materials' equipments, staff, time and procedures).

UNIT-III: Personnel Management: Manpower planning. Space Planning & Organizing, Recruitment, selection and orientation-Training and motivation, employee facilities & benefits, Types of employee welfare Schemes, training and development of employees. Labour Laws. Welfare policies and schemes for employees.

UNIT-IV: Energy and Finance Management: Importance of time and energy management, Types of energy – Human and fuel energy, Measures for utilization and conservation. Management of Finance: Sources of finance and Budgets, Cost accounting/analysis: Food cost analysis, Labour cost analysis and Cost Control Techniques.

Books Recommended

7. Catering Management – an integrated approach- M.Sethi & S.Malhon, Wiley Eastern Limited,
8. Institutional food Management- MohiniSethi, New Age International Publishers, New delhi
9. Catering Management in the Technological age-Fuller Barrievd- Rock hiff Publications.
10. Personal Management in the Hotel& Catering Industries- Boella- Hutchinson Publications.
11. Hotel House Keeping Training Manual- Andrews Snoher-Tata McGraw Hill Publication-New Delhi.
12. The Practice of Hospitality Management _vol I and II –R.Lewis, T.Begg's M.Shaw & S.Croffot-AVI Publishing Co.DC.West Port Connecticut. Hospitality & Catering- Ursula Jones & Newtons.
13. Handbook of Food Preparations – A.M. Home Economics Association.
14. Food Selection and Preparations – Sweetman, M.D., 4, Mackeller.
15. Food service Planning: layout Equipment – Lender H. Ketshevar and Marget E. Terrel.

Course No: FSN.514 d d. Food Processing and Preservation 4CH

Objective: To develop the skills for processing of food after postharvest and use of various preservation techniques in food processing industries.

Learning Outcome:

- Students will have a thorough understanding of various food processing techniques.
- The students will know the importance of various preservation techniques.

UNIT-I

Basic concept of food processing and preservation: Reason of food Spoilage and Scope of food processing preservation; principles of food processing and preservation. Principle and preservation by low temperature: (refrigeration, freezing, and

dehydro freezing; cold storage, frozen food), changes during freezing-physical and chemical changes. Processing and preservation by drying: factors affecting drying rate, types of dryer – (kiln, tray, drum, spray, tunnel, fluidized bed drying), types of drying technique (freeze drying, vaccum drying),

UNIT-II

Processing and preservation by heat: (blanching, pasteurization, sterilization, UHT processing, heating, dehydration, canning, Microwave cooking-(principle, changes during microwave cooking, advantages),difference between microwave and conventional heating, Use of Nano technology in food. Concentration and evaporation-(flash evaporator, falling film evaporator and multiple effect evaporators), changes during Concentration

UNIT-III

Processing and preservation by non-thermal method: irradiation, high pressure, pulsed electric field, high hydrostatic pressure, Hurdle technology: concept of hurdle technology and its application, Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques, ohmic heating, IR heating;

UNIT-IV

Food processing equipments: material handling, cleaning and grading, conveyors, size reduction, food grain storage, milling, Separation Technique: filtration, agitation and mixing. Baking, Roasting, Frying. Extrusion Technology-(principle, types of extruders).

References

10. Arsdel WB, Copley MJ & Morgan AI. 1973. *Food Dehydration*. 2nd Ed. Vols. I, II.AVI Publ.
11. Desrosier NW & James N.1977. *Technology of Food Preservation*. 4th Ed. AVI. Publ.
12. Fellows PJ. 2005. *Food Processing Technology: Principle and Practice*. 2nd Ed. CRC.
13. Jelen P. 1985. *Introduction to Food Processing*. Prentice Hall.

HISTORY

H 5.1.5 Computer Application in Historical Studies (60+10+10+20) 4 CH

Course Objectives:

To provide basic knowledge of computer organization, operating systems, and application programs used in historical research.

Learning outcome:

The students will have concepts of computer system architecture, classification of computers, operating system and application programs. Understand the concept and need of computers application to solve, analyze and represent data relevant to historical studies.

Unit -I

Introduction to computers, data and information, History of computer, Basic structure of computer: CPU, I/O devices, memory, classification of computers.

Unit-II

Operating system, concepts of different OS, Windows, UNIX and GNU/Linux, Basics of computer languages, low-level and high-level language.

Unit-III

Application programs and data representation, basic concept of word processing, spreadsheet, data entry and tabulation of data, presentation and other application software, concept of database management.

Unit-IV

Information technologies and its importance, Internet and its Resources, World Wide Web (www), Computer application in historical research.

BOOKS RECOMMENDED: 12

1. P.K. Sinha and Priti Sinha, 2007. *Computer Fundamentals*, BPB Publication, New Delhi.

2. T.M. Srinivasan, 2007. *Computer Application*, Aavishkar Publisher Distributors, Jaipur, Rajasthan.
3. Gary Lock and J. Muffett (Eds), 1992, *Computer Application and Quantitative Methods in Archaeology*, London:BAR International Series.
4. Reilley, P. and S. Rathz (Eds.), 1992. *Archaeology and the Information Age*, Routledge, London.
5. Snedecor, G.W. and W.G. Cochran, 1967. *Statistical Methods*, Oxford and IBH Calcutta..

H 5.1.2 Historical Application in Tourism (80+10+10) 4 CH

(Tourism Principle and Practice)

Course Objectives:
The objectives of this course are to provide a broad understanding on the basic principles and practices related to the Tourism Industry.

Course Outcomes:
Upon successful completion of this program of study, the students will choose a career path from a range of alternative options within the tourism enterprises and/or progress to higher level programs.

Unit-I

Tourism: Concept, Definition and Characteristics, Forms and Types of Tourism, Purpose of Tourism, Policy and Planning in Tourism,.

Unit-II

Tourism Promotion: Advertising, Publicity, Public Relation, Personal Selling and Merchandising, Travel Agencies, Tourism Organisation: International Organisations, Government and Private Sector Organisations in India

Unit-III

Tourism Information Sources: Government Agencies, Private Agencies and Media, Tour Packaging: Pricing and Travel, Tourist Accommodation and Catering, Role of Guides and Escorts.

Unit-IV

Tourism Management, Tourism Regulation: Inbound and Outbound Travel Regulations- Passport, Visa, Special Permit, Custom and other Regulations.

BOOKS RECOMMENDED

1. R. Bala, 2018. *Fundamental of Tourism.*
2. J.C. Dua & M. Bhargava, 2017. *Fundamental of Tourism and Travel Management.*
3. R. Burton, 1997. *Travel Geography*.
4. A.K. Bhatia, 2012. *Tourism Development, Principles and Practice*.
5. R. Acharya, 1986, *Tourism and Cultural Heritage of India*.
6. S. Agrawal, 1983. *Travel Agency Management*.
7. A. Nair, 2017. *Tourism Planning and Development*.
8. K.K. Karma, 2004. *Basics of Tourism : Theory, Operation and Practice*.

A : ARCHAEOLOGY

H 5.1.3 (A) Archaeological Culture and Sequence in Indian Perspective (80+10+10) 4 CH

Course Objective:
This course will introduce the Third Semester students to key concepts and varied approaches in archaeology, highlighting their applications in interpreting the human past. The definition, aims and scope of archaeology and its development as a discipline is introduced to the students. The nature of the archaeological record and the unique role of science in archaeology are explained. The course also provides understanding cultural sequence and diversity starting from the Lower Palaeolithic period to the civilization development. Legislation related to archaeology is also discussed in this course.

Course Outcome:
On the successful completion of Introduction to Archaeology students will develop a strong foundation on the basic understanding of the nature, development and value of archaeology as a discipline.

Unit-I

Definition, Aim and Scope of Archaeology, History of Indian Archaeology, Relationship of Archaeology with Social and Natural Sciences, New Archaeology , Processual & Post Processual Archaeology.

Unit-II

Palaeolithic Cultures of India, Sohan and Acheulian Traditions, Middle Palaeolithic Culture, Microlithic Tradition in India: with particular reference to Jwalapuram, Mehtakhei &West Bengal. Mesolithic Culture of India: Sarai Nahar Rai, Bagor and Adamgarh

Unit III

Neolithic Cultures of India, Burzoham, Southern India, Odisha, & Koldihawa, Chalcolithic Village Communities of India: Kayatha, Ahar, Malwa, Jorwe, Khameswaripali and Golbai Sason, Harappan Culture – Antecedents, main feature, Chronology & Factors Responsible for the Decline.

Unit-IV

Megalithic Culture of south India: Typology and Cultural Characteristics, Iron Age culture of Northern India: PGW and NBPW Cultures. A General Outline of Early Historic Urban Sites of India:Sisupalgarh and Arikamedu.

BOOKS RECOMMENDED

1. An Encyclopaedia of Indian ARchaeology, Vol.I&II : A. Ghosh (ed.), 1989, Munshiram Manoharlal, New Delhi.
2. Trigger B.G. 1989. *Towards A History of Archaeological Thought.* Cambridge: Cambridge University Press.
3. Schiffer, M.B. 1995. *Behavioral Archaeology*: *First Principles*. Salt Lake City: University of Utah Press
4. K. Paddaya & S.G. Deo (Eds.) 2017. *Prehistory of South Asia (The Lower Paleolithic of Formative Era of hunting gathering)*, The Mythic Society, Bengaluru.
5. Agrawal, D. P. & J.S. Kharakwal 2002. *South Asian Prehistory (Archaeology of South Asia-I).* Aryan International, New Delhi.

6. S. Settar and R. Korisettar (Eds.) 2002. *Indian Archaeology in Retrospect Prehistory Archaeology of South Asia. Vol. I* & II, Delhi: Indian Council of Historical Research and Manohar.
7. Possehl, G. 1999. The Indus Age. New Delhi. Oxford
8. Dhavalikar MK. 1997. Indian Protohistory. New Delhi: Books and Books.
9. Agrawal, D. P. & J.S. Kharakwal 2002. *Bronze & Iron Ages in South Asia. (Archaeology of Soth Asia-II).* Aryan International, New Delhi.
10. Tripathy, Vibha. 2001. The age of iron in South Asia, New Delhi, Aryan International
11. Alchin, F.R. 1995. The Archaeology of Early Historic South Asia (The emergence of Cities and States), Cambridge University Press.

Lal, B.B. 1949. Sisupalgarh 1948. An Early Historical Fort in Eastern India, Ancient India 5: 62-105.

B: MUSEOLOGY

H 5.1.3 (B) Introduction to Museology (80+10+10) 4 CH

Course Objectives:

The objective of this course is to introduce students to the purpose and functioning of museums. The importance of museums in linking archaeology and History with public education is stressed.

Course Outcomes:

Students learn the basic functions of museums and their activities. Conservation, education, exhibition collection, documentation and research and legislation relating to museum are the major topics students learn about.

Unit-I

History of Museums, Definition, Aim & Scope, History of Museums in India, Types of Museums and their classification, Functions of Museum, Collection: Aims, Method & Ethics of Collection.

Unit-II

Documentation; identification, classification, accessing, Museum and its Management: Staff, Insurance and Security, Storage, Surroundings and Marketing of Museum Objects.

Unit-III

Conservation & Preservation, Types of Museum Material, Deteriorating factors: Recognition and control, Conservation of organic material: manuscripts, wood, paper, ivory and bone objects. Conservation of inorganic material: stone, terracotta, glass and metal.

Unit-IV

Museum Exhibition – Types of Exhibition, Equipment, Labeling, Museum and Public Relations – Types of Visitors and Their Behaviors, Publication of Guide Books, Catalogue, Monograph, News Letter etc

BOOKS RECOMMENDED

1. T. Embrosse & Crispine Paine, 2012. Museum Basics (Heritage: Care- Preservation-Management)
2. D.P. Ghosh, 1968. *Studies in Museum and Museology in India.*
3. M. Zaheer, 1963. *Museums Management, Accession, Indexing, Custody Labelling and Varification of Objects*.

4. G. Morley, 1968. *Museums To-day*

5. D.H. Dudley and Irma-It-al Bezold, 1980. *Museum Registration Method* .

6. S. J. Baxi and V.P. Dwivedi, 1973. *Modern Museum*.

7. M.L. Nigam, 1966. *Fundamentals of Museology* .

8. O.P. Agrawal, 1979. *Care and Preservation of Museum Objects.*

9. A. Ayappa and S.Satyamurtti (Eds.), 1960. *Handbook of Museum Techniques*

10. H.J. Plenderleith and A.E.A. Warner, 1971. *Conservation of Antiquities and Works of Art.*

11. M.N. Basu, 1943. Museum Method & Process of Cleaning & Preservation, Calcutta: University of Calcutta

12. G.E. Hooper (Ed.), 1994. *Educational Role of the Museum*, London: Routledge.

13. S.M. Pearce (Ed.), 1994. *Interpreting Objects and Collections*, London: Routledge.

14. UNESCO Publication 1960. *The Organization of Museum: Practical Advice*, Paris

15. G. Edson & Dean David 1994. *Handbook for Museums*, London: Routledge

HOME SCIENCE

Course No: HSC- 412 Advance Food Science & Nutrition **4CH**

Objectives:

1. To gain knowledge on importance of and new trends in foods.

2.To understand scientific approaches of RDA and BMR and to learn macro and micro nutrient requirements and their effect on human health.

Expected Outcome:

Knowledge on advance food and nutrition will help students to plan balanced diet using food groups and help them to know new trends in food science and nutrition.

M.A/M.Sc in Home Science

Unit-I: Food science: Basic food groups, Five basic food groups, Seven basic food groups , Eleven basic food groups and their contribution to health. Food preparation: Cooking-objectives, preliminary preparation &, methods of cooking, microwave cooking & changes in nutrient during cooking. Selection and storage of food. Balanced diet, Meal planning: objectives, factors affecting meal planning, Food additives, Food adulteration.

Unit-II: Study of different foods & food products: Cereals & cereal products, **p**ulses, Fruits& Vegetables, Nut& oils seeds, Milk and milk products, Eggs, Meat, Poultry, Fish and other Flesh products, Fats &oils , Sugar & Confectionary, Condiments and spices. Food fortification, Functional foods, Antioxidants, Need for convenience foods, New trends in Foods.

Unit-III: Nutrition Science**:** Definitions, Recommended dietary Allowances-Factors affecting RDA, General principles of deriving RDA, Determination of RDA of different nutrients, Requirements and practical applications of RDA, Energy balance-Units, Direct & Indirect Calorimetry, Determination of energy value of food, Relation between oxygen required and calorimeter value. Total Energy Requirement. Basal Metabolic Rate(BMR):Measurement of Basal Metabolism-Direct, calorimetry and Indirect caloriemetry,Resting energy expenditure,Factors effecting Physical activity,Factors affecting Basal metabolic Rate,Factors Affecting the Thermic Effect of Food.

Unit IV: Nutritional Requirements: Macro nutrients(Carbohydrates, Protein ,Fat) and Micro nutrients(Vitamins & Minerals)-their classification,function,sources,recommended dietary allowances and effect of deficiency, Importance of water and roughage in diet. . Water & electrolytes balance. Emerging Concepts in Human Nutrition, Ongoing nutrition transition and its implications. Changing trends in life style patterns in population groups and their implications .

Books Recommended

1. Normal and Therapeutic Nutrition – C.H. Robinson, Oxford & IBH Publishing Co. Calcutta.
2. Essentials of Food and Nutrition – M. Swaminathan, vol. I & II, The Bangalore printing and Publishing Co. Ltd.
3. Human Nutrition and Dietetics – Davidson, Passmore, East wood, English Language Book Society (ELBS).
4. Nutrition and Dietetics – S.A.Joshi; Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
5. Dietetics – B.Srilakshmi; New age International (P) Limited, New Delhi.
6. Nutrient Requirements and Recommended Dietary Allowances for Indians – Indian Council of Medical Research, National Institute of Nutrition, Hyderabad.
7. Text Book of Human Nutrition – Mahtab. S. Bamji; N.Pralhad rao & Vinodini Reddy, Oxford & IBH Publishing Co. Pvt.Ltd.
8. Nutrition Science-B.Srilakshmi,New Age International Publication-2012.
9. Food Science and Nutrition-Sunetra Roday-Oxford University Press-2016

Course No: HSC. 413 Nutrition through Life cycle 4CH

Objectives:

1. To enhance knowledge of students about physiological changes and nutritional requirements during various stages of life cycle.

2. To understand problems of different age groups and its managements.

Expected Outcome:

Detail knowledge on nutrition across lifespan can be obtained and different nutritional problems can be tackled easily.

Unit-I: Nutrition during Infancy: Growth and Development during Infancy, nutritional requirement during in infancy. Feeding of infants: breast feeding, artificial feeding, weaning and supplementary foods, feeding of premature & low birth weight babies, Nutritional disorder and common ailments in infancy.

Unit-II: Nutrition for Preschool and school going children (1 to 12 years) Importance of nutrition during preschool/school age. Nutritional requirements during preschool/school years, Food requirements during preschool/school age, Nutrition related problems in preschool/school children, feeding programmes.

Unit-III: Nutrition for adolescents:, Physical & physiological changes, Nutritional requirement, Food preferences, Nutritional problems –Obesity, Eating disorders, osteoporosis, Under nutrition. Prevalence of Anemia in adolescence and its management**.** Nutrition in Adult hood period on the basis of sex & activities

UNIT-IV:Nutrition during physiological changes in body: Pregnancy: Physiological changes, weight gain, , food & nutrient requirements during pregnancy, impact of good nutrition on outcome of pregnancy, Complications of pregnancy& their nutritional management. Lactation: Physiology of lactation, impact of nutrition on milk production, food & nutritional requirement during lactation. , Nutrition during old age: Physical & physiological changes, nutritional requirements. Problems of old age, Degenerative diseases, Exercise and old age, Drugs and old age.

Books Recommended

1. Human Nutriton and Dietetics- Davidson and Passmore
2. Preventive and Social Medicine- Park and Park, Banarasidas Bhanot Publishers, Prem nagar, Nagpur Road, Jabalpur.
3. Normal and Therapeutic nutrition - C.H.Robinson, Oxford &IBH Publishing Co.Calcutta.
4. Public Health and Hygiene- Y.P.Bedi, Atma ram & sons, Kashmere gate, Delhi.
5. Text Book of Public Health and Social Medicine- A.N.Ghei, Lakshmi Book Store, New Delhi.
6. Nutrition in Preventive Medicine- G.H.Beatin & J.M.Bengea-WHO.
7. Combating under Nutrition- Basic Issues & Practical Approaches, C.Gopalan, NFI Publications.
8. NFHS Survey I & II- International Institute for Population Studies, Mumbai.
9. Introduction to Nutrition throughout the life cycle, SR Williams, RS Worthington, EDsneholinka, P.pipes, JM ress & KL Mahal, Times Mirroe Mosby college publication
10. Text Book of Human Nutrition- M.S.Bamji, P.N.Rao & V. Reddy- Oxford & IBH Publishing Co. PVT Ltd.

Course No: HSC. 424 Nutrition Communication for Health Promotion 4 CH

Objectives

1.To be familiar with the national/international dietary guidelines addressing nutrition and health aspects & to learn about the determinants of food behaviour. 2.To be able to plan, implement and evaluate behaviour change communication for promotion of nutrition and health among the vulnerable groups.

Expected Outcome:

Knowledge on Nutrition Communication for health promotion will help students to gain knowledge on dietary guidelines, behaviour change communication for nutrition and health promotion and different nutrition policy and programmes.

Unit I Dietary guidelines for nutrition and health related concerns :National / international guidelines and their role in nutrition promotion. Critical appraisal of the current guidelines.

Unit II Nutrition and Behaviour Inter-relationship :Food and health behaviour, models/theories of health behaviour, food choice, strategies for intervention at the ecological and individual level

Unit III Behaviour Change Communication for nutrition and health promotion**:** Concept and objectives of communication for behaviour change**.** Planning of communication strategies for behaviour change programme. Developing nutrition education plan, identifying communication strategies and approaches for nutrition and health promotion (e.g. social marketing), designing nutrition and health messages, selecting communication channels, developing and field testing of communication materials, designing training strategy for trainers and building capacity. Implementing behaviour change communication intervention. Evaluation of communication for behaviour change programmes.

Unit IV:Measures to combat malnutrition: National nutrition Policy & Programmes, Supplementary feeding programmes, Role of ICDS & national & international agencies in combating malnutrition (WHO, FAO, UNICEF,NIN, NFI, FNB, NNMB, CFTRI) Role of food technology in combating malnutrition (development of food mixtures, food fortification, food preservation & new foods).

Books Recommended

2. Gibney M.J., Margetts, B.M., Kearney, J.M., Arab, L. (Eds) (2004) Public Health Nutrition. NS Blackwell Publishing.

3. Prochaska, K.L., The Transtheoretical Model of Behavioural Change, Shumaker SA(Eds).
4. Public Health Communication: Evidence for Behavior Change by Robert C. Hornik © 2002 by Lawrence Erlbaum Associates, Inc.
5. Communication and Health: Systems and Applications. Edited by Eileen Berlin Ray and Lewis Donohew © 1990 by Lawrence Erlbaum Associates, Inc.
6. Designing health messages: Approaches from Communication Theory and Public Health Practice. Editors: Edward Maibach and Roxanne Louiselle Parrott © 1995 by Sage Publications, Inc.
7. Community Nutrition in Action: An Entrepreneurial Approach. Fourth Edition. Marie A. Boyle and David H. Holben. © 2006 Thomson Wadsworth.

Course No: HSC. 511 Therapeutic Nutrition 4CH

Objectives

1. To understand causative factors & metabolic changes in various diseases disorders.
2. To learn principles of dietary counselling & gain knowledge of the principles of diet therapy.

Expected Outcomes

Understanding foods nutrition will help students & individuals to plan, prepare & manage preparation of therapeutic diets in various disease condition & its management.

Unit-I: Therapeutic Nutrition: Therapeutic adoption of normal diets (normal, soft & fluid diets) factors to be considered in planning therapeutic diets, drugs & diet inter-action, special feeding methods, pre& post operative diets, role of dietician, dietary calculation using food exchange lists, high & low calorie diet, high protein, high fat,& low carbohydrate diets.

Unit-II: Therapeutic Diets: Etiology, symptoms, nutritional Problems, nutritional requirements& dietary management of the Followings: Fever & infection (Zika Virus & Ebola), Peptic ulcer, gastritis, (very low residue diet) ,Jaundice & Viral Hepatitis, cirrhosis of liver, Pancreatitis (High protein, high carbohydrate moderate fat or fat restricted diet)

Unit-III: Therapeutic Diets: Etiology, Symptoms, nutritional problems, nutritional requirements & dietary management of the followings: Diabetes mellitus (metabolic disorder), Obesity, Diseases of kidney (Nephrosis, glomerulonephiritis, renal failure, urinary calculi, dialysis) (controlled protein, potassium & sodium diet)

Unit-IV: Therapeutic Diets: Etiology, symptoms, nutritional Problems, nutritional requirements and dietary management of cardio vascular disorder-Atherosclerosis (fat controlled diet) Heart disease (sodium restricted diet) Hypertension.

Books Recommended

40. Guidelines for planning Therapeutic diets- C.Lenka, Akinik Publications, New Delhi
41. Nutrition and Dietetics – Subhangini A.Joshi – Tata McGraw-Hill Publishing Company Limited, New Delhi
42. Dietetics – B.Srilakshmi – New age international (P) limited New Delhi.
43. Clinical Dietetics and Nutrition – F.A. Antia, Oxford University Press, London.
44. Normal and Therapeutic Nutrition- C.H.Robinson, Oxford & IBH publishing Co. Calcutta.

45. Text Book of Human Nutrition- Mahtab S. Bamji, N.Rao & V. Reddy, Oxford & IBH Publishing Co. Pvt Ltd.
46. Essentials of Food and nutrition – M.Swaminathan, Vol I & II, The Bangalore Printing & Publishing Co. Ltd (BAPPCO)
47. Food, Nutrition & Diet Therapy-L.K.Mahan & Escott.Stump- W.B. Saunders Ltd
48. Applied Nutrition & Diet Therapy for Nurses- J Davis, K.Sherer- W.B.Saunders.Co
49. Human Nutrition & Dietetics- J.S.Garrow ,W.P.T.James, A. Ralph –Churhill Livingstone.

Course No: HSC. 512 Nutritional Biochemistry 4CH

Objectives:

1. To acquire knowledge on metabolic pathways in the human body for regulation of macro and micro nutrients.

2. To enrich knowledge in digestion, absorption and utilisation of nutrients

Expected Outcome:

Gaining knowledge on nutritional bio- chemistry will enable the students to understand how the food is being utilised by our body to get energy.

Unit-I: Nutritional Importance of Carbohydrates: definition, classification, structure, & function. Digestion, absorption, and Metabolism of carbohydrates, Blood sugar level & equilibrium.

Unit-II: Nutritional Importance of Amino acids& Proteins: Structure & classification of amino acids, structure of protein, & their function. Digestion, absorption transportation and metabolism of Protein (Nitrogen balance, transamination & deamination of protein, urea cycle)

Unit-III: Nutritional Importance of Lipids: definition, importance fatty acids, structure, classifications & types of lipids, importance of lipoprotein, Digestion, absorption, transport and Metabolism of lipids.

Unit-IV: Nutritional importance of macro &micro nutrients: Functions, absorption and metabolism of vitamin A, vitamin D,Calcium,Iron, Iodine.

Books Recommended:

16. Fundamental of Biochemistry – A.C.Deb, New Central Book agency (P) Ltd, Calcutta).
17. Food, Nutrition & Health- G. Biswal & C.Lenka, Kalyani Publishers, New Delhi.
18. Text Book of Medical Biochemistry –M.N Chaterjee & Rana Shinde, Jaypee Brothers, Medical Publishers (P) Ltd Bangalore.
19. Fundamentals of Biochemistry –J.L.Jain, S.Chand & Company Ltd, Ram Nagar, New Delhi.
20. Human Physiology Vol I – C.C.Chaterjee, Medical Allied agency, Mahatma Gandhi Road, Calcutta.
21. Human Nutrition & Dietetics – Davidson & Passmare
22. Lehninger's Principles of Biochemistry-D.L.Nelson & M.M.Cox, Macmillan Worth Publishers.
23. A manual of Laboratory techniques-Raghuramulu, N. Madhavan Nair and K.KalyanSundaram – NIN, ICMR.
24. Harpers Biochemistry- R.K.Murray, D.K.Granner, P.A. Mayes, V.W.Rodwell-Mac millan Worth Publishers
25. Text Book of Biochemistry with clinical correlation T.M.Devlin-Wiley Liss inc.

Course No: HSC. 513 Food Microbiology and Food Safety 4CH

Objectives

1. To understand the nature of microorganisms involved in food spoilage, food infections and intoxications.

2. To understand criteria for microbiological safety in various foods operations to avoid public health hazards due to food contamination.

Expected Outcome:

Knowledge on food microbiology and food safety will help students to know role of microorganisms in human welfare and quality control of food.

UNIT I: Overview of Basic Microbiology: Definition, Scope of Food Microbiology, Important Microorganisms in food microbiology: Bacteria, Fungi, Yeast, Viruses, Factors affecting the growth of microbes. Important food borne infections and intoxications due to bacteria, moulds, viruses.

UNIT II: Food Spoilage and Preservation: Food spoilage: Definition, sources of contamination and microorganisms involved in spoilages of various foods: Milk, Bread, Canned food, Vegetables and fruits, Fruit juices, Meat, Eggs and Fish. Physical and chemical means used in destruction of microbes: Definition of sterilization and disinfection, role of heat, filtration and radiation in sterilization, use of chemical agents-alcohol, halogens and detergents.

UNIT III: Microorganisms in Human Welfare: Importance of microbes in food biotechnology: genetically engineered organisms, probiotics and single cell proteins. Dairy products (cheese and yoghurt) and traditional Indian fermented foods and their health benefits.

UNIT IV: Food safety and Quality Control: Public health hazards due to microbial contamination of foods: (Salmonella typhi, Helicobacter pylori, Campylobacter jejuni, Yersinia enterocolitica, Bacillus cereus, Staphylococcus aureus, Clostridium botulinum, Escherichia coli, Mycotoxins, Hepatitis A virus & Rota virus)- Symptoms, mode of transmission and methods of prevention. Assessing the quality of food by sensory evaluation-subjective evaluation & objective evaluation. Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS) ,evaluation of food safety: control of food quality.(codex Alimentarius, Indian standards) .

Books Recommended:

5. Food Microbiology – M.R.Adams & M.O.Moss, New Age International (P) Limited, New Delhi.
6. Food Facts and Principles -N. Shakuntala Manay & M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
7. Food Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
8. Food Microbiology – William C.Frazier, Tata McGraw Hill publishing Company limited, New Delhi.
9. Food processing and Preservation – G. Subhalakshmi & Shobha A. Udipi, New Age International (P) Limited, New Delhi.
10. Food Hygiene & Sanitation – S.Roday- Tata McGraw Hill, New Delhi.
11. Frazier WC, Westoff DC.(1998)Food Microbiology. 4th ed. Tata McGrawHill Publishing Co. Ltd.
12. Garbutt John (1997) Essentials of Food Microbiology. Arnold London.
13. Jay JM, Loessner DA, Martin J.(2005) Modern Food Microbiology. 7th ed. Springer
14. Prescott LM, Harley JP, Klein DA. (2008) Microbiology. 6th ed. WMC Brown Publishers.

Course No: HSC. 514 Programme Planning In Public Health Nutrition 4CH

Objectives

1. To understand the process of planning, implementation and evaluation of public health nutrition programmes.

2. To understand the concept of nutrition monitoring and nutrition surveillance & to understand the nutritional problems during emergencies / disasters as well as the strategies to tackle them.

Expected Outcomes

Knowledge on programme planning in public health nutrition will help students how to monitor and evaluate nutrition surveillance programmes and strategies to undertake to tackle nutritional problems during emergencies.

Unit I Programme Planning and Management in Public Health Nutrition: Basic principles and models of programme planning, Planning process in public nutrition

Unit II Programme Monitoring And Evaluation: Definition, significance and purpose of monitoring the food and nutrition programmes. Identification and selection of indicators for monitoring, data collection and analysis system (e.g. MIS).Definition, significance and purpose of evaluation in food and nutrition programmes. Principles of evaluation, types, models and steps of evaluation. Identification and selection of indicators for evaluation. Strategies for data collection (qualitative and quantitative)

Unit III Nutritional Surveillance: Objectives, initial assessment indicators for use in nutritional surveillance, Nutritional surveillance for programme planning, Triple A approach, Current program monitoring system in India.

Unit IV: Nutrition In Emergencies And Disasters: Natural and manmade disasters resulting in emergency situations. Nutritional problems in emergencies in vulnerable groups,Macro and micronutrient deficiencies, Infection. Assessment and surveillance of affected population groups – clinical, anthropometric and dietary, utritional relief and rehabilitation – assessment of food needs, food distribution strategy, mass and supplementary feeding, sanitation and hygiene, evaluation of feeding programmes , Public nutrition approach to tackle nutritional problems in emergencies.

Books Recommended:

3. Edelstein S. (2006) Nutrition in Public Health. A handbook for developing programmes and services. Second Edition. Jones and Bartlett Publishers.
4. Goyet, Fish. V. Seaman, J. and Geijer, U. (1978) The Management of Nutritional Emergencies in Large Populations, World Health Organization, Geneva.
5. FAO. (1983) Selecting Interventions for Nutrition Improvement. A Manual Nutrition in Agriculture. No. 3.
6. Gibney M.J., Margetts, B.M., Kearney, J. M. Arab, I., (Eds) (2004) Public Health Nutrition, NS Blackwell Publishing.
7. Klein, R. E. (Ed) (1979) Evaluating the Impact of Nutrition and Health Programmes. London and New York: Plenum Press.
8. Owen. A. Y. and Frankle, R. T. (1986) Nutrition in the Community. The Art of Delivering Services, 2nd ed. Times Mirror/ Mosby.
9. WFP/ UNHCR (1998) WEP/ UNHCR Guidelines for Selective Feeding Programmes in Emergency Situations. Rome and Geneva: WEP & UNHCR.
10. Nutrition Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
11. Food processing and Preservation – G. Subhalakshmi & Shobha A. Udipi, New Age International (P) Limited, New Delhi.
12. Food Hygiene & Sanitation – S.Roday- Tata McGraw Hill, New Delhi.

Course No: HSC. 521: Public Health Nutrition 4CH

Objectives

1. To understand the concept of public health nutrition & be familiar with the national health care delivery system.

2. To understand the economic consequences of malnutrition & to learn about the strategies for improving the nutritional status of communities.

Expected Outcome:

Knowledge in public health nutrition will make student familiar with concept and current concern of public health nutrition & its implication on the quality of life.

Unit I. Public Health Nutrition And Health Care System: Aim, scope and content of public health nutrition. Currents concerns in Public Health Nutrition. Health – definition, dimensions, determinants, indicators, Community Health Care, National Health Care Delivery System

Unit II: Health Economics and Economics of Malnutrition – impact on productivity and national development. Enhancing quality of life through Nutrition Education (Methods, Teaching Aids & Mass communication Media).

Unit III Assessment of Nutritional Status- Anthropometry Assessment, Dietary Assessment, Clinical Examination, Radiological measurement, Functional Assessment, Laboratory & bio-chemical assessment. Vital Health Statistics.

Unit IV Approaches/ Strategies for Improving nutrition status and health status of the community: Health based interventions including immunization, provision of safe drinking water/ sanitation, prevention and management of diarrhoeal diseases. Food based interventions including food fortification, dietary diversification, supplementary feeding and biotechnological approaches. Education based interventions including growth monitoring and promotion (GMP), health/ nutrition related behaviour change communication.

Books Recommended:

9. Achaya, K.T. (Ed) (1984) Interface Between Agriculture, Nutrition and Food Science,
10. Beaton, G. H and Bengoa, J. M. (Eds) (1996) Nutrition in Preventive Medicine, WHO.
11. Gibney M.J., Margetts, B.M., Kearney, J. M. Arab, I., (Eds) (2004) Public Health Nutrition, NS Blackwell Publishing.
12. Gopalan, C. (Ed) (1987) Combating Under nutrition – Basic Issues and Practical Approaches, Nutrition Foundation of India.
13. Kaufman M. (2007) Nutrition in promoting the public health strategies, principles and practice. Jones and Bartlett Publishers.
14. Park, K. (2009) Park's Textbook of Preventive and Social Medicine, 20th ed. Jabalpur M/s. Banarsidas Bhanot.
15. Food Facts and Principles -N. Shakuntala Manay & M. Shadaksharaswamy, New Age International (P) Limited, New Delhi.
16. Nutrition Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
17. Food Hygiene & Sanitation – S.Roday- Tata McGraw Hill, New Delhi.
18. Essentials of Food and nutrition – M.Swaminathan, Vol I & II, The Bangalore Printing & Publishing Co. Ltd (BAPPCO)

Course No: HSC 522: Public Health Aspects Of Malnutrition **4CH**

Objectives

1. To understand the principles of nutritional epidemiology and its importance in public health
2. To understand the prevalence and determinants of community's nutritional/ health problems.
To learn about the public health implications of various nutritional problems and the strategies to overcome the same.

Expected Outcome:

Studies on public health aspects of Mal-nutrition will prepare students to handle different health problems at community level such as under-nutrition, SAM & lifestyle disorders.

Unit I Public Health Aspects of Under Nutrition : Etiology, public health implications, prevention and community based management of PEM and micronutrient deficiencies of public health significance(Vit-A, Vit-D, Calcium, Iron, Iodine, Zinc, Cobalt, Magnesium, Potassium, Sodium).

Unit II Basics of IYCF Feeding of Low Birth Weight Babies, Kangaroo Mother care and Feeding Options for HIV Positive Mothers Dummy Practice – Problem Oriented Approach IYCF Counseling.

Unit III Severe Acute Malnutrition - Severe acute malnutrition and its causes, Screening for SAM in the community, Recognise signs of SAM , Recommended criteria of SAM in children (6-59 months) of age, Criteria for hospitalization/in-patient care/NRC, Physiological changes occur in SAM children, Inpatient therapeutic care for children 6-59 months with SAM, Discharge criteria of SAM, Management of SAM in infants < 6 months of age: Management of SAM in HIV infected children.

Unit IV Public Health Aspects of life style related disorders: Public health implications and preventive strategies for obesity, hypertension, coronary heart disease, diabetes, osteoporosis, cancer, dental caries, Polycystic Ovarian Syndrome.

Books Recommended:

54. Berg, A. (1973) The Nutrition Factor, The Brookings Institution,Washington.
55. Bonita R, Beaglehole R, Kjellstrom (2006) Basic Epidemiology. Second Edition. WHO.
56. Frank G.C. (2008) Community Nutrition-Applying epidemiology to contemporary practice. Second Edition. Jones and Bartlett Publishers.
57. Gibney M.J., Margetts, B.M., Kearney, J. M. Arab, I., (Eds) (2004) Public Health Nutrition, NS Blackwell Publishing.
58. National Consensus Workshop on Management of SAM children through Medical Nutrition Therapy (2009)-Compendium of Scientific Publications Volume I and II. Jointly organized by AIIMS, Sitaram Bhartia Institute of Science and Research, IAP (Subspeciality chapter on Nutrition), New Delhi. Sponsored by DBT.
59. Textbook of Preventive and Social Medicine, Park, K. Park's 20th ed. Jabalpur M/s. Banarsidas.
60. Nutrition Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
61. Food Hygiene & Sanitation – S.Roday- Tata McGraw Hill, New Delhi.
62. Essentials of Food and nutrition – M.Swaminathan, Vol I & II, The Bangalore Printing & Publishing Co. Ltd (BAPPCO).
63. Nutrition & Dietetics- Subhangini Joshi, McGraw Hill Education (India) Pvt. Ltd.

HSC 523: Advanced Clinical Nutrition 4CH

Objectives

a) *To understand the effect of various disorders / diseases on nutritional status, nutritional and dietary requirements.*

b) *To be able to recommend and provide appropriate nutrition care for prevention and treatment of various disorders.*

Expected Outcome:

Knowledge in public health nutrition will make student familiar with concept and current concern of public health nutrition & its implication on the quality of life.

Unit I Nutrition Care In Stress: Diet, Nutrient and Drug interactions. Nutrition Support – Parenteral Nutrition, diagnosis, complications, treatment, and dietary counselling in Metabolic Stress -Surgery, Burns, Sepsis & Trauma .

Unit II Diseases of Heart and Blood Vessels : Etiopathophysiology, diagnosis, complications and recent advances in prevention, treatment, MNT and dietary counselling in Myocardial Infarction, Congestive Heart failure Coronary Bypass Surgery..

Unit III Nutrition in Cancer- Risk factors symptoms, general systematic reactions, Nutritional problems in cancer therapy, Nutritional requirements, Dietary management & role of food in prevention of cancer.

Unit IV Nutrition in HIV and AIDS- Current status of HIV & AIDS in India, relation of nutritional status & HIVor AIDS, Opportunistic Infections(OI), Anti Retro Viral Drugs(ARV's), Mother-to- Child transmission & Paediatric Aids care & Nutrition in HIV.

Books Recommended:

5. Mahan, L. K. and Escott Stump. S. (2008) Krause's Food& Nutrition Therapy 12th ed. Saunders-Elsevier
Shils, M.E., Shike, M, Ross, A.C., Caballero B and Cousins RJ (2005)

6. Modern Nutrition in Health and Disease. 10th ed. Lipincott, William and Wilkins. Gibney MJ, Elia M, Ljungqvist &Dowsett J. (2005)
7. Clinical Nutrition. The Nutrition Society Textbook Series. Blackwell Publishing Company Garrow, J.S., James, W.P.T. and Ralph, A. (2000)
8. Human Nutrition and Dietetics. 10th ed. Churchill Livingstone.
9. Nutrition & Dietetics- Subhangini Joshi, McGraw Hill Education (India) Pvt. Ltd.
10. Kaufman M. (2007) Nutrition in promoting the public health strategies, principles and practice. Jones and Bartlett Publishers.
11. Park, K. (2009) Park's Textbook of Preventive and Social Medicine, 20th ed. Jabalpur M/s. Banarsidas Bhanot.
12. Nutrition Science – B.Srilakshmi, New Age international (P) Limited, New Delhi.
13. Essentials of Food and nutrition – M.Swaminathan, Vol I & II, The Bangalore Printing & Publishing Co. Ltd (BAPPCO)
14. Dietetics – B.Srilakshmi, New Age international (P) Limited, New Delhi.

HSC 524: Entrepreneurship In Food Service 4CH

Objectives

1. To develop a knowledge base about the physical facilities needed for different types of food service units & to impart necessary expertise to manage the financial aspects in the units.

2. To help develop marketing strategies & to equip individuals to start their own food service unit as Entrepreneurs.

Expected Outcome:

At the end of the course student will gain knowledge on different aspects of entrepreneurship in food service unit and able to start their own food service unit.

Unit I Entrepreneurship Development**:** Entrepreneur**,** Entrepreneurship**,** Capacity building through Training:- Meaning, definition, importance & need of training, education vs training, setting training objective, training need assessment (TNA).

Unit II Marketing & Sales Strategies- Product Differentiation, Marketing Techniques & strategies, Sales Management. Importance of financial management in a food based enterprise. Budgets & Budgeting process, maintaining records (menu, purchase, store, production, sale & personal utility), books of accounts(Journal, sales return books, purchase return book, sales book, purchase book, cash book & ledger), Pricing and its methods (Costing, concepts and controlling techniques, cost effective procedures) & Reports(Cost analysis, concept of trial balance, Profit & Loss account).

Unit III Food Hygiene Sanitation and Safety**-** Importance of hygiene and sanitation in food service units**,** Sanitation measures for Food, Personnel and Unit Hygiene, Training techniques for food service personnel in Sanitation. Safety- causes of accidents, types, safety techniques, 3 Es of Safety**.**

Unit IV Establishment and Operations of a Food Based Enterprise, Conceptualizing the Enterprise(Survey of types of units, consumer needs , identifying clientele, menu, operations and delivery).Planning the set up: Identifying resources(Facility available and equipments needed, Menu and precosting, Manpower required, Utilities)Developing Project plan and Determining investments, Feasibility assessment. Operationalising the unit(Procedures for menu planning, purchase, production and delivery of product). Evaluation of the working of unit (Food cost analysis, Sales analysis, Profit and loss statement, Balance sheet.

Books Recommended:

5. West B Bessie & Wood Levelle (1988) Food Service in Institutions 6th Edition Revised By Hargar FV, Shuggart SG, & Palgne Palacio June, Macmillian Publishing Company New York.
6. Sethi Mohini (2005) Institution Food Management New Age International Publishers.
7. Kazarian E A (1977) Food Service facilities Planning 3rd Edition Von Nostrand Reinhold New York.
8. Kotas Richard & Jayawardardene. C (1994) Profitble Food and Beverage Management Hodder &

Stoughton Publications.

9. Taneja S and Gupta SL (2001) Entrepreneurship development, Galgotia Publishing.
10. Catering Management in the Technological age-Fuller Barrievd- Rock hiff Publications.
11. Personal Management in the Hotel& Catering Industries- Boella- Hutchinson Publications.
12. Food Service Systems & Administration- Hitchcock Macmillan Publication.
13. Hotel House Keeping Training Manual- Andrews Snoher-Tata McGraw Hill Publication-New Delhi.
14. The Practice of Hospitality Management _vol I and II –R.Lewis, T.Begg's M.Shaw & S.Croffot-AVI Publishing Co.DC.West Port Connecticut.

HSC 525: Food Processing 4CH

Objectives

To impart systematic knowledge of basic and applied aspects in food processing & to enable the student to understand food composition and its physico chemical, nutritional and sensory aspects.
To gain in depth knowledge about processing and preservation techniques of different food products.

Expected Outcome:

Course on food processing enrich knowledge of students on food preservation & food processing technologies of different food products & keep them to start different food processing units.

UNIT I: Cereal and cereal products technology: Cereals- Wheat, rice, maize, barely, oat, rye- Structure, cultivation, harvesting, properties, composition and commercial value. Milling process- Complete milling process, milled products and their nutritive value and applications. Baking technology- Bread, biscuits/ Cookies and cake, Principles of baking, Ingredients and their functions, methods of preparation, methods of leavening: physical, biological and chemical, scoring of quality parameters.

UNIT II: Meat, fish, egg and its products technology : Meat- Composition, variety, handling, grading, ageing, curing, smoking and tenderizing of meat, meat pigments and colour changes, cooking, storage, methods of preservation for value addition and spoilage. Eggs- Composition, quality factors, storage, bacterial infection and pasteurization, freezing, drying and egg substitutes. Fish- Composition, onboard handling & preservation, drying and dehydration, salt curing, smoking, marinades, fermented products, canning, Modified Atmosphere Packaging, and quality factors.

Unit III: Milk and milk products technology: Milk- composition, factors affecting milk quality, physical and chemical properties. Milk processing: Separation, centrifugal process, natural creaming, pasteurization, sterilization, homogenization, effect of processing on nutritive value. Milk products: Khoa, Chnna, butter, butter oil, margarine, cheese, ice cream- Commercial processing, BIS Standards, packaging and distribution.

Unit IV: Fruits and vegetable technology: Principles of fruits and vegetables preservation, Processing technologies- Freezing, dehydration/ during, canning, preserves: jam, jelly, marmalade, pickel, sauce, squash, chatni.

RECOMMENDED READINGS

8. Siddapa, G S(1986) Preservation of Fruits and Vegetables, ICAR PublicationVan Loesecke HW (1998),
9. Food Technology Series Drying and Dehydration of foods. Allie Scientific Publishers.
10. Salikhe D K and Kadam S S(1995), Handbook of fruit science and technology.
11. Production Composition, Storage and processing. Marcel Decker inc, New York.
12. Marriott N G (1985), Principles of Food Sanitation 1st Edition. A VI publication USA. De Su Kumar, Milk and milk products technology.
13. National Dairy Development Board, Amul, Milk and milk products processing. FPO 1955
14. Fabriani, G and Lintas C. (1988) Durum Wheat Chemistry and Technology. American Association of Cereal Chemistry Inc.
15. Kent N L.(1993) Technology of Cereals. 4th Edi. Pergamon Press.
16. Olson, V M; Shemwell G A and Pasch, S (1998) Egg and Poultry Meat Processing, VCH P, New York
17. Winton & Winton, (1991) Techniques of Food Analysis. Allied Scientific Publishers.

LL.M E 522 Paper - I CRIMINOLOGY 4 credits

UNIT – I	Definition, Nature and Scope of Criminology, School of Criminology
UNIT– II	Causes of Crime, Types of Crime – White color Crime, Organised Crime, Cyber Crime, Terrorism, Hijacking
UNIT – III	Juvenile Crime, Prostitution, Alcoholism, Drug Addiction.
UNIT– IV	Victims of Crime, victim Compensation, Restitution, Rehabilitation and after care

LL.M E 523 Paper - II PENOLOGY 4 credits

UNIT– I	Punishment, Objective of Punishment, Theories of Punishment, Forms of Punishment, Capital Punishment
UNIT – II	Prison, Prison Administration, Human rights violation, International Treaties,
UNIT – III	Principles of sentencing, Alternatives to Imprisonment – Probation, Parole, Plea Bargaining, Executive Clemency
UNIT– IV	Police – power and function, Police Administration, Custodial Death, Human Rights Violation, National Police Commission

LL.M. E – 524

PAPER – I , Law of Banking & Negotiable Instrument – I 4 Credits

Unit – I	Historical Retrospection of Banking System in UK & India, Bank as a Social Control Institution..
Unit – II	Relevant portion of Banking Regulation Act, 1949. Nationalization of Banks, Regulations for Nationalized Banks.
Unit – III	Reserve Bank of India, State Bank of India.

Unit – VI Rural Banks – Organizational Structure & Function .

LL.M. E – 525

PAPER – II , Law of Banking & Negotiable Instrument – II 4 Credits

Unit – I Rights and Obligations of Bankers in respect of opening of accounts and maintenance of secret Accounts.

Unit – II Statutory Protection available to Bankers, Bankers and Customers relationship.

Unit - III Negotiable Instrument, kinds of Negotiable Instruments, Promissory Notes, Bills of Ex- change, Cheque, Endorsement- Presentation for Acceptance – Dishonor of Instruments.

Unit – VI Modes of Discharge, Material alterations, Crossing of Instruments, Making of Cheque, Noting and Protest, Recent Trend of Banking System : Information Technology, Automation, Smart Card, Credit Cards .

LL.M. E – 526 Statute Law – I 4 Credits

Unit – I Hindu Marriage Act, 1955
Unit – II Special Marriage Act, 1954
Unit - III Hindu Adoption & Maintenance Act, 1956
Unit – VI Hindu Adoption & Maintenance Act, 1956

LL.M. E – 527 Statute Law – II 4 Credits

Unit – I Hindu Minority & Guardianship Act, 1956
Unit – II Hindu Minority & Guardianship Act, 1956
Unit - III Hindu Succession Act, 1956
Unit – VI Hindu Succession Act, 1956

LL.M. E – 530 Paper – I **Patent**

Unit - I Patent – History, Origin, Nature, Meaning, Definition of Patent, Salient Features of Patent

Unit – II Acquisition of Patent ; Application of Patents, Examination of application, Effects ofExamination 7 Investigation and validity of patent, Rights of Patentees of others, Passing of the Patent Rights

Unit – III Surrender & Revocation of patents, functionaries and establishments under the Act

Unit - IV Infringement & remedies of patent, Exclusive Marketing Rights (EMRs)

LL.M. E – 531 Paper – II **Trade Marks Designs, Protection of Geographical Indications & New varieties of Plants**

Unit - I Concept, Definition of Trade Marks, Essential features of Trade Marks, Subject matter of trademarks, Types of Trademarks, Functions of Trade Marks.

Unit – II Acquisition of Trade Marks, Distinctiveness of Trade Marks, Deceptive similarities, Passing of Action.

Rights conferred by Registration of Trade Marks, Infringement & remedies of Trade Marks

Unit – III Design – Definition , Meaning, Essential of Designs, Registration of Designs, Rights granted to Design Holders, Infringement of Designs and Remedies

Unit - IV Geographical Indications Protection – Definition of Geographical Indication Protection, Indication of Source, Appellation of Origin, Position under Micro-organisms, Protection of new varieties of plants

LL.M. C - 532 (Law Teaching)

A topic is assigned to each student in advance. He/she is required to handle a class for 25 to 30 minutes. The student may be asked to teach the LL.M first and second semester students .They can select any one of the methods of teaching.

MASTER OF LIBRARY & INFORMATION SCIENCE

Course No. MLIS-431 EFFECTIVE COMMUNICATION SKILL

Course Objective:

The objective of this course is to acquaint the students with effective writing and presentation skills. The students will be familiar with public speaking and official correspondence.

Course Outcome:

1. Remember and understand the basic concepts related to Effective communication skill
2. Analyse the Various Concepts to understand them through case studies
3. Apply the knowledge in understanding practical problems
4. Execute/create the Project or field assignment as per the knowledge gained in the course

Course Content:

UNIT-1: EFFECTIVE WRITING

Effective Writing Skills: Elements of Effective Writing, Main Forms of Written Communication: Agenda, Minutes, Notices, Writing of CV, Memo, Drafting an E-mail, Press Release. Correspondence: Personal, Official and Business, Report Writing.

UNIT-2: EFFECTIVE PRESENTATION

Presentation Skills, Interviews, Public Speaking, Preparing the Speech, Organising the Speech, Special Occasion Speeches. • Greeting and introducing. • Practising Short Dialogues. • Group Discussions, Seminars/Paper-Presentations. • Listening News/Conversations/Telephonic Conversation.

M.Sc. (LIFE SCIENCES)

LS-411	Fundamentals of Physical Sciences	3 CH	50 marks

OBJECTIVE

This paper contains three units, namely basic physics, basic chemistry and basic mathematics. Each unit contains a description of the principles related to that unit, well-supported by mathematical derivations of equations, descriptions of laboratory experiments, historical background etc; with solved examples that explain equation just derived or the concept just discussed. These courses will help in fixing the Ideas firmly in student's mind. The examples discussed are used to encourage students for participation in discussions and motivate towards advance learning in the field.

PROGRAMME EDUCATION OBJECTIVES (PEOs): After studying Fundamentals of Physical Science in the curriculum, students will be able to:

PEO1. Understand the nature and basic concepts of Physical Sciences in Biology relating to M.Sc. degree in Life Sciences.

PEO2. Analyze the relationships among different concepts of Physical Sciences.

PEO3. Perform procedures as laid down in the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Fundamental of Physical Sciences in the curriculum

Students will be able to:

CO1. Remember and understand the basic concepts of Physical sciences.

CO2. Analyze the various concepts to understand them through laboratory experiments/case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute/create the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Basic Physics: What is Physics? Physics and mathematics**,** Fundamental and Derived Quantities, Units and Dimensions, their conversions and their uses, Order of Magnitudes; The forces: Gravitational, Electromotive and Nuclear forces; Different forms of energies, Kinetic vs Potential energy, Mass-energy equivalence, Surface tension, Viscosity, Photoelectric effect, Basic characteristics of electricity, charge, current, voltage, resistance, capacitor, and electric field.

Unit-II: Basic Chemistry: Atomic structure – waves and wave functions, quantum numbers, Atomic orbitals, electronic configuration of atoms and periodic properties of elements, ionic radii's, ionization potential, electronic configuration of molecules. Bond lengths, Bond angles, bond order and bond energies, types of chemical bond (weak and strong), intermolecular forces, structure of simple ionic and covalent bonds, carboxylic acids, aldehydes and ketones, and amines.

Unit-III: Basic Mathematics: Logarithms, exponential series, factorials, graphs, Coordinate geometry – straight line and non-linear relationships. Differentiation– Rates and limits, Differential coefficients, Differentiation of a function. Integration – Basic concepts of integration, integration by substitution, integration by parts. Matrix algebra – linear transformation between vector spaces, Representation of linear transformation by matrices, Algebra of matrices, Eigen values and Eigen vectors of linear transformation.

SUGGESTED READING:

1. Text book of Physics by Barik, Das, Sharma.
2. Essentials of Physical Chemistry by Arun Bahl, B S Bahl & G.D. Tuli.
3. Text books in mathematics published by NCERT, India.
4. Concepts of Physics by H C Verma.
5. IIT Chemistry by O P Agarwal.
6. PMP Certification Mathematics by V Subramanian & R Ramachandran.

LS-412	Biochemistry	3 CH	50 marks

OBJECTIVE

The objective of this particular paper is to provide an advance understanding of course principles of biochemistry and their experimental basis. It will enable the students to understand the various aspects of biochemistry and its importance in daily life. Further it can be utilized for clinical diagnosis, manufacturing of biological products and treatment of diseases.

PROGRAMME EDUCATION OBJECTIVES (PEOs): After studying Biochemistry in the curriculum, students will be able to:

PO1. Understand the nature and basic concepts of Biochemistry.

PO2. Analyze the relationships among different concepts of Biochemistry.
PO3. Perform procedures as laid down in the areas of study.
PO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying biochemistry in the curriculum Students will be able to:

CO1. Remember and understand the basic concepts of Biochemistry.

CO2. Analyze the various concepts to understand them through laboratory experiments/case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute/create the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Structure of Biomolecules: Polysaccharides, starch and glycogen as reserve fuel; Cellulose as structural polysaccharides; Lipids: triglycerides and spingosides, conjugated and complex lipids.Structure and conformation of nucleic acids. Proteins: molecular organization, protein structure (Primary, Secondary, Tertiary and Quaternary).

Unit-II: Metabolism and Bioenergetics: Glycogenesis and glycogogenolysis, HMP shunt, Gluconeogenesis and its physiological significance; Oxidation of fatty acids. Electron transport in mitochondria and chloroplast; Basic principles of oxidative and photophosphorylation.

Unit-III: Enzymes:Classification of enzymes, concept of active site and its analysis, Mechanism of enzyme catalysis (with examples), Michaelis-Menten, Linewever-Burke plot, Eddy-Hoftsee plot and Hans plot,Factors affecting enzyme catalysis, Enzymes inhibitions, Allosteric enzymes.

SUGGESTED READING:

1. Fundamental of Biochemistry by J. L. Jain.
2. IIT Chemistry by O P Agarwal.
3. Principles of Biochemistry by Lehninger, David L. Nelson and Michael M. Cox
4. Biochemistry by Jeremy M. Berg, John L. Tymoczko and Lubert Stryer
5. Principles of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W. Pratt

LS-413	Biophysics and Biophysical Chemistry	3 CH	50 marks

OBJECTIVE:

Biophysics and Biophysical Chemistry is an advanced field of Biological sciences which uses the principles and techniques of physical science in the study of living systems. The course includes the fundamentals of weak electrostatic interactions and their significance in maintenance of the structural stability of biologically important macromolecules and diversified structures. The course also emphasizes the importance of light and other electromagnetic radiations in the regulation of different developmental activities in plants, animals and microbes. Additionally, biophysical chemistry enhances the knowledge on chemistry of life and its active involvement in different biological activities in the living organisms.

This paper contains three units, namely Inter-molecular interactions, Photo Biophysics, and Biophysical Chemistry. Each unit contains a description of the principles related to that unit, well-supported by different

equations, descriptions of laboratory experiments, historical background etc. with solved examples. These will help in fixing the Ideas firmly in student's mind and motivate the students forhigher study.

PROGRAMME EDUCATION OBJECTIVES (PEOs): After studying Biophysics and Biophysical Chemistry in the curriculum, students will be able to:

PEO1. Understand the nature and basic concepts of Biophysics and Biophysical Chemistry relating to M.Sc. degree in Life Sciences.
PEO2. Analyze the relationships among different concepts of Biophysics and Biophysical Chemistry.
PEO3. Perform procedures as laid down in the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Biophysics and biophysical chemistry in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of Biophysics and Biophysical chemistry.
CO2. Analyze the various concepts to understand them through laboratory experiments/case studies.
CO3. Apply the knowledge in understanding practical problems.
CO4. Execute/ create projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Molecular interactions: Dipole and dipole moments, induced and transient dipole, unit charge, charge-charge interaction, charge-dipole interaction, dipole-dipole interaction, hydrogen bonding, Van der Waal's interaction, role of weak electrostatic interactions in the stability of proteins (α-helix and β-pleated sheets), nucleic acids, bio-membranes, liposomes, micelles, artificial lipid bilayers and structure of water, protein folding.

Unit-II: Photobiophysics: Light absorption, emission and quantum transfer mechanism, laws of photochemistry, quantum yield and inductive resonance, photochemistry of photosynthesis and vision, UV-induced DNA damage and repair mechanisms, ionising and non-ionising radiations, effect of ionising radiations on biomolecules and cells and photo-protective mechanisms in plants during stress.

Unit-III: Biophysical chemistry: pH and Buffers, Ionic strength, Buffer strength, Buffering zone and preparation of buffers, Molecularity and kinetic order of reaction, Theories of reaction rate, Laws of thermodynamics and biology – Concept of free energy, Entropy, Q_{10} and Arrehnious equation.

SUGGESTED READING:

1. Modern College Chemistry by R C Acharya & Y R Sharma.
2. Essentials of Physical Chemistry by Arun Bahl, B S Bahl & G.D. Tuli.
3. Biophysical Chemistry By Upadhyay, Upadhyay & Nath.
4. Electrical Interactions in Molecular Biophysics: An Introduction. Raymond Gabler. Academic Press, New York.

LS-414	Microbiology	3 CH	50 marks

OBJECTIVE:

Microbiology is a broad discipline and students have a wide range of options for the study of microbiology including: microbial physiology, microbial genetics, microbial ecology, pathogenesis, immunology, virology, parasitology,

epidemiology, evolution and diversity. Microbiology is a laboratory-based science, and as such, our curriculum supports laboratory components in most of the courses taught in the program.

PROGRAMME EDUCATION OBJECTIVES (PEOs):

PEO1. Understand the nature and basic concepts of Microbiology relating to M.Sc. degree in Life Sciences.
PEO2. Analyze the relationships among different concepts of Microbiology.
PEO3. Perform procedures as laid down in the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Microbiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of Microbiology.

CO2. Analyze the various concepts to understand them through laboratory experiments/case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute/ create projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Historical resume of Microbiology, An overview of the microbial world (Bacteria, Archea, Eukaryote). Classification of Archea and Eubacteria as per Bergey's manual; Microbial phylogeny. Structural organization of prokaryotic cell (bacterial wall, capsule, flagella, pilli, pronucleus, ribosomes, plasmid).

Unit-II: Bacterial nutrition and nutritional category, Bacterial culture: Synchronomous and asynchronous culture, continuous culture and chemostat principle. Bacterial growth: phases of growth, Mathematical expression of growth, generation time, specific growth rate. Bacterial metabolism: Glucose dissimilation pathways, Bacterial respiration with organic and inorganic reductant, Chemolithotrophy. General principle of bacterial conjugation, transduction and transformation. Bacterial pathogenecity and anti- microbial compounds.

Unit-III: Virus**:** Generalproperties, structure, purification, cultivation, principle of viral taxonomy. Bacteriophage: structure, classification, one-step growth experiment. Production of DNA phage, RNA phage, Lytic cycle, Temperate phage and Lysogeny. Animal virus and its reproduction, viral infection (Presistent, Latent and Slow virus infection). Plant virus and their transmission. Anti-viral agents; M-13, Lambda, HIV, Influenza virus, Viriods and Prions.

SUGGESTED READING:

1. Brock Biology of Microorganisms (12th edition) by Madigan and John M. Martinko, Paul V. Dunlap, David P. Clark Benjamin Cummings; 2008.

2. Principles of Virology: Molecular Biology, Pathogenesis and Control of Animal Viruses by S.J. Flint, L.W. Enquist, V.R. Racaniello, and A.M. Skalka 2nd edition, ASM Press, Washington, DC, 2004.
3. Introduction to Modern Virology EPZ by Nigel Dimmock, Andrew Easton and Keith Leppard, 5th edition, Blackwell Publishing, 2005

4. Microbiology. Sixth edition, International edition by Prescott, L. M., J. P. Harley and D. A. Klein. 2005., Mc Graw Hill.

5. Microbiology. Fifth edition by Pelczar, T. R. and M. J. Chan and N. R. Kreig. 2006, Tata Mc Graw-Hill INC. New York.

6. Fundamentals of Microbiology & Immunology by Ajit Banerjee and Nirmalya Banerjee 2008.. New Central Book Agency (P) Limited.

7. A Textbook of Microbiology, 4th Edn. by R C Dubey and D K Maheshwari , S. Chand Publishing.

LS-415	Molecular Biology	3 CH	50 marks

OBJECTIVE:

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, protein synthesis.

PROGRAMME EDUCATION OBJECTIVES (PEOs): After studying Molecular Biology in the curriculum, students will be able to

PEO1. The course will help the students to understand basic concepts of Molecular Biology.

PESO2. At molecular level and there will be analysis of the interactions between the various systems of a cell, including the interrelationship of DNA, RNA and protein synthesis and learning how these interactions are regulated.

PEO3. The concepts discovered in this manner can be applied to mainstream biology, medicine, wildlife study and protection of endangered animals, food industry, pharmaceutical industry and environment protection.

OUTCOME

CO1. After studying the Molecular Biology curriculum, students will be able to understand the basic organization of genome through evolutionary process, transfer of the information for continuance of life and heredity at molecular level.

CO2. They can analyze the basic steps in transfer of genetic information and its regulation. and will have an insight into the natural process of repair mechanism and the recombination process which brings about variation in the genetic material.

CO3. They can construct and utilize predictive models to study and describe complex biological systems and apply concepts from other sciences in order to interpret biological phenomena.

CO4. The can execute project applying the basic principles of genetic engineering.

COURSE

Unit-I: Genetic organization of Prokaryotes and Eukaryotes including nuclear genome and organellar genome; DNA as the genetic material; Central dogma of Molecular Biology; Genome complexity; C- value paradox, Cot value, Repetitive DNA, Satellite DNA; Gene structure in Prokaryotes and Eukaryotes;Cistron, Recon, Muton; Variants of gene- Split genes, Pseudogenes, Overlapping genes and selfish DNA; DNA methylation.

DNA replication: Models of DNA replication, Enzymes of DNA replication, Process of DNA replication (initiation, elongation, termination), DNA replication at the telomere; Replication of Mitochondrial and Chloroplast genome.

Unit-II: DNA-Protein interaction, DNA repairs mechanism, DNA recombination (site-specific and homologous) mechanisms and its significance.

Transcription: Components of transcription machinery in Prokaryotes and Eukaryotes, Trancriptional factors, Transcription process (initiation, elongation and termination); Post-transcriptional processing, m-RNA stability, m-RNA editing; Gene silencing.

Unit-III: Translation: Genetic Code- Principle of translation, Translation machinery in Prokaryotes and Eukaryotes (t-RNA, Aminoacyl synthetase, Ribosome), Translation process (initiation, elongation and termination); Post-translational modifications of proteins.

Regulation of gene expression: Constitutive and Induced gene expression; Regulation of gene expression in Prokaryotes and Eukaryotes; Operon concept (Lac, Ara, Trp and His).

SUGGESTED READING:

1. Gene – VIII by B. Lewin, Pub: Jones and Barlett .
2. Molecular biology of the gene 5th Edn. by J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine and R. Losick, Pub: Cold Spinger Harbr Laboratory Press.
3. Molecular Biology of the cell 4th Edn. by B. Alberts, D. Brey, J Lewis, M.Raff, K. Roberts and J.D. Watson, Pub: Garland Science
4. Molecular biology LabFax, by T.A. Brown.
5. Molecular Biology by T.A. Brown
6. The cell A molecular Approach by G.M. Cooper and R.E. Hausman

LS-417	**Practical based on Biochemistry and Instrumentation**	**2 CH**	**50 marks**

LS-418	**Practical based on Microbiology**	**2 CH**	**50 marks**

LS-421	**Ecology**	**3 CH**	**50 marks**

OBJECTIVE:

The Environment and Ecology is the paper to understand the nature of environmental influences on individual organisms, their populations and communities at the level of biosphere. It will also deal with the local distribution of animals in various habitats and the influence of the deterioration of habitats on the population and the community as a whole.

PROGRAMME EDUCATION OBJECTIVES (PEOs): After studying Environment and Ecology the students will be able to:

PEO1. To provide an understanding on the fundamentals of environment
PEO2. To analyze the relationship between various components of ecosystem
PEO3. Perform experiments to study various ecological parameters and biodiversity in laboratory/field

conditions.

PEO4. Apply the basic concepts learned to execute them for environment protection.

COURSE OUTCOMEs (COs): After studying Environment and Ecology in the curriculum

Students will be able to:

CO1: Remember and understand the basic principles of ecology and can judge how organism function, interact within and across trophic levels, influence the flow of energy and the movement and recycling of matter in communities and ecosystems

CO2: Analyze interactions within the context of specific habitats and judge how the habitat shapes the distribution and abundance of species. And can recognize that the distribution of organisms is a product of positive and negative interactions within and across trophic levels, including competition, mutualism, predation, and parasitism

CO3: Apply basic ecological principles to meet societal resource management and conservation goals.

CO4: Execute a productive role towards improving life and protecting the environment with due regard given to ethical values

COURSE:

Unit-I:

Concepts of environment and ecosystem: Biotic and abiotic interactions; Cybernetic nature of ecosystem; stability through feedback control and through redundancy of components; resistance and resilience stability, Gaia hypothesis; Concept of limiting factors- Liebig's law, Shelford's law; Ecological indicators. Energy in the environment: Laws of thermodynamics, energy flow in the ecosystem; Primary productivity and secondary productivity. Food chain, food web, trophic levels. Ecological pyramids, Ecological efficiencies, Bio-geochemical cycles- patterns and types (CNP).

Unit-II:

Population Ecology: Concept of population and population attributes: Density, natality, mortality, survivorship curves, life table, age structure, population growth forms, Concept of carrying capacity and environmental resistance, Life history strategies, r- and k- selection, Biological scaling (allometry), , Concept of community: concept of habitat and niche, Quantitative features and attributes of community, Community dynamics: trends and significance, Climax theory, Co-evolution of species populations in the community.

Unit-III:

Concepts of Resource: Biotic & Abiotic Resources, Renewable and Nonrenewable resources, Exhaustible and non-exhaustible resources. Resource Conservation and Management, Concept of Sustainable Development,

Concept of stress and Strain, Tolerance Hypothesis, Steno-and Eury species, Concept of limiting factors, Environmental Pollutants as stress factor: Sources/pathways of pollutants, metallic pollutants such as Mercury,Arsenic,CVadfmiun, Photochemical smog, Acid rain, Ozone hole, Eutrophication, Biological magnification, Fluoride as a pollutant, Global warming, Green house gases and climate change.

SUGGESTED READING:

1. Fundamentals of Ecology by Eugene P. Odum and Gary W. Barrett ,(2009) Amazon.in
2. Fundamentals of Ecology by S. Dash, M. Dash, 3rd Edition, Mcgraw Higher Ed
3. Concepts of Ecology by Concepts of Ecology (1995) by Edward J. Kormondy

LS-422	Cell Biology 41	3 CH	50 marks

OBJECTIVE: Membrane Biology associated with cellular transport along with cell signaling is key events in cell metabolism. Basic physiological processes in relation to different kinds of radiation largely influences cell dynamics and thus survival. This paper comprises of three units, namely Cell dynamics and Cell signaling, Cellular Transport, and Cellular Radiation Physiology. Each unit contains a description of the principles related to that unit, well-supported by different examples, descriptions of laboratory experiments, historical background etc. with solved equations that explain the concept. These courses will help in fixing the Ideas firmly in student's mind which will bring them to a habit of being excellent scientific temperament.

PROGRAMME EDUCATION OBJECTIVES (PEOs): After studying Cell Biology in the curriculum, students will be able to:

PEO1. Understand the nature and basic concepts of Cell Biology relating to M.Sc. degree in Life Sciences.
PEO2. Analyze the relationships among different concepts of Cell Biology.
PEO3. Perform procedures as laid down in the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Biophysics and biophysical chemistry in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts/principles of Cell Biology.

CO2. Analyze the various concepts to understand them through scientific experimentations/ case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute/create the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Cell dynamics and Cell signaling: The dynamics of cell and its evolution, Architecture and life cycle of cells, Overview of cell to cell signaling at intercellular communications, Cell surface receptors and their role in signal transduction, G-protein coupled receptors and RTKs, 2nd messengers and signaling pathways, Regulation of signaling pathway.

Unit-II: Cellular Transport: Passive and active transport, co-transport and counter transport mechanisms, Diversity of transporter proteins in the cell membrane, diffusion and bulk flow, carrier mediated transport, Kinetics of transport, Concept of water potential, its components, units and measurement, Ion channel proteins and aquaporins.

Unit-III: Cellular Radiation Physiology: Basic radiation biophysics, UV and ionizing radiations, radiation effects on cell and sub-cellular components (nucleic acids and proteins), Dose response curves in prokaryotes and eukaryotes; Split dose technique and concept of dose LD_{50}.

SUGGESTED READING:

1. Essential Cell Biology by Albert et al.
2. Cell Biology by Gerald Karp
3. Fundamentals of Radiation Biology by P. Umadevi
4. Radiation Biology for Radiologist by Eric J. Hall
5. Molecular Cell Biology by Lodish et al.

6. A manual of Laboratory Experiences in Cell Biology by C E Gasque.
7. Cells by Lewin et al.

LS-424	Genetics	3 CH	50 marks

OBJECTIVE

The objective of this study is to have an understanding of the inheritance and expression of genes. They will have a clear concept on various terminologies used in genetics. It will also help to understand the processes which help in maintaining the stability of the genetic material and the processes which bring about variation in genetic pool.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Immunology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Immunology
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Inheritance Biology in the curriculum, students will be able to:

CO1. Remember and understand Mendelian principles and the way of transfer of genetic material from one generation to another.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding extrachromosomal inheritance, the occurrence of variance in the gene pool and population genetics practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Mendelian principles: Dominance, segregation, independent assortment; Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.Extra-chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

Unit-II: Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests. Gene mapping methods: Linkage maps, Tetrad analysis, Pedigree analysis, lod score for linkage testing, Mapping with molecular markers, Mapping by using somatic cell hybrids, Development of mapping population in plants. Quantitative genetics: Polygenic inheritance, Heritability and its measurements, QTL analysis.

Unit-III: The origin of genetic variability through mutation (Spontaneous and chemical mutation, Frame-shift mutation, point mutations and chromosomal abberations).Causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Structural & numerical changes of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications, Genetic diseases and

syndromes.Population Genetics: Gene pool, Gene frequency, Hardy Weinberg genetic equilibrium and the factors influencing it, Gene flow and Genetic drift.

SUGGESTED READING:

1. Genetics by Sinnot, Don, Dobjanasky.
2. Genetics by Strickberger.
3. Genetics by Gardner.
4. Concepts of Genetics by Klug and Cumming.
5. Applied Genetics by Emmanuel, Ignacimuthu and Vincentet
6. Molecular biology of the gene 5th Edn. by J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine and R. Losick, Pub: Cold Spinger Harbr Laboratory Press.
7. Introduction to Genetic Analysis 12th Edn. by Griffith et. al.

LS-425	Taxonomy, Biodiversity and Biostatistics	3 CH	50 marks

OBJECTIVE:

Biosystematics will help in studying the biodiversity and its origins. In a broader sense, it is a science through which organisms are discovered, identified, named and classified with their diversity, phylogeny, spatial and geographical distributions. The objective of Biostatistics is to advance statistical science andits application to problems of biology including human health and disease, with the ultimate goal of advancing statistics. The role of biostatisticians is an important one, especially when it comes to designing studies and analyzing data from research problems.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying biosystematics and biostatistics in the curriculum, students will be able to:

PEO1. To understand the fundamental principles of systematic in which the animals/plants are classified according to their characters and what are the theories which have to be followed for classification. International rules of nomenclature and classification is studied. Also to understand the proper use and interpretation of significance levels (p values), recognize and understand the relevance of probability distributions such as the normal & binomial be able to formulate and test statistical hypotheses using 6 steps.

PEO2. To analyze the relationships between various taxa of organisms based in their evolutionary history and establishing their phylogeny

PEO3. To perform different tests of significance for getting a concrete conclusion in various aspects of biological experiments

PEO4. To apply the basic concepts of biosystematics and biostatistics to deal with kinds and diversity of organisms and any or all relationships among them and to deal with inferential statistics

COURSE OUTCOMEs (COs): After studying biosystematics and biostatistics in the curriculum, students will be able to:

CO1: Remember and understand the role in biology by providing the means for characterizing the organisms that we study. CO2; Analyse the classifications that reflect evolutionary relationships that allows predictions andtestable hypotheses

CO3: Apply the basic concepts for effective decision-making about conservation and sustainable use.
CO4: Execute the field based knowledge by providing a framework for systematic conservation planning for the management of biological diversity and natural resources.

COURSE

Unit-I: Taxonomy:Theories of evolution; Evidences in support of evolution (Morphology to Molecular level);Species concept and Speciation, Ranking and nomenclature, Types of classification (Artificial, Natural, Phylogenetic and Phenetic)of plants and animals, Modern methods of taxonomy such as biochemical, molecular, serological and numerical.

Unit-II: Biodiversity:Genetic diversity, Species diversity and Ecosystem diversity; Tools of diversity analysis (diversity, dominance, evenness and similarity indices); Relationship between diversity, dominance and productivity. ; Attributes of biodiversity (keystone species, flag ship species, indicator species, rare species, vulnerable species, endangered species); Latitudinal gradients of biodiversity and mega biodiversity. Methods of biodiversity conservation (i*n situ* and e*x situ*,and germplasm conservation)

Unit-III: Biostatistics: Concept of biostatistics, Measures of central tendency and dispersion; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Test of significance: Regression and Correlation; t-test; Analysis of variance; X^2 test; Basic introduction to Multivariate statistics.

SUGGESTED READING:

1. Mayr, E. 1969. Principles of Systematic Zoology. McGraw Hill Book Company,Inc., NY. 24.
2. Mayr, E.1997. This is Biology: The Science of Living world. Universities PressLtd.Biostatistics: Theory and Application by G.B.N Chainy, G. Mishra, P.k. Mohanty, Kalyani Publishers.
3. Stace, C. A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London Introductory practical Biostatistics by B.N.Mishra, M.K. Mishra, Naya Prokash publication, Calcutta
4. Plant Systematics: Theory and Practice by Singh, Gurcharan. 2012 Completely revised and enlarged 3rd edition. Oxford & IBH, New Delhi.
5. Plant Taxonomy (Second Edition) by O.P. Sharma.

LS-426	Advanced Techniques in Biology	3 CH	50 marks

OBJECTIVE:

The paper on Advanced Techniques in Biology aims to introduce the applications of techniques like crystallography, cytometry etc which will help in understanding intricately the processes occurring inside the cell, tissues os the organism as a whole.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Advanced Techniques in Biology in the curriculum, students will be able to:

PEO1. To understand the fundamental principles of various techniques like X-ray crystallography, OD and CRD, Infra Red (IR), Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy.

PEO2. To analyze the processes occurring inside the organisms using the techniques described in this paper.

PEO3. To perform experiments in various aspects of biological systems.

PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Advanced Techniques in the curriculum, students will be able to:

CO1: Remember and understand the biological processes using various techniques.

CO2; Analyse the relationships between biochemical reactions and the biological processes.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Principle and application of the instrumental technique: X-ray crystallography, OD and CRD, Infra Red (IR), Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy.

Unit-II: MALDI-TOF, MS-MS; Flow cytometry, Cytofluorometry and FACS; Atomic absorption spectroscopy (AAS); FISH, IRGA.

Unit-III: Principle and application of HPLC, GLC; PCR and its variants; Application of PCR in Biology; DNA and Protein sequencing; Micro-array analysis (DNA and Protein).

SUGGESTED READING:

1. Learning Radiology: Recognizing the Basic by William Herring
2. Handbook of HPLC-HPTLC (PB 2021) by Nema R.K.
3. Applications of MALDI-TOF Spectroscopy 2013 Edition by Zongwei Cai, Shuying Liu , Springer
4. Physical Biochemistry by David Freifelder
5. Modern Experimental Biochemistry by Rodney Boyer
6. Molecular Cloning by Sambrook Russel

LS-427	**Practical based on Ecology and Biostatistics**	**2 CH**	**50 marks**

LS-428	**Practical based on Genetics and Immunology**	**2 CH**	**50 marks**

LS-531	**Bioinformatics and Computer Application**	**3 CH**	**50 marks**

OBJECTIVE

They will learn storing the biological data, developing the tools that are essential to processing the data, and the important goal of this is to exploit the computational tools for analyzing the data that simply depicts the results. The computational education of biologists is changing to prepare students for facingthe

complex datasets of today's life science research.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Bioinformatics and Computer Application in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Bioinformatics and Computer Application

PEO2. Analyze the relationships among different concepts related to tools and techniques related to Bioinformatics and Computer Application.

PEO3. Perform procedures as per the areas of study.

PEO4. Apply the basic concepts learned to execute them to analyse different datasets.

COURSE OUTCOMEs (COs): After studying Bioinformatics and Computer Application in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts Bioinformatics and Computer Application.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignments as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Major bioinformatics resources: NCBI, EBI, ExPASy, RCSB; open access bibliographic resources and literature databases: PubMed, BioMed central, Sequence databases formats, querying and retrieval; nucleic acid sequence databases: GenBank, EMBL, RAPDB, TAIR.

UNIT-II: Sequence Analysis using BLAST; Promoter architecture (TSS & TATA Box Prediction); transcription factor binding motifs (PLACE & Plant Pan); Gene Prediction (FGENESH, Genescan). Nucleotide polymorphism identification (Clustal Omega & MEGA); Primer Designing (gene specific; CDS specific; SNP and degenerate primer designing); Phylogenetic Analysis. Introduction to small RNA databases (miRBASE);

UNIT-III: Protein structure classification (SCOP & CATH); Protein secondary and tertiary structure prediction. Protein Conserved domain identification (NCBI CDD); Identification of Protein functional sites (Prosite); Protein localization (Protcomp); Protein phosphorelation (Musite); Protein-Protein Interaction network analysis (STRING).

SUGGESTED READING:

1. Essential Bioinformatics by Jin Xiong; Cambridge University Press (2006). ISBN-13 - 978-0521600828.

2. Bioinformatics: Sequence and Genome Analysis, David Mount, CBS Publishers & Distributors. ISBN-13: 9788123912417.

3. Problems and Solutions in Biological Sequence Analysis by Mark Borodovsky, Svetlana Ekisheva; Cambridge University Press (2006). ISBN-9780521612302.

4. RNA Sequence, Structure, and Function: Computational and Bioinformatic Methods by Jan Gorodkin & Walter L. Ruzzo (2014). ISBN-9781627037082

5. Protein Bioinformatics: An Algorithmic Approach to Sequence and Structure Analysis by Ingvar Eidhammer, Inge and Jonassen (2009) William R. Taylor Wiley India Pvt Ltd. ISBN-13- 978- 8126522729

LS-532 (A - B)	STREAM PAPER-I (Any one)	3 CH	50 marks

LS-532 (A)	Plant Morphology	3 CH	50 marks

OBJECTIVE

Knowledge of morphology is essential for recognition or identification of plants. Certain importantcriteria for classification of plants are obtained from morphology. Knowledge of morphology is required for studying various aspects of plant life like genetics, ecology, anatomy, etc.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Plant Morphology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Plant Morphology
PEO2. Analyze the relationships among different concepts related to tools and techniques related to Plant Morphology.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them to analyse different datasets.

COURSE OUTCOMEs (COs): After studying Plant Morphology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts Plant Morphology.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignments as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Algae: Range of thallus structure and reproduction in Chlorophyceae, Phaeophyceae and Rhodophyceae. **Fungi:** Reproduction and degeneration of sexuality in Phycomycetes, Ascomycetes, Basidiomycetes.

Unit-II: Bryophytes: Gametophytic structure of Marchantiales, Anthoceretolales as the connecting link between bryophytes and pteridophytes, Mosses as the advanced group of bryophytes.Evolution of Saprophytes in Bryophytes. **Pteridophytes:**Origin and evolution in pteridophytes, Heterospory and its significance, Fillicales as an advanced group of pteridophytes, Range of reproductive structure and their evolution in pteridophytes.

Unit-III: Gymnosperm: Origin and outline classification, Cycadofilicales as an intermediate group between pteridophytes and gymnosperms, Cycadalesas the relic of ancient gymnosperms, Phylogenetic

position of Ginkgo,Angiospermic activity of Gnetum,Evolution of ovule in gymnosperm. **Angiosperms:** Origin and evolution of angiosperm, outline classification in orders according to Bentham and Hooker, Engler and Prantle, and Hutchinson system; Range of floral structure affinities and phylogeny of Rannales, Mangolliales, Tubifloreae and microspermeae.

SUGGESTED READING:

1. The structure and Reproduction of Algae Vol. I & II by Bishan Singh, Mahendra Pal Singh, Dehradun. Delhi.651 pp.1999.

2. Algae by O.P. Sharma. 2011, TATA McGraw-Hill, India.

3. Algae: A review, Prescott, G.W. 1984. Bishan Singh, Mahendra Pal Singh. Dehradun.

4. An introduction of Algae by Morris, I. 1986. Cambridge University Press U.K.

5. Botany for Degree students- Bryophyta by Vashishta. B.R., Sinha, A.K. and Adarsh Kumar, 2005. S. Chand and Company Ltd., New Delhi.

6. An Introduction of Fungi, 4th Edition by Dube, H.C 2013. Scientific Publisher, India.

7. Introductory Microbiology. 4th edition by Alexopoulous. C.J. Mims C.H and Black well, M., 2007. John Wiley and Sons, New York.

8. Fungi, I stEdition by Vashishta, B.R and sinha,A.K., 2011. Published by S. Chand and Company Ltd. New Delhi.

9. Plant Pathology. 5th Edition by George, N. Agrios, 2005, Academic Press.

10. Schumann, G.L., 2006. Essential Plant Pathology. APS Press.

11. Microbiology. 13th Edn. Pelezar,J.M., chan E.C.S and Kreig, R.N. 2008. Tata Mc. Graw Hill Publishing Company Ltd, New Delhi.

12. Botany for Degree students – Pteritophyta by Vashishta. P.C., A.K. Sinha and Adarsh Kumar. 2008. S. Chand and Company Ltd., New Delhi.

13. Gymnosperms by Vashishta, P.C. 1991. S. Chand & Company Ltd., Ram Nagar, New Delhi.

14. A text of Microbiology (Revised edition) by Dubey, R. C. and D. K. Maheswari. 2012. S. Chand and Company Ltd., New Delhi.

15. Plant Systematics: Theory and Practice by Singh, Gurcharan. 2012. Completely revised and enlarged 3rd edition. Oxford & IBH, New Delhi.

16. Plant Taxonomy (Second Edition) by O.P. Sharma.

LS-532 (B)	**Animal Morphology**	**3 CH**	**50 marks**

OBJECTIVE

The course will give an insight into morphology i.e. the study of the size, shape, and structure of animals and of the relationships of their constituent parts. They will learn about the the general aspects ofbiological form and arrangement of the parts of an animal.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Animal Morphology in the curriculum, students will be able to:

PEO1. This course will help to the broader problems connected with the form of animals such as the phylogenetic evolution of form, the form-producing and form-maintaining factors.

PEO2. It will also help in analyzing the differences and similarities between organisms on the basis of their morphology.

PEO3. They will apply it to know how each group of organisms arose and how did they establish themselves in the environment with their special characteristics

OUTCOME:

CO1. After successfully completing this course, the students will be able todevelop an understanding on the diversity of animal life forms in general and group of animals on the basis of their morphological characteristics/ structures.
CO2. They can analyze the diversity and evolutionary history of different organ systems.
CO3. Also they will apply the knowledge in having an insight into the fact that how morphological change due to change in environment helps drive evolution over a long period of time.
CO4. They can execute the projects or field experiments as per the knowledge gained in the course.

COURSE

Unit-I: Segmentation and cepahalisation in animals; Larval forms in animals; Parasitism; Host-Parasite interaction with reference to *Sacculina* and *Bonelia*; Polymorphism in animals. Adaptive radiation and convergence in mammals; Minor phyla such as *Ectoprocta, Endoprocta, Bryozoa, Onychophora, Phornida*.
Unit-II: Neoteny and Paedogenesis in animals; Functional evolution of brain and digestive system in vertebrates; Living fossils and their significance. Zoogeography and distribution of animals; Migration in birds and celestial navigation; Anadromous and Catadromous migration in fishes.

Unit-III: Instinct vs acquiredbehaviour, Orientation in animals, Learning memory and intelligence, Social behaviour in animals; Neural basis of behaviour; Mimicry, Aestivation and hibernation in animals.

SUGGESTED READING:

1. The Invertebrata, by L.A.Borradaile and F.A.Potts
2. The Development of Animal Form: Ontogeny, Morphology, and Evolution by Alessandro Minelli Form and function by E.S.Russel
3. An introduction to animal morphology and systematic zoology by A. Maclistert
4. Animal Morphology by J.R.A.Davis
5. Concepts and approaches in animal morphology by P.Dullemeijer
6. Life of Vertebrates by Y.J. Young, Freeman Publication

LS-533 (A - B)	**STREAM PAPER-II (Any one)**	**3 CH**	**50 marks**

LS-533 (A)	**Plant Developmental Biology**	**3 CH**	**50 marks**

OBJECTIVE

The course help in understanding the basic life processes of plants. Research on plants enriches our intellectual life and adds to our knowledge about other life processes. The results of research on plant systems also can teach us how to approach problems in agriculture, health, and the environment.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Plant Developmental Biology in the curriculum, students will be able to:

PEO1. This course will help to understand problems connected with the germination and fertilization and its regulation.

PEO2. It will also help in analyzing the floral development and phyllotaxy.

PEO3. They will apply it to know how each group of organisms arose and how did they establish themselves in the environment with their special characteristics

OUTCOME:

CO1. After successfully completing this course, the students will be able to develop an understanding on the diversity of animal life forms in general and group of animals on the basis of their morphological characteristics/ structures.

CO2. They can analyze the diversity and evolutionary history of different organ systems.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignments as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Germination and Greening: Stored genetic message in seeds. Physiological anad molecularchanges during germination, Biosynthesis of chlorophylls, Synthesis, targeting and assembly of LHC. Synthesis of Rubisco subunits and their assembly. Leaf development and phyllotaxy.

Unit-II: Flowering and Senescence: Photoperiodism, Biological clock, Biochemical signals involved in flowering, Gene regulation of floral development, Transition of flowering, floral meristem and gene regulation of floral development. Types of senescence, Physiological significance and regulation of leaf senescence by genes.

Unit III: Regulation of Plant growth and development: Biosynthesis, storage, breakdown and transport, physiological response and mechanism of action of hormones (IAA, GA, Ethylene, cytokinin and ABA). Physical and chemical properties of photoreceptors: Phytochrome, Phototropin and Cryptochrome, and their mechanism of action on plants. Regulation of gene expression by photoreceptors.

SUGGESTED READING:

1. Plant Physiology and Development by L.Taiz and E. Zeiger
2. Plant Growth and Development-A Molecular Approach by Donald E. Fosket
3. Plant Development by by RF Lyndon
4. Mechanisms in Plant Development by Ottoline Leyser, Stephen Day
5. Plant Physiology by L.Taiz and E. Zeiger
6. Biochemistry and Molecular Biology of Plants by Bob B. Buchanan, W. Gruissem and Russel L. Jones

LS-533 (B)	Animal Developmental Biology	3 CH	50 marks

OBJECTIVE: This paper contains three units, namely Basics of Developmental Biology, Developmental Processes, and Morphogenesis. Each unit contains a description of the principles related to that unit, well-supported by different examples, descriptions of laboratory experiments, historical background etc; with solved equations that explain the concept discussed. These will help in fixing the Ideas firmly in student's mind. The examples discussed in the class-room are used to encourage students to participate in discussions.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Animal Development in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Animal Development.
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying Immunology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of Immunology.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Basics of developmental biology: Cell fate, potency, fate maps and mechanism of developmental commitment (cytoplasmic determinants, instructive and permissive induction, competence, mosaic vs regulative development); Maintenance of differentiation; Pattern formation, segmentation; Experimental developmental biology (model organisms, developmental mutants and transgenic organisms, cellular and microsurgical techniques).

Unit II: Developmental process: Gametogenesis; Ultrastucture of sperm and ovum, gamete recognition; Fertilization, sex determination; Cleavage; Cytological and biochemical changes during fertilization and cleavage; Blastula formation; Gastrulation; Germ layers formation.

Unit III: Morphogenesis and organogenesis: Mechanism of morphogenesis; cell aggregation and differentiation in *Dictyostelium*; Axes and pattern formation in *Drosophila*; Organogenesis; Vulva specification in *C. elegans*; Limb development and regeneration in vertebrates, Neurogenesis; Post-embryonic development: larva formation and metamorphosis.

SUGGESTED READING:

1. An Introduction to Embrylogy by Balinsky et al.
2. Chordate Embryology PS. Verma and V K Agarwal
3. Chordate Embryology by V B Rastogi.
4. Transition from embryology to developmental biology by Boris Balinsky
5. Developmental Biology 9th Edn. by Scoot F. Gilbert

LS-534 (A - B)	STREAM PAPER-III (Any one)	3 CH	50 marks

LS-534 (A)	Plant Physiology	3 CH	50 marks

OBJECTIVE

By revealing the dependence of the life processes on environmental conditions, plant physiology serves as the theoretical basis for increasing the total productivity of plants, improving their nutritional value, and raising the quality of their tissues and organs for use in industry. In order to understand the plant way of life, knowing the structure and functioning of is crucial. Plant Physiology provides information on how the plants survive. Therefore, studying the subject is necessary to get a deeper insight into the plants.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Plant Physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of water and solute translocation, photosynthesis and other physiological processes in plants.
PEO2. Analyze the relationships among different concepts related to tools and techniques related to Plant Physiology
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them to analyse different datasets.

COURSE OUTCOMEs (COs): After studying Plant Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts Plant Physiology.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignments as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Water relations in plants and translocation of solutes: Absorption of water, Ascent of Sap, Transpiration, Stomatal mechanism, Translocation of organic solutes and its pathways, Pressure flow mechanism, Phloem loading and unloading,Synthesis of sucrose and starch.

Unit-II: Photosynthesis: Structure of photosynthetic apparatus, organization of light harvesting pigments, absorption spectrum and action spectrum; Mechanism of photosynthetic- electron and proton transport, cyclic and non-cyclic photophosphorylation, C_3, C_4 and CAM pathways of carbon fixation, photorespiration.

Unit-III: Respiration and mineral nutrition: RQ, electron transport & oxidative phosphorylation; Micro and macro nutrients; Role of essential elements and deficiency symptoms. Nitrogen cycle and fixation;Assimilation of nitrate, sulphur and ammonium ions; Nitrogen transformations.

SUGGESTED READING:

1. Plant Physiology and Development by L.Taiz and E. Zeiger
2. Introduction to Plant Physiology by William Hopkins
3. Plant Physiology by Frank B. Salisbury and C. W. Ross

LS-534 (B)	Animal Physiology	3 CH	50 marks

OBJECTIVE:

Animal physiology examines how biological processes function, how they operate under various environmental conditions, and how these processes are regulated and integrated. The proper studying of animal physiology is crucial for understanding and evaluating underlying biological processes, behavioral states and animal response to different biological, social and environmental stimuli.

PROGRAMME EUCATION OBJECTIVES (PEOs): After studying Animal Physiology in the curriculum, students will be able to:

PEO1. To understand the basic comparative physiology by introducing students to the principles of normal biological function in a wide range of organisms.

PEO2. To analyze the relationships existing between different physiological systems of animal body

PEO3. To perform laboratory experiment to know the basic physiological processes occurring in animals and to see how animals respond to changes in their environments

PEO4.To apply physiological concepts and principles at the basic and applied levels, to develop a working knowledge of the major physiological systems, and to associate anatomical areas with their specific function.

COURSE OUTCOMEs (COs): At the end of the course students can:

CO1: Remember and understand the functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems;

CO2: Analyse and report on experiments and observations in physiology through case studies;

CO3: Apply the knowledge to integrate related topics from separate parts of the course.

CO4: Execute the project based on the knowledge gained from course material.

Unit-I: Electrical properties of neural membrane, Neurons, action potential, , central and peripheral nervous system, neural control of muscle tone and posture. Muscles as energy transducers, Muscles proteins and molecular mechanism of muscle contraction, Excitation – contraction coupling, Neural control of muscle contraction, Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

Unit-II: Enzyme secretion and motility of GI tract, digestion and absorption of nutrients. Respiratory pigments in animals, Oxygen equilibrium curve of HbA, HbF, Hill plot, Bohr and Root effect. Physiology of excretion, urine formation and concentration, Regulation of water balance, acid-base balance.

Unit-III: Hormones: General properties, sources and types, Molecular mechanism of steroid and non-steroid hormone action; Concept of hormonal control and feedback regulation, Pheromones.

SUGGESTED READING:

1. General and comparative animal physiology W.S. Hoar (3rd edn.1983)
2. Textbook of medical physiology by A.C. Guyton and J.E.Hall (11thedn. 2006)
3. Vander, Sherman, Luciano's Human Physiology: The Mechanisms of Body Function , Mcgraw-Hill (Tx); 9th edition (January 1, 2003)
4. Human physiology by C.C. Chattergee (2016)
5. Animal Physiology by R. Hill (2016)
6. Comparative animal physiology by C.L. Prosser (1973)

LS-535 (A)	Bioenergetics	3 CH	50 marks

OBJECTIVE: This paper contains three units, namely Energy transduction in cells, Conversion of Light energy in Cells, Transformation of Energy in Mitochondria. Each unit contains a description of the principles related to that unit, well-supported by different examples, descriptions of laboratory experiments, historical background etc; with solved equations that explain the concept discussed. These will help in fixing the Ideas firmly in student's mind. The examples discussed in the class-room are used to encourage students to participate in discussions.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Bioenergetics in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of energetic in biological system.
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Bioenergetics in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of Energy transduction, transformation of conversion in biological system.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Energy transduction in cells and types of transducers, Concept of free energy, Energetics of biochemical reactions, Redox system and redox potential, Phosphate transfer and phosphorylation potential, ATP as the energy rich compound.

Unit-II: Conversion of light energy to chemical energy during photosynthesis, Photo excitation, Photo induced electron transport and photophosphorylation, Dark reaction as the sink, Energetics of carbon fixation.

Unit-III: Energy transformation in mitochondria, Enzyme complexes and mobile electron carriers of mitochondrial membrane, Energetics of electron transfer reactins, Coupling factor, Coupling of oxidative phosphorylation and electron transport and mechanism of oxidative phosphorylation, Power transmission by proton gradients as the central motif of bioenergetics both in chloroplast and mitochondria.

SUGGESTED READING:

1. Fundamentals of Biochemistry by J L Jain.
2. Biochemistry by U Satyanarayan.
3. Lehninger Principles of Biochemistry.
4. Biochemistry by L Stryer.
5. Principles of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W. Pratt

LS-535 (B)	Microbial Physiology	3 CH	50 marks

OBJECTIVE

Microbial physiology and metabolism provides information on sources of energy and its utilization by microorganisms. Microorganisms play important role in environment as producers, consumers and decomposers. To know the specific parameters it is important to understand physiology of these organisms in detail which will impart knowledge of the basic principles of bacteriology, virology, mycology, immunology and parasitology including the nature of pathogenic microorganisms, pathogenesis, laboratory diagnosis, transmission, prevention and control of diseases common in thecountry.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Microbial Physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Microbial Physiology
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Microbial Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of microbial metabolism, normal microbiota in humans and therapeutic measures to control microbial infections.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Microbial metabolism, heterotrophic generation of ATP, Fermentation versus respiration, Respiratory metabolism, Oxidative phyosphorylation, autotrophic generation of ATP, Chemolithotrophy with reference to sulphur oxidizing, nitrifying and methanogenic bacteria. Anoxigenic bacterial photosynthesis. Fermentation pathways (ethanol, homo and hetero lactic fermentation, mixed acid fermentation, butandiol and propanic acid, amino acid fermentation), Biosynthesis of peptidoglycans.

Unit-II: Normal human microbiota (skin, gastrointerstinal tract, oral cavity, respiratory tract, genitourinary tract), Virulence factor of pathogens (toxin and toxigenicity, invaviveness, factors affecting phagocytocis), Host defence mechanism, inflammatory response).

Unit-III: Chemotherapy and antimicrobial agents: principles of chemotherapy, microbial structure and biochemical reactions as potential targets. Antimicrobial agents and their mode of action (sulfa drugs, β-lactum antibiotics, Aminoglycosides, Macrolides, Tetracycline, Chloramphenicol, Cycloserine, Isoniazid, antiviral durgs).

SUGGESTED READING:

1. Brock Biology of Microorganisms (12th edition) by Madigan and John M. Martinko, Paul V. Dunlap, David P. Clark Benjamin Cummings; 2008.

2. Microbiology: An Introduction by Gerard J Tortora, Berdell R Funke, Christine L Case Benjamin-Cummings Publishing Company ; 2008.
3. Microbial Physiology,4th Edition by Michael P. Sector, Albert G. Moat, John W. Foster, Michael P. Spector. Wiley.
4. General Microbiology 5e (Intern Ed) by Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. Palgrave Macmillan.
5. Fundamental Food Microbiology. 3rd edition by B. Ray., CRC press, 2006.
6. Microbiology. Sixth edition by Prescott, L. M., J. P. Harley and D. A. Klein. 2005. International edition, Mc Graw Hill.

LS-535 (C)	System Ecology	3 CH	50 marks

OBJECTIVE:

Ecology enriches our world and is crucial for human wellbeing and prosperity. It provides new knowledge of the interdependence between people and nature that is vital for food production, maintaining clean air and water, and sustaining biodiversity in a changing climate,. It will enable the scholar to understand how these relationships work. For example, humans breathe out carbon dioxide, which plants need for photosynthesis. Plants, on the other hand, produce and release oxygen to the atmosphere, which humans need for respiration.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying System Ecology in the curriculum, students will be able to:

PEO1. To understand the application of general systems theory to ecology and to study an ecosystem as a complex system exhibiting emergent properties;

PEO2. To analyze the interactions and transactions within and between biological and ecological systems; develop the ability to connect systems thinking and methods of application of general systems theory to identify the characteristics of ecosystems, using modern methods of ecological modelling;

PEO3. To perform practicals to acquire methodological skills for building a qualitative and quantitative ecological models that will allow them to acquire new knowledge about the behaviour of the studied ecosystems (models for interpretation);

PEO4. To apply the acquired skill to predict their behaviour (predictive models) and build models for the management of these systems (models decision support)

COURSE OUTCOMEs (COs): After studying in the System Ecology in the curriculum, students will be able to:

CO1: Understand the mutual and reciprocal relationships between different levels of ecological systems which will enable them to identify their responses (from species to ecosystem level) to changes in environmental factors.

CO2: Analyze the various concepts pertaining to organism-environment complex, ecosystem productivity, quantitative ecology and Ecological modelling.

CO3: Apply the knowledge of general systems theory to identify the characteristics of ecosystems, using modern methods of ecological modelling.

CO4: Execute the acquired methodological skills design the systemic measures to reduce or eliminate negative impacts on ecosystemand to develop new approaches that will help them to improve the condition of affected ecosystems.

COURSE

Unit-I: Organism- environment complex: Concept of stress and strain, biological adaptation and biological evolution, convergence and divergence, Concept of productivity: Primary production, Factors influencing primary productivity, Energy partitioning in food chain and web, Secondary productivity, secondary production from Indian ecosystems, Biological diversity and stability.

Unit-II: Quantitative Ecology: Quantification of diversity, dominance, evenness and species richness, Species area curve, Niche theory, Niche overlap, Population interactions: Inter-specific and Intra-specific interaction, Complexity theory and law of diminishing return.

Unit-III: Concept of Ecosystem modelling: Features of ecological modelling, model symbols. Modelling for environmental sciences and management, Types of models, Causal diagrams, System Dynamics, Population modelling, modelling of material flows through the systems (pollutants transfer, etc), Positive and negative feedback loops. Mathematical modelling, Classification: Deterministic model: matrix model, stochastic model: ANOVA model, Regression model, MARKOV model.

SUGGESTED READING:

1. Jorgensen, S. E. 2012. Introduction to systems ecology. New York. CRC Press: 320 pp.
2. Bertalanffy von, l. 1968. General System Theory. New York, George Braziller: 295 pp.
3. Jorgensen, S. E., Müller, F. (eds.). 2000. Handbook of Ecosystem Theories and Management. Boca Raton, London, New York, Washington D. C., Lewis Publishers: 600 pp.
4. Müller, F., Leupelt, M. (eds.). 1998. Eco Targets, Goal Functions, and Orientors. Berlin, Springer: 619 pp.
5. Jorgensen, S. E., Bendoricchio, G. 2001. Fundamentals of Ecological Modelling, Third edition. Elsevier, 530 pp.

LS-535 (D)	Cell Physiology	3 CH	50 marks

OBJECTIVE

Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. Students will understand how these cellular components are used to generate and utilize energy in cells. Cell physiology is a biological science in which you study live cells, tissues and the functions of organs and organ systems to learn how the body works.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Cell Physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Cell Physiology
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Cell Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of cell transport, cell cycle and its regulation etc.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in cell physiology.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Cellular Transport: Passive and active transport, bulk flow and diffusion, organization of transport at plant membranes, diffusion of small molecules across phospholipid bilayer, pumps and carrier mediated transport, uniport, antiport and co-transport mechanisms, overview of membrane transport proteins, general properties of ion channels and their role in transport, water transport through water channel proteins.

Unit-II: Senescence and programmed cell death: Types of cell death in plants and animals, PCD in the life cycle of plants, pigments, proteins and nucleic acid metabolism during senescence, impact of senescence on photosynthesis and oxidative metabolism, role of endogenous plant hormones.

Unit-III: Cell cycle regulation: Plant and animal cells and their cell cycles, Over view of cell cycle and its control, DNA synthesis and replication during cell cycle, molecular mechanism of cell cycle control, regulation of cell cycle by intrinsic and extrinsic signals, cell cycle regulation in plant growth and development and check points in cell cycle regulation.

SUGGESTED READINGS:

1. **Molecular Cell Biology.** Lodish, Berk,Krieger, Bretscher,Ploegh, Amon and Martin. Freeman Macmillan Publishers (8^{th} Edition).
2. **Fundamentals of Plant Physiology**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Sixth Edition).
3. **Biochemistry and Molecular Biology of Plants**. B. B.Buchanan, W.Gruissem and R.L.Jones (Ed.), Wiley Blackwell Publishers (Second Edition).
4. Molecular Biology of The Cell. Bruce Alberts , Taylor & Francis.

LS-536 (A - D)	**SPECIAL PAPER- II (Any one)**	**3 CH**	**50 marks**

LS-536 (A)	**Enzymology**	**3 CH**	**50 marks**

OBJECTIVE:

The major learning objective of the course is to understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell. Enzymes help speed up chemical reactions in the human body. They bind to molecules and alter them in specific ways. They are essential for respiration, digesting food, muscle and nerve function, among thousands of other roles. The study of the regulation of enzymes will help in regulating the cell and body function.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Enzymology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of enzymes and their regulation.

PEO2. Analyze the relationships among different concepts of enzyme kinetics and regulation.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Cell Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of cell kinetics and its regulation etc.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in enzymology.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Mechanism of enzyme catalysis; Detailed mechanism of enzyme action (lysozyme, carboxy peptidase, chymotrypsin and RNAase); Coenzymes- their catalytic role and structure; Isozymes- their evolutionary and adaptive significance; Ribozyme, Multi-enzyme complexes and concerted catalysis.

Unit-II: Enzyme kinetics and significance of Km and Vmax; Effect of temperature and pH on enzyme catalysis. Mechanism and kinetics of competitive, non-competitive and uncompetitive inhibition; Allosteric inhibition; Bi-substrate reactionskinetics and mechanism; Kinetics of the Ping-pong catalysis.

Unit-III: Enzyme regulation and its significance; Covalent modification, Allosteric regulation of enzymes with reference to Aspartic transcarbamylase. Enzyme purification: extraction and purification; Enzyme immobilization and its significance.

SUGGESTED READING:

1. Fundamentals of Enzymology by Nicholas C. Price and Lewis Stevens
2. Enzyme Technology by S. Shanmugam, T.Sathishkumar, M. Shanmugaprakash
3. Outlines of Biochemistry by Eric E.Conn, Paul K. Stumph,George Bruening, Roy H. Doi
4. A Study of Enzymes: Enzyme Catalysts, Kinetics, and Substrate Binding by Stephen Allen Kuby
5. Introduction to Proteins: Structure, Function, and Motionby Amit Kessel and Nir Ben-Tal
6. Enzyme Technology: Pacemaker of Biotechnology by Prasad Nooralabettu Krishna

LS-536 (B)	Microbial Genetics	3 CH	50 marks

OBJECTIVE:

Microbial genetics is also important for understanding molecular techniques used to modify genes and proteins, manipulate bacteria, archaea, and eukaryotic organisms for fundamental research as well as practical applications in diverse areas of medicine and biotechnology. Microbial genetics will play a unique role in developing the fields of molecular and cell biology and also has found applications in medicine, agriculture, and the food and pharmaceutical industries. Hereditary processes in microorganisms are analogous to those in multicellular organisms.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Microbial Genetics in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of microbial genetics.
PEO2. Analyze the relationships among different concepts of enzyme kinetics and regulation.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Microbial Genetics in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of genetic transformation etc.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in Microbial Genetics.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: The study of microbial genes: The inheritance of characteristics and variability, Phenotypic and genotypic changes: Types of mutation; Mutagenic age mechanism of mutagenesis;Mechanisms of suppression of non-sense and frame shift mutations; Repairing mechanism of mutations. Oncogenes: Transformation of normal cells to Tumor cells; Oncogenes; Oncogenic DNA and RNA viruses.

Unit II: Genetic transformation in Microbes: Introduction to Microbial genomes; Gene transfer in bacteria: Modes of gene transfer, phages, yeast and fungi, Molecular genetics of conjugation, transduction and transformation; Genetic mapping of bacteria. Genetics and life cycle of phages-lambda, T4, pi, Mu and Ml3. Restriction and modification systems in bacteria.

UNIT- III: Gene Expression and regulation: Genetic switches; Regulation of transcription and translation, post-translational modifications. Transposable elements: structure and classification of bacterial and yeast transposons, Mechanisms of transposition.

SUGGESTED READING:

1. Molecular Genetics of Bacteria by Larry Snyder and Wendy Champness, 3rd edition; ASM press; 2007.
2. Brock Biology of Microorganisms (12th edition) by Madigan and John M. Martinko, Paul V. Dunlap, David P. Clark Benjamin Cummings; 2008.
3. Microbiology : An Introduction by Gerard J Tortora, Berdell R Funke, Christine L Case Benjamin- Cummings Publishing Company ; 2008.
4. Medical Microbiology and Immunology by Levinson W, Jawetz E: Lange publication; 2001.
5. Microbial Physiology, 4th Edition by Michael P. Sector, Albert G. Moat, John W. Foster, Michael P. Spector Wiley.
6. General Microbiology 5e (Intern Ed). By Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. Palgrave Macmillan.
7. Microbiology. Sixth edition, International edition by Prescott, L. M., J. P. Harley and D. A. Klein. 2005. Mc Graw Hill.

LS-536 (C)	ECOLOGICAL ENERGETICS	3 CH	50 marks

OBJECTIVE:

The primary objective of studying Ecological Energetics is to understand the rates of flow of energy and rates of movement of nutrients are measured. In this section we will learn how energy flow and nutrient cycling can provide insight into ecological systems and provide tools to manage our world.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Ecological Energetics in the curriculum, students will be able to:

PEO1. To understand the concept of laws of thermodynamics in transfer of energy in ecosystem

PEO2. To analyze solar energy available to earth surface and environmental influences on the energy availability for ecosystem productivity

PEO3. To performlaboratory studies on ecological efficiency of animal and plant populationthat can be broadly accessible to field ecologists

PEO4. To apply the concept of ecological energetics on human being

COURSE OUTCOMEs (COs): After studying in the Ecological Energetics in the curriculum, students will be able to:

CO1: Remember and understand the energetic costs in ecological processes that are crucial to an animal's growth, survival, and reproductive fitness

CO2: Analyze the various concepts of plant and animal energetics through case studies

CO3: Apply the knowledge to address real-world questions at many spatial and temporal scales.

CO4: Execute the project and field studies as the knowledge gained in the course

Unit-I: Energy in ecological system: Concept, Laws of thermodynamics, Solar radiation and the energy in environment; Solar flux, Photo-synthetically active radiation, Attenuation of radiation, Attenuation coefficient. Reception of radiance by leaves: reflectance, absorbance and transmittance.

Unit-II: Energy transformation in nature: Concept of productivity and productivity efficiency; photochemical reaction, environmental influences on photosynthetic capacity, seasonality of photosynthesis, and ecological consequences of different photosynthetic pathways. Laboratory studies and ecological efficiency. Field studies and ecological efficiency.

Unit-III: Energy flow at population level: Individual organisms and ecosystems, Energy flow studies in plant populations and animal populations; Productive pattern of biotic communities in different geographical regions; Implication of ecological energetics on human being.

SUGGESTED READING:

1. Ecological energetic by John Phillipson, St. Martin's Press, 1966 , pp57

2. Maximum Power: A Festschrift on Ecology, Energy and Economy in Honor of H. T. Odum, Charles A. S. Hall (Editor) University Press of Colorado, 1995
3. Energy Basis for Man and Nature by Howard T. Odum, McGraw Hill, 1981

LS-536 (D)	Crop Physiology	3 CH	50 marks

OBJECTIVE:

The major learning objective of the course Crop physiology is concerned with the processes and functions of the crops at cellular, sub-cellular and whole plant levels in response to environmental variables and growth. In short, physiology is the study of functional aspects of crop plants. Thus, physiological understanding of crop plants provides the fundamental scientific base about various aspects of metabolism, growth and development. This is immensely important for crop improvement or technology improvement in agriculture or horticulture.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Crop physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of crop growth and yield.
PEO2. Analyze the relationships among different concepts of enzyme kinetics and regulation.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Crop Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of cell kinetics and its regulation etc.

CO2. Analyze the various effects of environmental factors to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in crops.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Dynamics of Crop growth and yield, harvest index, induction of flowering, genetic manipulation of fruit ripening, modification of product traits like starch, vitamin and mineral contents, engineering plant protein composition, manipulation of crop yield through photosynthesis, metabolic engineering of lipids and molecular farming.

Unit-II: Effect of light and hormones (IAA,GA,ABA and Ethylene) on crop growth and yield, agricultural productivity through GM crops, regulations for GM crops and their products, greener geneticengineering, biotechnology of nitrogen fixation, in crop plants, incorporation of *Nod, Nif, Hup* genes for better crop production.

Unit-III: Water and mineral use efficiency and their manipulation for crop improvement, use of pesticides and herbicides in modern agriculture, physiological and biochemical mode of their action, strategies for engineering herbicides resistance and herbicide resistant crops, environmental impact of herbicides resistance and super-weeds, plant-pathogen interaction, biotechnological approaches to diseaseresistance for increased crop production.

SUGGESTED READING:

1. **Plant Physiology and Development**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Sixth Edition) 2015.
2. **Fundamentals of Plant Physiology**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Sixth Revised Edition) 2018.
3. **Plant Physiology**. F.B. Salisbury and C.W. Ross. Thomson Information Publising Group (5th Edition)1991.
4. Physicochemical and Environmental Plant Physiology. Park S. Nobel, Elsevier Science, (5th Edition) 2020.
5. Introduction to Plant Physiology. Huner NPA and Hopkins, WG. Wiley publishers, (4th Edition) 2013.
6. **Biochemistry and Molecular Biology of Plants**. B. B.Buchanan, W.Gruissem and R.L.Jones (Ed.), Wiley Blackwell Publishers (Second Edition) 2015.

LS-537 (A – B)	**Practical (Any one)**	**2 CH**	**50 marks**
LS-537 (A)	**Practical based on Plant Morphology, Development and Physiology**	**2 CH**	**50 marks**
LS-537 (B)	**Practical based on Animal Morphology, Development and Physiology**	**2 CH**	**50 marks**

LS-538 (A – D)	**Special Paper Practical – I (Any one)**	**2 CH**	**50 marks**
LS-538 (A)	**Practical based on Bioenergetics and Enzymology**	**2 CH**	**50 marks**
LS-538 (B)	**Practical based on Microbial Physiology and Microbial Genetics**	**2 CH**	**50 marks**
LS-538 (C)	**Practical based on System Ecology and Ecological Energetics**	**2 CH**	**50 marks**
LS-538 (D)	**Practical based on Cell Physiology and Crop Physiology**	**2 CH**	**50 marks**

LS-541	**Genetic Engineering**	**3 CH**	**50 marks**

LS-541 GENETIC ENGINEERING

OBJECTIVE:

Genetic engineering, also called recombinant DNA technology, involves the group of techniques used to cut up and join together genetic material, especially DNA from different biological species, and tointroduce the resulting hybrid DNA into an organism in order to form new combinations of heritable genetic material.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Genetic Engineering in the curriculum, students will be able to:

PEO1. The students will understand the basic concepts in genetic engineering.

PEO2. They will get acquainted with the versatile tools and techniques employed in genetic engineering and recombinant DNA technology.

PEO3.They will be appraised about applications genetic engineering

PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOME (COs): After studying the Genetic Engineering in the curriculum, students will be able to:

CO1. On completion of the genetic engineering course the students will have an understanding of basic concepts in genetic engineering.

CO2.They can analyse the tools for genetic manipulation.

CO3. They will have an insight into basic means of gene isolation, insertion in proper hosts and the manipulations for appropriate expression of heterologous genes.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Scope and milestones in Genetic engineering**,** Molecular tools: Enzymes (Nucleases, Restriction endonucleases, Phosphomonoesterase, Alkaline phosphatase, Polynucleotide kinase, DNA ligase, DNA polymerases, Reverse transcriptase, terminal deoxynucleotidyltransferase, Poly A polymerase), Hosts (E. coli, yeast, animal cells and Plant cells) and Vectors (Plasmids, Bacteriophages, Cosmids, Phagemids and Artificial Chromosome Genetic Engineering: Restriction endonuclease, Ligase and other modifying enzymes; Linker, Adapter and MCS; Gene cloning vectors- Plasmid, bacteriophage, cosmid, BAC, YAC; Expression vectors: basic concept, bacteria and yeast based expression vector; Gene library- genomic and c-DNA; Polymerase Chain reaction, Blotting techniques: Southern, Northern, Western, Dot and Slot; Nucleic acid hybridization.

Unit-II: Basic concept of gene cloning: Cloning of interacting gene: two hybrid and three hybrid assay; DNA finger printing and DNA foot printing; DNA Sequencing; Site directed mutagenesis; *In vitro* transcription and translation; RNA interference: Antisense RNA, siRNA and miRNA; Ribozyme Technology; Genetic engineering regulations and safety guidelines. Expression Strategies for Heterologous genes: Saccharomyces cerevisiae expression systems (S. cerevisiae vectors, intracellular cellular production of heterologous proteins, secretion of heterologous proteins by S. cerevisiae), Baculovirus-insect cell expression systems, mammalian cell expression systems.

Unit-III: Cell and tissue culture: Primary and secondary culture, cell lines, callus culture, protoplast culture, cell fusion and somatic hybridization.
Gene transfer methods in plant and animal cells (calcium phosphate method, electroporation, biolistic, liposomal bag, microinjection and *Agrobacterium* mediated).Genome editing using CRISPER. Selection and screening of transgenic plants using marker and reporter genes.Preparation of transgenic organisms and its advantages.

1. Genome by T.A. Brown.
2. DNA Science. A First Course in Recombinant Technology by Mickloss and Freyer
3. Molecular Biotechnology by S.B. Primrose From genes to genome by J.Dale and M von Schantz
4. Molecular Biotechnology by Glick and Pasternak
5. Molecular Biology by Weaver
6. Molecular Cloning: A laboratory manual by J. Sambrook and E.F. Fritsch.
7. Protein Expression – A Practical Approach by Higgins and Hames

LS-542 (A - I)	ELECTIVE PAPER (Any one)	3 CH	50 marks

LS-542 (A)	Cell Culture Technique	3 CH	50 marks

OBJECTIVE: This paper contains three units, namely Animal Cell culture, Plant Cell culture, Somatic Hybridization. Each unit contains a description of the principles related to that unit, well-supported by different examples, descriptions of laboratory experiments, historical background etc; with solved equations that explain the concept discussed. These will help in fixing the Ideas firmly in student's mind. The examples discussed in the class-room are used to encourage students to participate in discussions.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Cell Culture Technique in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Cell Culture Technique.
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Cell Culture Technique in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of Cell and tissue culture.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE

Unit-I: Animal cell culture: Natural vs artificial culture media, Properties of culture media, Advantages and disadvantages of serum in culture media; Techniques for primary cell culture, Development and maintenance of cell lines, Monolayer vs Suspension culture, Advantages and limitations of animal cell culture; Application of animal cell culture, Stem cell culture.

Unit-II: Introduction: history & scope of plant cell and tissue culture, media preparation, culture of plant cell and tissue; Somatic embryogenesis; Synthetic seeds; Haploid & triploid production.

Unit-III: Somatic hybridization and cybridization, Methods of gene transfer in plant cells; Somaclonal and gametoclonal variant selection, Application of tissue culture technique in horticulture, forestry and industry; Germplasm conservation.

SUGGESTED READING:

1. Biotechnology by B D Singh.
2. A textbook of Biotechnology by R C Dubey.
3. Biotechnology by J E Smith.
4. Biotechnology by U Satyanarayana.

LS-542 (B)	Genomics and Proteomics	3 CH	50 marks

OBJECTIVE:

Genomics, study of the structure, function, and inheritance of the genome (entire set of genetic material) of an organism. A major part of genomics is determining the sequence of molecules that make up the genomic deoxyribonucleic acid (DNA) content of an organism. The major learning objective of the course proteomics is to analyze the varying proteomes of an organism at different times in order to highlight differences between them. Put more simply, proteomics analyzes the structure and function of biological systems.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Crop physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of genomics and proteomics.
PEO2. Analyze the relationships among different concepts of genomes and regulation.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Cell Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of genetic organization and its regulation etc.

CO2. Analyze the various genome sequencing projects to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in genome and varying proteomes.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Genetic organization of prokaryotes and eukaryotes; Genome sequencing: principle and methodology; Recognition of coding and non-coding sequences and genetic annotation; Tools of genome analysis- Linkage analysis including pedigree, Genetic mapping using molecular markers (RFLP, RAPD, SSR, STS); Physical mapping. Genome analysis using 16s rRNA sequencing, ESTs and SNPs; Concept of TILLING, DNA microarray technology.

Unit-II: Genome sequencing projects (Microbes, plants and animals); Assessing and retrieving genome project information from the web; Reverse Genetics; Basics of Structural genomics and Comparative Genomics; High throughput screening in genome for drug discovery andidentification of gene targets; Pharmoco-genomics and Drug development.

Unit-III: Proteomics: Protein analysis (measurement of concentration, amino acid composition, N-terminal sequencing); 2-D electrophoresis; IEF; Micro-scale solution; Peptide fingerprinting; MALDI-TOF; SAGE and Differential display proteomics; Protein-Protein interactions, Yeast-two hybrid and Three-hybrid system; Protein microarray; Proteomics and Drug discovery.

SUGGESTED READING:

1. Data Mining for Genomics and Proteomics: Analysis of Gene and Protein Expression DataBook by Darius M. Dziuda
2. Introduction to genomicsBook by Arthur M. Lesk
3. Genetics and Genomics in MedicineBook by Judith Goodship, Patrick Chinnery, and Tom Strachan

LS-542 (C)	Protein Engineering	3 CH	50 marks

Unit-I: Protein structure and its hierarchical architecture; Protein engineering: concepts and applications; Characteristics of proteins that can be engineered: affinity and specificity; Spectroscopic properties; Factors affecting stability (pH, temperature, amino acid sequence, aggregation propensities *etc.*); Forces stabilizing proteins (Vander Waals, electrostatic, hydrogen bonding and weakly polar interactions, hydrophobic effects); Entropy – enthalpy compensation.

Unit-II: Methods of measuring the stability of a protein; Spectroscopic methods used for physiochemical characterization of proteins: UV, CD, Fluorescence, ORD, Laser Raman spectroscopy; Hydrodynamic properties: viscosity, hydrogen-deuterium exchange; NMR, Mass spectroscopy, X-ray crystallography and their application.

Unit-III: Experimental methods of protein engineering: Rational designing, Directed evolution: Site directed mutagenesis, Module shuffling, Guided protein recombination; Computational approaches to protein engineering: sequence and 3D structure analysis; Ramachandran plot. Mechanism of stabilization of proteins from psychrophiles and thermophiles vis-à-vis those from mesophiles. Structure-function relationship; Protein engineering: its stability, specificity and affinity (Protease, Lipase and Lysozyme).

LS-542 (D)	Medical Microbiology	3 CH	50 marks

OBJECTIVE:

Medical Microbiology laboratory plays an important role in patient care by providing the cause of infection and antimicrobial susceptibility data to physicians. Rapid diagnosis of pathogens is importantfor initiating effective antibiotic administration and improving the outcomes of treatment. The major importance of medical microbiology is that it helps in the identification, isolation, diagnosis and treatmentof pathogenic microorganisms and also produces beneficial organisms such as yeasts and some antibiotics. Biologists use microbiology to develop new methods for preventing illness.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Medical microbiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of disease biology and nature of pathogens..
PEO2. Analyze the relationships among different categories of pathogens and their of mechanism of action.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Medical Microbiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of genetic organization and its regulation etc.

CO2. Analyze the various genome sequencing projects to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in genome and varying proteomes.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit I: Concept of diseases: Harmful microbial interactions with humans: Entry of pathogen into the host, colonization and growth; Virulence factors and toxins: Exotoxins, Enterotoxins, Endotoxins. Host defense mechanisms: Nonspecific innate resistance, Inflammation and fever.

Unit II: Pathogens: Enteric pathogens: *Vibrio*, *Salmonella, Shigella, E. coli*. Gram positive cocci; *Staphylococcus, Micrococcus* and *Streptococcus*. Gram positive rods: *Coryneforms, Listeria, Mycobacterium* and *Nocardia*. Gram negative rods-*Klebseilla, Salmonella, Shigella, Neisseria, Haemophilus* and *Pseudomonas*. Anaerobic bacteria: *Clostridium*. Opportunistic fungal pathogens. Virus-Host interactions: Pathogenesis of viral infections.

Unit III: Antimicrobial agents, therapy and resistance: Antibacterial agents and their mechanism of action, Resistance to antimicrobial drugs, Basis of resistance, Antibiotic sensitivity testing, Antibacterial assays, Antiviral and Antifungal agents, and susceptibility test.

SUGGESTED READING:

1. Medical Microbiology E-Book Book by Ken S. Rosenthal, Michael A. Pfaller, and Patrick R Murray
2. Medical Microbiology & Immunology Book by Ernest Jawetz and Warren E. Levinson
3. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J. Ryan

LS-542 (E)	Vermitechnology	3 CH	50 marks

OBJECTIVE:

The branch of science that studies the importance and utilization of different earthworm species to answer problems related to ecology and environment is known as Vermitechnology. Use of vermicompost has been found effective for improving soil aggregation, structure, and soil fertility, increasing soil microbial population and enzymes, improving moisture-holding capacity of soil, increasing cation exchange capacity, and crop yield.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Vermitechnology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of soil profile and the role of earthworms in soil fertility.
PEO2. Analyze the relationships among different categories of earthworms and their of mechanism of action.
PEO3. Perform procedures as per the areas of Vermitechnology like Vermiculture, Vermicompost and vermiconservation.
PEO4. Apply the basic concepts learned to execute them in improving the soil condition.

COURSE OUTCOMEs (COs): After studying in the Vermitechnology in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of vermitechnology.

CO2. Analyze the various soil types and to improve them through case studies.

CO3. Apply the knowledge in understanding practical problems in soil fertility and vermiremediation.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in soil conditioning.

COURSE:

Unit-I: Fundamental concepts and strategies: Concept of pedosphere , Diversity soil biota and their role in soil fertility, General idea on earthworms, Identification of functional category of worms, extraction and sampling methods of earthworms, Concept of endemic and exotic worms, General principles of soil and manure testing.

Unit-II: Processes: General idea of decomposition and composting processes, Impact of functionalcategory of earthworms on soil properties, Biofertilization, Biotransformation, Bioremediation, Biomagnification, Biodegradation, Bioturbations with earthworms, Prospects of vermitechnology in reducing methane gas emission, Organic farming and protein production.

Unit-III Technology: Small and vermicomposting technology, Advantages of vermicomposting over composting, Vermiconservation, Restoration/ reclamation of degraded terrestrial environment through

integrated vermitechnology, Case studies on vermitechnology, WINDROW models, SOVADEC computerized model, Prospects and problems of vermitechnology.

SUGGESTED READING:

1. Charles Darwin's Plough: Tools for Vermitechnology. Dash M. C. (2012). IK International Publishers. ISBN 9381141274 ISBN 978-9381141274.
2. Vermitechnology (English, Paperback, Violet A Mary Christy
3. Vermitechnology (English, Paperback, Yadav Shweta)

LS-542 (F)	Hormonal Plant Physiology	3 CH	50 marks

OBJECTIVE:

This paper aims to give an view of various hormones regulating various plant processes and their regulation.The physiological effects of these hormones and mode of their action will be the main focus.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying **Hormonal Plant Physiology** in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of hormones and the role plant development
PEO2. Analyze the different categories of hormones and their mechanism of action.
PEO3. Perform procedures as per the areas of hormonal effect on plant growth with specific case studies.
PEO4. Apply the basic concepts learned to execute them in improving the crop growth and yield.

COURSE OUTCOMEs (COs): After studying in the **Hormonal Plant Physiology** in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of hormones related to plants.

CO2. Analyze the various mechanisms of hormonal actions and to improve them through case studies.

CO3. Apply the knowledge in understanding practical problems in hormonal control.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in plant development.

COURSE:

Unit-I: Concept of hormones and their action, Auxin: the principal growth regulators in plants, Biosynthesis and degradation of auxins, Auxin transport to different plant parts, Extraction and measurement of auxins, Physiological effects of auxins on root and shoot growth, Phototropism and Gravitropism, Auxin signal transduction pathways, Auxin as herbicides.

Unit-II: Gibberlins and Cytokinins: Discovery of Gibberlins, Biosynthesis and metabolism of gibberlins, Physiological roles of gibberlins, Mechanism of gibberlin action, Gibberlin signal transduction pathway. Discovery and properties of cytokinins, Cytokinins and cell division, Sites of cytokinin biosynthesis and transport, Cytokinin metabolism, Physiological role of cytokinins, Cellular and molecular modes of cytokinin action.

Unit-III: Ethylene and ABA: Structure, biosynthesis and measurement of ethylene, Developmental and physiological effects of ethylene, Cellular and molecular modes of ethylene action. ABA: a stress hormone, Occurrence and chemical structure of ABA, Biosynthesis, metabolism and transport of ABA, ABA induced stomatal closure, Physiological role of ABA, Cellular and molecular modes of ABA action.

SUGGESTED READING:

1. **Fundamentals of Plant Physiology**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Sixth Edition) 2018.
2. **Plant Physiology**. F.B. Salisbury and C.W. Ross. Thomson Information Publising Group (5th Edition)1991.
3. Physicochemical and Environmental Plant Physiology. Park S. Nobel, Elsevier Science, (5th Edition) 2020.
4. Introduction to Plant Physiology. Huner NPA and Hopkins, WG. Wiley publishers, (4th Edition) 2013.
5. **Biochemistry and Molecular Biology of Plants**. B. B.Buchanan, W.Gruissem and R.L.Jones (Ed.), Wiley Blackwell Publishers (Second Edition) 2015.

LS-542 (G)	Plant Metabolism	3 CH	50 marks

OBJECTIVE:

This paper aims to give an view of various hormones regulating various plant processes and their regulation.The physiological effects of these hormones and mode of their action will be the main focus.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Plant Metabolism in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of photosynthesis and metabolism of biomolecules.
PEO2. Analyze the the different categories of biomolecules and their mechanism of action.
PEO3. Perform procedures as per the areas of plant metabolism with specific case studies.
PEO4. Apply the basic concepts learned to execute them in engineering new lipids and proteins etc.

COURSE OUTCOMEs (COs): After studying in the Plant Metabolism in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of biomolecules and their synthesis.

CO2. Analyze the various mechanisms of plant metabolism and to improve them through case studies.

CO3. Apply the knowledge in understanding practical problems in plant metabolism.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in plant development.

COURSE:

Unit-I: Carbohydrate Metabolism: Photosynthesis, C_3 and C_4 pathways, CAM metabolism, Photorespiration, Metabolism of polysaccharides such as starch, cellulose, lignin and pectin. Metabolism of sucrose, Various phosphate pools and their interaction. Integration of carbohydrate metabolism in plant cell, Electron transfer in plant mitochondria, Interaction between chloroplast and mitochondria.

Unit-II: Lipid Metabolism: Fatty acid biosynthesis, Desturation and elongation of fatty acids, Synthesis of unusual fatty acids, Metabolism of phospholipids, Synthesis and catabolism of storage lipids, Engineering of new lipids.

Unit-III: Secondary Metabolites: Types and distribution of secondary metabolites, Terpenoids: biosynthesis and function of terpenoids in higher plants. Alkaloid localization and biosynthesis,

Flavonoid biosynthesis, Shikimic acid pathway, Acetate-Malonate pathway, Function of flavonoids, Cyanogenic glycosides and non-protein amino acids.

SUGGESTED READING:

1. **Fundamentals of Plant Physiology**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Sixth Edition) 2018.
2. **Plant Physiology**. F.B. Salisbury and C.W. Ross. Thomson Information Publising Group (5th Edition)1991.
3. Introduction to Plant Physiology. Huner NPA and Hopkins, WG. Wiley publishers, (4th Edition) 2013.
4. **Biochemistry and Molecular Biology of Plants**. B. B.Buchanan, W.Gruissem and R.L.Jones (Ed.), Wiley Blackwell Publishers (Second Edition) 2015.

LS-542 (H)	Photobiochemistry	3 CH	50 marks

Unit-I: Photosynthesis: Structural subdivision of chloroplast, Light absorption and fluorescence characteristics of photosynthetic pigments, Organization of photosystem, Reaction center, Light absorption by PS II and charge separation. Co-operation of PS II and PS I and NADP reduction, Proton translocation and coupling of ATP synthesis to light driven electron flow.

Unit-II: Photomorphogenesis: Biological significance of phytochrome; Physical and chemical properties of phytochrome, Distribution in the cell/organelles; its role in photomorphogenesis, Photo-transformation of phytochrome and mechanism of action, Cytochrome- the blue light and UV-A photoreceptor.

Unit-III: Photo-oxidative stress in Higher Plants: Photosynthetic apparatus under light stress, Light induced production of active oxygen species, Damage of Photosystem and Photoinhibition of photosynthesis, Photo-protective strategies in plants, Carotenoids as photo-protective pigments, Operation of Xanthophyll cycle and dissipitation of light in antenna level.

LS-543 (A – D)	SPECIAL PAPER- III (Any one)	3 CH	50 marks

LS-543 (A)	Structure and Metabolism	3 CH	50 marks

OBJECTIVE:

The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialised knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Structure and Metabolism in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Structure and Metabolism of biomolecules.
PEO2. Analyze the the different categories of biomolecules and their microbial production.
PEO3. Perform procedures for deeper understanding of biomolecules with specific case studies.
PEO4. Apply the basic concepts learned to execute them in regulation and synthesis etc.

COURSE OUTCOMEs (COs): After studying in the Structure and Metabolism in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of biomolecules and their synthesis.

CO2. Analyze the various mechanisms of biomolecule synthesis with specific case studies.

CO3. Apply the knowledge in understanding practical problems in biomolecule regulation.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in biomolecules.

COURSE:

Unit I: Carbohydrates and Lipids: Structural organization of polysaccharides; Metabolic pathways and energetics of carbohydrates: Glycolysis, HMP shunt, Glycogen metabolism; Calvin cycle and C_4 pathway; Photorespiration; ED pathway. Structural organization of complex lipids and steroids; Lipid biosynthesis; α, β, ω oxidation of fatty acids; Energetics of lipid oxidation and regulation; Cholesterol biosynthesis.

Unit II: Nucleic acid and Proteins: *De novo* and Salvage pathway of nucleic acid biosynthesis. Molecular organization and hierarchy of proteins; Ramchandran plot and establishment of higher order structures; Proteolysis.

Unit III: Amino acid, Vitamins and Hormones: Amino acid metabolism: transamination, deamination, decarboxylation; Urea cycle. Vitamins and Hormones: absorption and transport; Biochemical functions of vitamins: A, D, E , K, B and C.

SUGGESTED READING:

1. Principles of Biochemistry by AL Lehninger, David L. Nelson and Michael M. Cox
2. Biochemistry by Jeremy M. Berg, John L. Tymoczko and Lubert Stryer
3. Principles of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W. Pratt

LS-543 (B)	Industrial Microbiology	3 CH	50 marks

OBJECTIVE:

The aim of the course is to give the students broad theoretical and practical skills in industrial microbiology.The students will be able to discuss the role of microorganisms in industry, as well as to carry out experiments to produce microbial metabolites. Industrial microbiology uses different microorganisms, such as naturally occurring organisms, laboratory selected mutants, or even genetically modified organisms, to produce a very large variety of industrial products in large quantities.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Industrial Microbiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts in designing and operations of bioreactors.
PEO2. Analyze the the different categories of bioreactors and commercial enzyme production.
PEO3. Perform procedures for deeper understanding of bioproductions with specific case studies.
PEO4. Apply the basic concepts learned to execute them in regulation and synthesis etc.

COURSE OUTCOMEs (COs): After studying in the Structure and Metabolism in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of bioreactors.

CO2. Analyze the various mechanisms of enzyme synthesis in bioreactors with specific case studies.

CO3. Apply the knowledge in understanding practical problems in bioreactor designing.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in commercial production and mass culture of cell in bioreactors.

COURSE:

Unit-I: Design and operation of conventional bioreactor (design, sterilization, inoculation, sampling, aeration and control system); Solid substrate fermentation; Variation in bioreactor design (Batch, Fed-batch, CSTR, Tubular flow and Packed Bed). Residence time distribution (E-curve, F-curve and C- curve). Diauxic growth and substrate inhibition kinetics.

Unit-II: Commercial production of microbial enzymes, industrial chemicals (alkanes, butanol, ethanol, amino acid, hydrogen, organic acids, exo-polysaccharides), antibiotics, sterols, therapeutic peptides and proteins. Microbial technology for alcoholic beverages production (beer, wine and cider), vinegar production; Dairy fermentation (butter and cheese); SCP.

Unit-III: Mass culture of cell in bioreactor system; Immobilized cell culture; Enzyme immobilization and its application in bioreactor; Biofilm; Strategies for maximizing productivity (Amino acid and SCP). Downstream processing of product/enzyme recovery: case study.

SUGGESTED READING:

1. Microbial Ecology By Atlas R.M., Bartha R., Benjamin Cummings Publishing Co, Redwood City, CA., 1993.
2. Principles of Fermentation Technology by P.F. Stanbury, W. Whitaker &S.J. Hall, Aditya Books (P) Ltd., New Delhi, 1997.
3. Industrial Microbiology: An Introduction by Waites, Morgan, Rockey & Highton, Blackwell Science, 2001.
4. Fundamental Food Microbiology , 3rd edition by B. Ray., CRC press, 2006.
5. Food Microbiology by M.R. Adams & M.O. Moss., Royal Society of Chemistry, 2000.
6. Molecular Biology of the Gene by James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine & Richard Losick , 6th Edition; CSHL Press; 2007.
7. Principles of Microbiology by R.M. Atlas , Mosby publishers, St. Louis; 1995.

LS-543 (C)	Microbial Ecology	3 CH	50 marks

OBJECTIVE:

Analyze the causes of climate change and see how human activities affect the climate. See the consequences of global climate change for ecosystems and human society. Recognize the moral principles, goals, and virtues needed for making sound policy and lifestyle responses to global climate change.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Atmosphere and Climate Change in the curriculum, students will be able to:

PEO1. To understand the basic concept of atmospheric properties and to educate the students about the new concept of climate change.

PEO2. Analyze the impact of climate change on agriculture, forest, water resources, and monsoon system of India

PEO3. Perform procedures to lower the impact of climate change on the environment at home

PEO4. To apply the scientific background for research and other careers across a broad spectrum of atmosphere related science, focusing particularly on the links between the atmosphere and the land surface environment.

COURSE OUTCOMEs (COs): After studying in the Atmosphere and Climate Change in the curriculum, students will be able to:

CO1: Remember and understand the basic concept of atmospheric properties, its dynamic nature and variability in turns of the global energy balance.

CO2: Analyze the concepts related to the fundamentals of climatology, pollution climatology, and the phenomenon of climate change with emphasis on India.

CO3:Apply the knowledge in understanding the effects due the imbalance of the atmospheric processes such as global warming, air pollution, climate change etc.

CO4: Execute the field assignment as per the knowledge gained in the course.

COURSE

Unit I: Basic atmospheric properties, climatic controls, climatic classifications and variability. Movement in the atmosphere: global scale, regional scale, local scale. Wind, stability and turbulence; Energy balance in atmosphere, Atmospheric moisture: Forms of cloud condensation; Precipitation, Thunderstorms, floods and droughts, Indian monsoon, El Nino, La Nina effect, and western disturbances,

Unit II: Natural climate changes: Records of climate change (glacial cycles, ocean sediments, corals, tree rings). Indian climate through ages; impact of the Himalayan mountain building and the Indian Summer, Monsoon. Drivers of climate change- greenhouse gases, aerosols – reflective and black carbon, land use changes. Energy balance, feed-back processes in climate system, concepts of global warming potential (GWP), radiative forcing.

Unit III: Climate change scenarios of India: impact of climate change on agriculture, forest, water resources, monsoon system of India. Causes and consequences of Global warming: Greenhouse effect; Global and regional trends in greenhouse gas emissions; Sea level rise; role of oceans and forests as carbon sinks; Ozone depletionstratospheric ozone shield; Ozone hole. Impacts of Climate change: Effects on organisms including humans; effects on ecosystems and productivity; species responses in terms of distribution ranges, adaptation; spread of diseases; Extinction risk for temperature-sensitive species; UV effects.

SUGGESTED READING:

1. Hardy, J.T. 2003. Climate Change: Causes, Effects and Solutions. John Wiley & Sons.
2. Harvey, D. 2000. Climate and Global Climate Change. Prentice Hall.
3. Barry, R. G. 2003. Atmosphere, Weather and Climate. Routledge Press, UK
4. Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. &Sen, K. 2004. Climate Change and India. Universities Press, India.

LS-543 (D)	**Stress Physiology**	**3 CH**	**50 marks**

OBJECTIVE:

The importance of studying the effects of stress on individual organisms is addressed by considering the use of individual-level information to: elucidate the mechanistic bases of inter-population variation; predict population-level effects; and monitor stress in natural communities.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Stress Physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts stress and its effect in nature.
PEO2. Analyze the different types of stresses and their effects.

PEO3. Perform procedures for deeper understanding of stress management in organisms with specific case studies.
PEO4. Apply the basic concepts learned to execute them in management of both abiotic and biotic stresses.

COURSE OUTCOMEs (COs): After studying in the Stress Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of stresses encountered in nature.

CO2. Analyze the various mechanisms of stress effect with specific case studies.

CO3. Apply the knowledge in understanding practical problems in stress and its management.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in stress effect study.

COURSE:

Unit-I: Abiotic stresses and organismal responses; Biological stresses and strain; Stress injury and resistance and their classification; Physiology of acclimation and acclimatization; Molecular approaches to study stress response in plants; Gene expression and signal transduction in response to stress signals.
Unit-II: High and low temperature stresses; Organismal response to chilling, Freezing and high temperature stresses; Molecular mechanisms of adaptation to high temperature stress; HSPs, AFPs and their expression; Molecular response to drought; drought injury and resistance, expression of stress resistant genes in plants; LEA proteins, aquaporins and water use efficiency.

Unit-III: Salinity stress in plants; Salt stress injury and resistance mechanisms, Salt regulated genes expression; ABA responsive genes and osmotin; ABA dependent and ABA independent pathways of stress response; Role of *cis*-acting and *trans*-acting factors in stress resistance; Heavy metal stress and phytochelatin response; Engineering stress resistant genotypes.

SUGGESTED READING:

1. **Plant Physiology and Development**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Sixth Edition) 2015.
2. **Fundamentals of Plant Physiology**. Lincoln Taiz, Eduardo Zeiger, Ian Max Moller and Angus Murphy. Sinaur Associates Inc. publishers(Revised Sixth Edition) 2018.
3. **Plant Physiology**. F.B. Salisbury and C.W. Ross. Thomson Information Publising Group (5th Edition)1991.
4. Physicochemical and Environmental Plant Physiology. Park S. Nobel, Elsevier Science, (5th Edition) 2020.
5. Introduction to Plant Physiology. Huner NPA and Hopkins, WG. Wiley publishers, (4th Edition) 2013.
6. **Biochemistry and Molecular Biology of Plants**. B. B.Buchanan, W.Gruissem and R.L.Jones (Ed.), Wiley Blackwell Publishers (Second Edition) 2015.
7. **Physiological Plant Ecology,** Walter Larcher
8. **Plant Physiological Ecology,** Hans Lambers and Reffel S. Oliviera.

LS-544 (A – D)	**SPECIAL PAPER- IV (Any one)**	**3 CH**	**50 marks**

LS-544 (A)	**Metabolic Regulation**	**3 CH**	**50 marks**

OBJECTIVE:

Metabolic regulation enables the balance between substrate and product of enzyme-catalyzed reactions to be maintained so that ordered metabolic flow can occur in response to developmental requirements and environment.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Metabolic Regulation in the curriculum, students will be able to:

PO1. Understand the basic the basic nature and basic concepts in regulation of metabolic processes.
PO2. Analyze the Molecular mechanism of hormone action.
PO3. Perform procedures for deeper understanding of bio-productions with specific case studies.
PO4. Apply the basic concepts learned to execute them in regulation and synthesis etc.

COURSE OUTCOMEs (COs): After studying in the Structure and Metabolism in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of bioreactors.

CO2. Analyze the Signal response coupling in metabolic processes with specific case studies.

CO3. Apply the knowledge in understanding practical problems metabolic regulation

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Metabolic regulation: Glycolysis, Phosphofructokinase and pyruvate kinase as control points in glycolysis; Pasteur effect; TCA cycle and its control; Glyoxalate cycle and its regulation; Regulation of glycogen metabolism.

Unit-II: Molecular mechanism of hormone action: Epinephrine, Insulin, Thyroxine, Estrogen, Phytohormones namely cytokinin and ethylene.

Unit-III: Signal response coupling in metabolic processes: Sugar sensing signal transduction; Hexokinase as sugar sensor; Ca-Calmodulin signaling system; cAMP as 2^{nd} messenger; GTP binding protein and kinase/phosphatase cascade.

SUGGESTED READING:

1. Principles of Biochemistry by AL Lehninger, David L. Nelson and Michael M. Cox
2. Biochemistry by Jeremy M. Berg, John L. Tymoczko and Lubert Stryer
3. Principles of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W. Pratt
4. Harpers Illustrated Biochemistryby Victor Rodwell , David Bender

LS-544 (B)	Virology	3 CH	50 marks

OBJECTIVE:

Virology is the study of understanding viruses – from more common infections such as chicken pox to new and emerging infections like Zika and Ebola. Virologists are medical doctors that oversee thediagnosis, management and prevention of infection. By studying viruses, we can learn about the biology of host cells and organisms, develop strategies against viral disease and manipulate viruses for our own purposes. Some viruses are only a single self-replicating gene, while others can encode almost a thousand proteins and be the size of a bacterium.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Industrial Virology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of viral structure and taxonomy.
PEO2. Analyze the different categories of virus and their reproduction.
PEO3. Perform procedures for deeper understanding of viral physiology and genetics.
PEO4. Apply the basic concepts learned to execute them in regulation of virus.

COURSE OUTCOMEs (COs): After studying in the Virology in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of viruses.

CO2. Analyze the various mechanisms of reproduction and infection with specific case studies.

CO3. Apply the knowledge in understanding practical problems in viral infections.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum viral processes.

COURSE:

Unit-I: Definitive properties of viruses, Virus structure (capsid, nucleic acid, viral envelope and enzyme); Viral diversity: classification of virus and taxonomy; Viral cultivation, detection and enumeration. Viral evolution and emergence of new virus.

Unit-II: Viral attachment and entry into the host cell; Genomic replication of DNA viruses and RNA viruses; Viral translational strategy; Viral assembly, maturation and exit of viruses. General features of TMV, HIV, Poliovirus, Rhabdovirus, Reovirus, Retrovirus, Adenovirus, Poxvirus).

Unit-III: Classification of bacteriophage; One step growth experiment; Reproduction of dsDNA, ssDNA and RNA phage; Lytic cycle; Temperate bacteriophage and Lysogenic cycle; Choice of lysis and lysogeny. Viral pathogenesis, prevention of viral diseases (vaccines & antiviral drugs).

SUGGESTED READING:

1. Principles of Virology: Molecular Biology, Pathogenesis and Control of Animal Viruses by S.J. Flint, L.W. Enquist, V.R. Racaniello, and A.M. Skalka 2nd edition, ASM Press, Washington, DC, 2004.
2. Introduction to Modern Virology EPZ by Nigel Dimmock, Andrew Easton and Keith Leppard, 5th edition, Blackwell Publishing, 2005
3. Basic Virology by Edward K. Wanger, Martinez Hewiett, David Bloom and David Camerini, 3rd edition, Blackwell Publishing, 2007Medical Microbiology and Immunology by Levinson W, Jawetz E: Lange publication; 2001.
4. Virology: Principles and Applications. Dr John Carter and Prof Venetia Saunders .John Wiley & Sons.1st edition.
5. A. Maharajan. 2011. Virology. Daya Publishing House. ISBN: 9788170356813.
6. Plant pathology by George N. Agrios: 4th ed., Academic press, New York, 1969.
7. Plant pathology by R.S. Mehrotra: Tata McGraw –Hill publishing company limited. New Delhi.
8. Human Virology by John Oxford (Author), Paul Kellam (Author), Leslie Collier

LS-544 (C)	Environmental Management	3 CH	50 marks

OBJECTIVE:

Objectives and Guiding Principles of Environmental Management is creating the awareness about environmental problems among people; imparting basic knowledge about the environment and its allied problems and Developing an attitude of concern for the environment.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Industrial Microbiology in the curriculum, students will be able to:

PEO1: To understand the population dynamics, the use of natural resources and environmental pollution.

PEO2: To analyze the fundamentals of cost-benefit, environmental planning, and economic development.

PEO3: To perform procedures to develop managerial skills that allows the quality control of the environmental programs.

PEO4: To apply the scientific planning strategies required for environmental problem analysis

COURSE OUTCOMEs (COs): After studying in the Structure and Metabolism in the curriculum, students will be able to:

CO1: Remember and understand the rationale behind the exploitation of natural environments. It provides you with detailed knowledge and understanding of the important relationships between sustainable environmental management and natural ecosystems and the value of adopting an integrated approach to studying both.

CO2: Conduct research and present findings on selected environmental sustainability topics.

CO3: Apply the knowledge to develop controls to reduce or eliminate risk

CO4: Execute the study in managerial, technological and policy approaches to natural resource management

Unit-I: Degradation of environment and its management: Impacts of developmental projects on environment; Land, water, air pollution: Definition, Sources and types, causes, effects, and management; Loss of biodiversity; Principles of environment management; Concept of carbon trading, carbon capture and storage.

Unit-II: Environmental management techniques and standards: Life cycle assessment and SWOT analysis, municipality solid waste management, Air quality management, Water quality management, Biodiversity and its management, Environmental Management Plan(EMP), Applications of GIS and Remote sensing in environmental management. Environment management system standards: ISO 14000, CPCB.

Unit-III: Environmental management policies: Environmental Economics, Environmental monitoring programme, Ecosystem Services; Conventions and Summits: Kyoto Protocol, 1997, Cartagena Protocol, 2003, Rio Declaration 1992, Montreal Protocol, 1987, Stockholm Declaration, 1972, Ramsar Convention, 1971, IPCC Report 2008, Bali Summit on Climate; Indian Acts on Environment: Indian Forest Act 1927, The National Forest Policy, 1952, Water Act, 1974, The Forest (Conservation) Act, 1980, The Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986, The Biological

SUGGESTED READING:

1. T. V. Ramachandra and Vijay Kulkarni, Environmental Management (2009), TERI press
2. Mary K. Theodore, Louis Theodore, Introduction to Environmental Management (2009), CRC press
3. I.V Murali Krishna Valli Manickam, Environmental Management 1st Edition (2017), Elsevier
4. Environmental Engineering First Editionby Gerard Kiely (Author) (1996), McGraw-Hill

LS-544 (D)	Radiation Biology	3 CH	50 marks

OBJECTIVE:

Radiation biology (also known as radiobiology) is a medical science that involves the study of biological effects of ionizing radiation on living tissues. Whether the source of radiation is natural or man-made, whether it is a large dose of radiation or a small dose, there will be some biological effects. The study also aims to know the limits on the exposure to radiation are designed to avoid unnecessary damage to health. These limits need to be continually assessed in the light of new scientific discoveries. Limits that are set too low may create unacceptable morbidity for individuals.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Radiation Biology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of radiation in nature.
PEO2. Analyze the cellular response to radiation.
PEO3. Perform procedures for radiation exposure and recovery mechanism with specific case studies.
PEO4. Apply the basic concepts learned to execute them in regulation of radiation damage.

COURSE OUTCOMEs (COs): After studying in the Radiation Biology in the curriculum, students will be able to:

CO1. Remember and understand the basic aspects of radiations – ionizind and non-ionizing.

CO2. Analyze the various mechanisms of cellular response to radiation exposure with specific case studies.

CO3. Apply the knowledge in understanding practical problems in related to radiation application.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum in kinetics of radiation influences.

COURSE:

Unit-I: Fundamentals of radiation biology: Types of radiation, Interaction of ionizing radiation with matter; Photoelectric effect; Compton scattering and pair production; Direct and indirect effects of ionizing radiation; Detection and measurement of radiation; Radiation chemistry and free radicals; Radiolysis of water; Radiation effects at sub-cellular and molecular level.

Unit-II: Cellular responses to ionizing radiation: Target theory and cell survival curves in prokaryotic and eukaryotic cells; Single hit and multi hit phenomena; Do, Dq and n; Kinetics of cell killing; Oxygen effect and cell survival curves; Radio-sensitivity of synchronized cell population, Cell synchronization techniques; Factors influencing the effects of ionizing radiation.

Unit-III: Radiation injury and recovery mechanisms: Radiation induces chromosomal aberrations and gene mutation; DNA damage and repair; Acute radiation effect and delayed effects; Effects on cell cycle; Split dose technique; Elkind recovery patterns; Dq as measure of repair; Effects of hypoxia on the repair

of sub-lethal radiation damage; High LET radiations in cancer therapy; Radiolabelled compounds in biology and medicine.

SUGGESTED READING:

1. P. Uma Devi, A. Nagarathnam and B.S. Satish Rao. Introduction to Radiation Biology. B.I. Churchil Livingstone Pvt.Ltd.
1. Prasad, K.N., *CRC Handbook of Radiobiology*, CRC Press, Florida
2. Eric J Hall, Amato J Giaccia. *Radiobiology for the Radiologist*. Lippincott : Williams & Wilkins.
3. A.H.W. Nias. *An Introduction to Radiobiology*. John Wiley and sons
4. Alison P Casarette. *Radiation Biology*. Prentice Hall Inc.

LS-535 (B)	Microbial Physiology	3 CH	50 marks

OBJECTIVE

Microbial physiology and metabolism provides information on sources of energy and its utilization by microorganisms. Microorganisms play important role in environment as producers, consumers and decomposers. To know the specific parameters it is important to understand physiology of these organisms in detail which will impart knowledge of the basic principles of bacteriology, virology, mycology, immunology and parasitology including the nature of pathogenic microorganisms, pathogenesis, laboratory diagnosis, transmission, prevention and control of diseases common in thecountry.
PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Microbial Physiology in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of Microbial Physiology
PEO2. Analyze the relationships among different concepts.
PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Microbial Physiology in the curriculum, students will be able to:

CO1. Remember and understand the basic concepts of microbial metabolism, normal microbiota in humans and therapeutic measures to control microbial infections.

CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: Microbial metabolism, heterotrophic generation of ATP, Fermentation versus respiration, Respiratory metabolism, Oxidative phyosphorylation, autotrophic generation of ATP, Chemolithotrophy with reference to sulphur oxidizing, nitrifying and methanogenic bacteria. Anoxigenic bacterial photosynthesis. Fermentation pathways (ethanol, homo and hetero lactic fermentation, mixed acid fermentation, butandiol and propanic acid, amino acid fermentation), Biosynthesis of peptidoglycans.

Unit-II: Normal human microbiota (skin, gastrointerstinal tract, oral cavity, respiratory tract, genitourinary

tract), Virulence factor of pathogens (toxin and toxigenicity, invaviveness, factors affecting phagocytocis), Host defence mechanism, inflammatory response).

Unit-III: Chemotherapy and antimicrobial agents: principles of chemotherapy, microbial structure and biochemical reactions as potential targets. Antimicrobial agents and their mode of action (sulfa drugs, β-lactum antibiotics, Aminoglycosides, Macrolides, Tetracycline, Chloramphenicol, Cycloserine, Isoniazid, antiviral durgs).

SUGGESTED READING:

1. Brock Biology of Microorganisms (12th edition) by Madigan and John M. Martinko, Paul V. Dunlap, David P. Clark Benjamin Cummings; 2008.
2. Microbiology: An Introduction by Gerard J Tortora, Berdell R Funke, Christine L Case Benjamin-Cummings Publishing Company ; 2008.
3. Microbial Physiology,4th Edition by Michael P. Sector, Albert G. Moat, John W. Foster, Michael P. Spector. Wiley.
4. General Microbiology 5e (Intern Ed) by Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. Palgrave Macmillan.
5. Fundamental Food Microbiology. 3rd edition by B. Ray., CRC press, 2006.
6. Microbiology. Sixth edition by Prescott, L. M., J. P. Harley and D. A. Klein. 2005. International edition, Mc Graw Hill.

LS-536 (B)	Microbial Genetics	3 CH	50 marks

OBJECTIVE:

Microbial genetics is also important for understanding molecular techniques used to modify genes and proteins, manipulate bacteria, archaea, and eukaryotic organisms for fundamental research as well as practical applications in diverse areas of medicine and biotechnology. Microbial genetics will play a unique role in developing the fields of molecular and cell biology and also has found applications in medicine, agriculture, and the food and pharmaceutical industries. Hereditary processes in microorganisms are analogous to those in multicellular organisms.

PROGRAMME EDUCATION OBJECTIVESS (PEOs): After studying Microbial Genetics in the curriculum, students will be able to:

PEO1. Understand the basic the basic nature and basic concepts of microbial genetics.
PEO2. Analyze the relationships among different concepts of enzyme kinetics and regulation.PEO3. Perform procedures as per the areas of study.
PEO4. Apply the basic concepts learned to execute them.

COURSE OUTCOMEs (COs): After studying in the Microbial Genetics in the curriculum, students willbe able to:

CO1. Remember and understand the basic concepts of genetic transformation etc.CO2. Analyze the various concepts to understand them through case studies.

CO3. Apply the knowledge in understanding practical problems in Microbial Genetics.

CO4. Execute the projects or field assignment as per the knowledge gained in the course curriculum.

COURSE:

Unit-I: The study of microbial genes: The inheritance of characteristics and variability, Phenotypic and genotypic changes: Types of mutation; Mutagenic age mechanism of mutagenesis;Mechanisms of suppression of non-sense and frame shift mutations; Repairing mechanism of mutations. Oncogenes: Transformation of normal cells to Tumor cells; Oncogenes; Oncogenic DNA and RNA viruses.

Unit II: Genetic transformation in Microbes: Introduction to Microbial genomes; Gene transfer in bacteria: Modes of gene transfer, phages, yeast and fungi, Molecular genetics of conjugation, transduction and transformation; Genetic mapping of bacteria. Genetics and life cycle of phages- lambda, T4, pi, Mu and Ml3. Restriction and modification systems in bacteria.

UNIT- III: Gene Expression and regulation: Genetic switches; Regulation of transcription and translation, post-translational modifications. Transposable elements: structure and classification of bacterial and yeast transposons, Mechanisms of transposition.

SUGGESTED READING:

8. Molecular Genetics of Bacteria by Larry Snyder and Wendy Champness, 3rd edition; ASM press;2007.
9. Brock Biology of Microorganisms (12th edition) by Madigan and John M. Martinko, Paul V.Dunlap, David P. Clark Benjamin Cummings; 2008.
10. Microbiology : An Introduction by Gerard J Tortora, Berdell R Funke, Christine L CaseBenjamin- Cummings Publishing Company ; 2008.
11. Medical Microbiology and Immunology by Levinson W, Jawetz E: Lange publication; 2001.
12. Microbial Physiology, 4th Edition by Michael P. Sector, Albert G. Moat, John W. Foster, Michael P. Spector Wiley.

13. General Microbiology 5e (Intern Ed). By Stanier RY, Ingrahm JI, Wheelis ML and PainterPR. Palgrave Macmillan.
14. Microbiology. Sixth edition, International edition by Prescott, L. M., J. P. Harley and D. A. Klein.2005. Mc Graw Hill.

M.Sc. MICROBIOLOGY

MB-414	Bacteriology	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Bacteriology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I: Historical resume of Microbiology; An overview of the microbial world; Classification of Micro-organisms: Haeckel's Concept, Whittaker's Concept, Domain Concept of Carl Woese, Bergey's Manual of Determinative and Systemic Bacteriology; **Morphology and Ultrastructure of Bacteria:** Architecture of cell wall of gram positive and gram negative bacteria; Structural organization of prokaryotic cell (bacterial wall, capsule, flagella, pilli, pronucleus, ribosomes, plasmid, Gas Vesicle, Chromosome, Carboxysomes)

Unit-II: Bacterial nutrition and nutritional categorization; **Bacterial culture**: Synchronous and asynchronous culture, continuous culture and chemostat principle; **Bacterial growth:** phases of growth, Physical and Chemical Growth Kinetics, Measurement of Growth and Control of Bacteria, Concept of Bacterial Preservation

Unit-III:
An Overview of Archeabacteria and Proteobacteria: a brief introduction, classification and Diversity; **Mollicutes:** Structure and Salient features of classification; **Actinomycetes:** General Properties and their Classifications; **Photosynthetic Bacteria**

MB-534	Applied and Industrial Microbiology	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Applied and Industrial Microbiology
CO-2	Analyse the Various Concepts to understand them through case studies

CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I:

General Considerations: Metabolic pathways and metabolic control mechanisms, primary and secondary metabolites.

Fermentation in batch culture: Microbial growth kinetics, measurement of growth (cell number, direct and indirect methods) growth and nutrient, growth and product formation, heat evolution, effect of environment (temperature, pH, high nutrient concentration) media formulation. Sterilization, kinetics of thermal death of micro-organisms, batch and continuous sterilization.

Unit-II:

Continuous culture: Continuous culture system, productivity, product formation.

Aeration and agitation, power requirement oxygen transfer kinetics, concepts of Newtonian and Non-Newtonian fluids, plastic fluids apparent viscosity, foam and antifoam.

Scale-up, instrumentation control, physical and chemical environment sensors, downstream process.

Unit-III:

Water Purification and Sanitary Analysis, Waste Water Treatment, Micro-organisms Used in Industrial Microbiology, Microorganism Growth in Controlled Environments

Major Products of Industrial Microbiology, Biodegradation and Bioremediation by Natural Communities, Bioaugmentation, Microbes as Products, Impacts of Microbial Biotechnology

MB-535	**Fundamentals of Microbial Infection and diseases**	**3 CH**	**50 marks**

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Fundamentals of Microbial Infection and diseases
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I:

Principles of Medical Microbiology: Classification of medically important microorganisms. Normal microbial flora of human body; Origin of normal flora; normal flora and human host.

Unit-II:

Infection: Sources of infection for man; vehicles or reservoirs of infection. Exogenous Infection: 1) Patients; 2) carriers – (Healthy; convalescent; contact; paradoxical and chronic); 3) Infected animals (zoonosis); 4) Soil endogenous infection. Mode of spread of infection: 1. Respiratory; 2) skin; 3) wound and burn infection; 4) Venereal infections; 5) Alimentary tract infection; 6).Arthorpod – borne blood infections & 7) Laboratory infections. Pathogenesis: Microbial Pathogenicity: Transmissibility, Infectivity and Virulence. Opportunistic pathogens; True pathogens. Toxigenicity; Invasiveness, Other aggressins (Hyaluronidase), coagulase, Fibrinolysins or kinase; depolymerizing enzymes (mucinase, lipases, proteases, nucleases, collagenase, neuraminidase. Organotropism, variation and virulence.

Unit-III:
Epidemiology of Infectious Disease: Epidemiological Terminology, Measuring Frequency, Recognition of an Epidemic, The Infectious Disease Cycle, Bioterrorism and Preparedness, Diseases caused by Viruses, Prions, Bacteria, Fungi, and Protists

MB-536	Mycology and Phycology	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Fundamentals of Mycology and Phycology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I:
Historical introduction to mycology structure and cell differentiation. Division myxomycota Acrasiomycetes, hydromyxomycetes, myxomycetes, Plasmo-diophoromycetes. Zoosporic fungi– Chytridiomycetes, Hypochytridiomycetes, oomycetes. Zygomycotina – Zygomycetes, Trichomycetes – Evalutionary tendencies in lower fungi.
Ascomyctina – Hemiascomycetes, plectomycete, pyrenomycetes Discomycetes, laboulberiomycetes, oculoascomycetes. Basidiomycotina teliomycetes, hymenomycetes. Deuteromycotina – hypomycetes, coelomycetes, blastomycetes.

Unit-II:
Heterothalism,sex hormones in fungi.Physiological specialization phylogeny of fungi, Lichens – ascolichens, basidiolichens, deuterolichens. Mycorrhiza – ectomycorrhiza, endomycorrhiza, vesicular arbuscular mycorrhiza.fungi as insect symbiont, Fungal diseases – mycoses systemic and subcutaneous, candidiasis, Pneumocystis, blastomycoses, dermotophytosis.
Fungi and ecosystem

Unit-III:
Distribution of algae,classification of algae, algal nutrition, algal thallus, algal reproduction, greenalgae, diatoms, euglenoids, brown Rhodophyta, pyrrophyta. Algal ecology and algal biotechnology

MB-541	Environmental Microbiology	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Fundamentals Environmental Microbiology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I:

Aquatic microbiology: Water ecosystems – types – fresh water (ponds, lakes, streams) – marine habitats (estuaries, mangroves, deep sea, hydrothermal vents, saltpans, coralreefs). Zonations of water ecosystems – upwelling – eutrophication – food chain. Potability of water – microbial assessment of water quality – water purification – brief account of major water borne diseases and their control measures.

Unit-II:

Soil Microbiology: Classification of soils – physical and chemical characteristics, microflora of various soil types (bacteria and nematodes in relevance to soil types; rhizosphere – phyllosphere – brief account of microbial interactions symbiosis – mutualism – commensalism – competition – amensalism – synergism – parasitism – predation; biogeochemical cycles and the organisms, – carbon nitrogen – phosphorus and sulphur, biofertilizers – biological nitrogen fixation – nitrogenase enzyme – nif genes; symbiotic nitrogen fixation – (*Rhizobium, Frankia*) – non symbiotic microbes – *Azotobacter* – *Azospirilium* – (vesicular arbuscular mycorrhizae – VAM) – ecto, endo, ectendomycorrhizae – rumen microbiology.

Unit-III:

Waste treatment: Wastes – types – solid and liquid wastes characterization – solid – liquid; treatments – physical, chemical, biological – aerobic – anaerobic – primary – secondary – tertiary; solid waste treatment – saccharification – gasification – composting, Utilization of solid wastes – food (SCP, mushroom, yeast): fuel (ethanol, methane) fertilizer (composting), liquid waste treatment – trickling – activated sludge – oxidation pond – oxidation ditch. Subterranean microbes and bioremediation

Positive and negative roles of microbes in environment: - biodegradation of recalcitrant compounds – lignin – pesticides; bioaccumulation of metals and detoxification – biopesticides; biodeterioration – of paper – leather, wood, textiles – metal corrosion – mode of deterioration – organisms involved – its disadvantages – mode of prevention. GMO and their impact.

MB-542	Medical and Diagnostic Microbiology	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Medical and Diagnostic Microbiology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I:

Early discovery of pathogenic microorganisms; development of bacteriology as scientific discipline; contributions made by eminent scientists. Classification of medically important micro organisms; Normal microbial flora of human body; role of the resident flora; normal flora and the human host.

Establishment, spreading, tissue damage and anti-phagocytic factors; mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts. Role of aggressins, depolymerising enzymes, organotropisms, variation and virulence. Organs and cells involved immune system and immune response.

Unit-II:

Classification of pathogenic bacteria. *Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Cornebacterium Bacillus, Clostridium*, Non sporing Anaerobes, Organisms belonging to Enterobacteriacea, Vibrios, Non fermenting gram negative bacilli *Yersinia*; *Haemophilus; Bordetella, Brucella; Mycobacteria, Spirochaetes, Anctiomycetes; Rickettsiae, Chlamdiae.*
General properties of Viruses; Viruses Host interactions; Pox viruses; Herpes virus, Adeno viruses; Picarno Viruses; Orthomyxo viruses; Paramyxo viruses; Arboviruses, Rhabdo viruses, Hepatitis viruses; Oncogenic viruses; Human Immuno deficiency viruses (AIDS). Dermatophytes, dimorphic fungi, opportunistic fungal pathogens. Description and classification of pathogenic fungi and their laboratory diagnosis.

Unit-III:

Laboratory control of antimicrobial therapy; various methods of drug susceptibility testing, antibiotic assay in body fluids. Brief account on available vaccines and schedules; passive prophylactic measures; Noscomical infection, common types of hosptial infections and their diagnosis and control.

MB-543	Microbial Technology	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Microbial Technology
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit I:

Biotechnological innovations in the chemical industry, biocatalyst in organic chemical synthesis, efficiency of growth and product formation, growth stoichiometry, maintenance energy requirement and maximum biomass, yield, P/O quotients, metabolite overproduction and growth efficiency. Shake flask, stirred tank airlift fermenter, fed batch, continous and immobilised cell reactor. Large scale production.

Unit II:

Metabolic pathways and metabolic control mechanism, industrial production of citric acid, enzymes, ethanol, acetic acid, production and diversification of antibodies. Steroids. Biofertilizers, biopesticides, mushroom production, fermented food beverages. Biopolymers. Bioremediation.

Unit III:

Industrial strains. Strategies for selection and improvement, maintenance containment of recombinant organisms, large scale production using recombinant microorganisms. Product recovery.

MB-544	Microbial Genetics and Proteomics	3 CH	50 marks

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles on Microbial Genetics and Proteomics
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Unit-I:

Whole genome analysis: preparation of ordered cosmid libraries, bacterial artificial chromosome libraries, shotgun libraries and sequencing, conventional sequencing (Sanger, Maxam and Gilbert methods), automated sequencing.

Sequence analysis: computational methods, homology algorithms (BLAST) for proteins and nucleic acids, open reading frames, annotations of genes, conserved protein motifs related structure/function (PROSITE, PFAM, ProfileScan). DNA analysis for repeats (direct and inverted), palindromes, folding programmes.

Unit-II:

Use of Internet, public domain databases for nucleic acid and protein sequences (EMBL, GenBank), database for protein structurers (PDB).

DNA microarray: printing or oligonucleotides and PCR products on glass slides, nitrocellulose paper. Whole genome analysis for global patterns of gene expression using fluorescent labelled cDNA or end labelled RNA probes. Analysis of single nucleotide polymorphisms using DNA chips.

Unit-III:

Proteome analysis: Two-dimensional separation of total cellular proteins, isolation and sequence analysis of individual protein spots by mass spectroscopy. Protein microarrary. Advantages and disadvantages of DNA and protein microarrays.

MATHEMATICS

PYTHON LANGUAGE

Course No: M-514 **Credits-4**

Objective:

The objective of the course is to prepare the Mathematics students for jobs in software

industry involving data analysis and computing skills. The course is followed by MATLAB to further strengthen the computing skills.

Expected Course Outcome: On completion of the course students will be able to

1: Explain numerical packages like PYTHON

2:. Solve Calculus problems using PYTHON.

3: Compare method of bisection and Newton Raphson method to find roots of an equation.

4: Apply Gauss Elimination method in solving linear equations.

5: Interpret calculation and interpretation of errors in numerical method.

UNIT-I

Introduction to Python ,The basic elements of python, Branching Programs , Control Structures , Strings and Input ,Iteration, Functions, Scoping and Abstraction,Specifications ,Recursion ,Global variables , Modules ,Files , System Functions and Parameters,

UNIT-II

Structured Types, Mutability and Higher-Order Functions , Strings, Tuples, Lists and Dictionaries , Lists and Mutability ,Functions as Objects, Testing, Debugging, Exceptions and Assertions , Types of testing – Black-box and Glass-box ,Debugging ,Handling Exceptions, Assertions.

UNIT-III

Classes and Object-Oriented Programming, Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Generators

UNIT-III

Simple Algorithms and Data structures, Search Algorithms, Sorting Algorithms.
Applications: Basics of probability and plotting in Python.

Text Book

1. John V Guttag. “Introduction to Computation and Programming Using Python – With application to Understanding Data” 2nd Edition,MIT Press, Prentice Hall of India

Reference Books:

1. R. Nageswara Rao, “Core Python Programming”, dreamtech
2. Wesley J. Chun. “Core Python Programming - Second Edition”, Prentice Hall
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Pyhon”, Wiley
4. Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication
5. Luke Sneeringer, “Professional Python”, Wrox
6. Jason R Brigs, Python for kids – a playful introduction to programming, No Starch Press

Lab-I(Using Python): - PROGRAMMING LABORATORY - I (PYTHON)

Course No: M-516 **Credits-2**

Objective:

These practicals augment to the theory course taught in PYTHON programming to enhance the numerical skills.

Expected Outcome:

1. To learn to write codes using basics of Python programming

2. To write code for problems from calculus ,linear Algebra and Numerical analysis .

NOTE:Though any distribution of Python 3 software can be used for practical sessions, to avoid difficulty in getting and installing required modules like numpy, scipy etc, and for uniformity, the Python 3 package Anaconda 2018.x (https://www.anaconda.com/distribution/#downloadsection) may be installed and used for the practical sessions. However, a brief introduction on how to use Python IDLE 3 also should be given.

1. Finding the limit of functions,
2. Finding the derivative of functions, higher-order derivatives
3. Finding the maxima and minima
4. Finding the integrals of functions.
5. Verify the continuity of a function at a point
6. Find Area between two curves
7. Finding the length of a curve.
8. Polynomial Interpolation by Lagrange's Method, Newton's Method
9. Find Roots of Equations by Method of Bisection and Newton-Raphson Method
10. Gauss Elimination Method (excluding Multiple Sets of Equations),
11. Doolittle's Decomposition Method only from LU Decomposition Methods
12. Numerical Integration
13. By Newton-Cotes Formulas
14. Trapezoidal rule,
15. Simpson's rule and Simpson's 3/8 rule

A practical record book should be maintained by the students.

PROGRAMMING LAB-II (MATLAB)

Course No: M-526 **Credit-2**

Objective:

These practicals add to their undergraduate training of writing MATLAB CODES for various Mathematical problems

Expected Outcome:

1. To learn to write codes using basics of MATLAB
2. To write code for problems from calculus and series sums.
3. To Write MATLAB codes for problems linear Algebra
4. To write MATLAB code for finding roots of equations, for problems in Numerical analysis .

List

GROUPA

1.Write MATLAB code to find a root of the equation $x^3-5x+1 = 0$ by using Bisection method.

2. Write MATLAB code to find the solution of a nonlinear equation $\tan(\pi-x)-x = 0$ by using Bisection method.

3. Using Bisection method find the roots of the following equation taking up to 50 iteration. $X^2 + 2x-2 = 0$.

4. Write MATLAB code to find a root of the equation $x^3 -5x + 1 = 0$ by using Secant method.

5. Write MATLAB code to find a root of equation $\sin x = e^x - 5$ by using Newton-Raphson method.

6. Write MATLAB code to find a root of the equation $\cos x-xe^x = 0$ by using Newton Raphson method.

7. Write MATLAB code to find a root of the equation $x^3 - 5x + 1 = 0$ by using Regula-Falsi Method.

8. Write MATLAB code to find a root of the equation $\cos x - xe^x = 0$ by using Regula-Falsi Method.

9. Write MATLAB code to find the approximate value of $\int_0^{\frac{\pi}{2}} \boldsymbol{sinxdx}$ by using the trapezoidal rule. Also compute the error.

10. Write MATLAB code to find the approximate value of $\int_0^1 \boldsymbol{e^{-x}dx}$ by using the trapezoidal rule. Also compute the error.

11. Write MATLAB code to find the approximate value of $\int_0^1 \frac{1}{1+x}\boldsymbol{dx}$ by using Simpson's 1/3rd Rule.

12. Write MATLAB code to find the approximate value of $\int_0^1 \frac{1}{1+x}\boldsymbol{dx}$ by using Simpson's 3/8 Rule.

13. Write MATLAB code to find the solution of the system of equations : $4x_1 +x_2 +x_3 = 2$; $X_1 + 5x_2+2x_3 = -6$; $x_1+2x_2+3x_3 = -4$ by using Gauss-Jacobi iteration method with $[0.5,-0.5,-0.5]^T$.

14. Write MATLAB code to find the solution of the system of equations $4x_1 + x_2 + x_3 = 2$; $X_1 + 5x_2 + 2x_3 = -6$; $x_1 + 2x_2 + 3x_3 = -4$ by using Gauss-Seidal iteration method.

15. Write MATLAB code to find the solution of the system of equations $x_1-2x_2+ x_3 = 0$;

$2x_1 + x_2 - 3x_3 = 5$; $4x_1 - 7x_2 + x_3 = -1$ by using Gauss elimination method.

16. Write MATLAB code to find the value of a function f at 2.2 using Lagrange interpolation method, where f(0) = 1, f(1) = 3 and f(3) = 55.
17. Write MATLAB code to find the value of a function f at 13 using Lagrange interpolation method, where f(5) = 12, f(6) = 13, f(9) = 14 and f(11) = 16.

GROUP B

1. Write MATLAB code to plot y = sin(1/x) and y = sinx + cosx on a single figure window.
2. Write a MATLAB program to plot y = cos(1/x) and y = sin2x−cos(x/2) on a single figure window.
3. Write a MATLAB program to plot y = sin(1/x) and $y = x^2 + expx$ on a single figure window.

4. Write MATLAB code to Sketch the parametric curve Trochoid, cycloid and epicycloid.
5. Write MATLAB code to Sketch Ellipsoid, Hyperboloid and sphere of radius 2.
6. Write MATLAB code to the parametric curve Trochoid, cycloid and epicycloid.
7. Write MATLAB code to Sketch Ellipsoid, Hyperboloid and sphere of radius 5.3.
8. Write a MATLAB code to plot surface of revolution around x-axis.
9. Write a MATLAB code to plot sin(4x−1), 1/(ax+b)and |−7x + 78|.
10. Write a MATLAB code to plot sin(ax + b), 1/(ax+b) and |ax + b|.
11. Write a MATLAB code to plot the surface $z= \frac{xy^2}{x^2+y^2}$ for $-1 \le x \le 3$ and $1 \le y \le 4$.
12. Write MATLAB code to plot a function f(x,y) = $\frac{xy}{x^2+y^2}$.
13. Write MATLAB code to plot the surface $z = \frac{xy(x^2-y)}{x^2+y^2}$ for $-3 \le x \le 3$ and $-3 \le y \le 3$.
14. Write MATLAB code to plot the surface $z = \frac{y^2(x^2-y^2)}{x^2+y^2}$ for $-2 \le x \le 2$ and $-2 \le y \le 2$.
15. Writa a MATLAB code to trace Parabola and Ellipse.
16. Write a program to find one-norm and two-norm of a given 3×3 Martix.
17. Write a program to find one-norm and two-norm of a given 5×5 Martix.
18. Write MATLAB code to plot the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ where a = b = 5 and c = 3.

Students are required to maintain practical records

PROGRAMMING LABORATORY - III (MATLAB)

Course No: M-534 **Credit -2**

Objective:

The aim of these pracicals is to strenghthen their knowledge of MATLAB by handling various Mathematical problems in real life and computing

Expected Outcome:

1. To be able to write codes using MATLAB for real life situations in mathematical modeling.
2. To write code for advanced problems from Matrix theory and linear Algebra
3. To Write MATLAB codes for advanced problems of differential equations and numerical Analysis

4. To write MATLAB code for linear programming problems

The student should be able to write MATLAB CODE for the following types of problems

GROUPA

1. Matrix Algebra:
   a. Matrix addition using function or pointer
   b. Matrix multiplication using function or pointer
   c. Matrix Inverse
2. Solution of System of linear equation by following method

a. Gauss Elimination Method

b. Gauss Seidal iteration Method

c. Gauss Jordan Elimination Method

3. Rank of a matrix
4. Determinant of a Matrix
5. Solution of System of linear equation by Crammers Rule
6. Eigen value and Eigen vector of a matrix
7. Differential Equations: Solution of Initial value problem using following methods :
   a. Euler's Method
   b. Backward Euler Method
   c. Eulere-Richardson's Method
   d. Second order Ranga-Kutta Method
   e. Milne's predictor corrector Method
   f. Gauss predictor corrector Method
8. Solution of boundary value problem.

10. Linear Programming Problem:

a. Solution of LPP by Simplex Method
b. Solution of LPP by Revised Simplex Method

11. Transportation Problem
12. Assignment Problem

GROUP-B

1. Write MATLAB code to evaluate $\int_{-5}^{0}\int_{0}^{5} 3x^2 + 5y^2\, dxdy$.
2. Write MATLAB code to evaluate $\int_{0}^{\frac{\pi}{4}}\int_{0}^{cosy} x^2\, sinydxdy$.
3. Write MATLAB code to generate the matrix A of dimension 5×5, whose entries are $(a_{i,j}) = i + j - 3$ and to calculate the trace of that matrix.
4. Write MATLAB code to plot the solution family of the second order differential equation $y'' + y = 0$ with initial condition y(0) = 0, $y'(0) = 1$ in the interval [0,10].
5. Write MATLAB code to plot the solution family of the third order differential equation $3y''' + 4y'' - 20y' + 25y = 0$ with initial condition y(0) = 0,$y'(0) = 1$.
6. Write MATLAB code to plot the solution of the differential equation for the lake pollution model dC/ dt = −RC with initial concentration of pollution C(0) = 3.97×103 parts per million and R = 0.053. Here C(t) denotes concentration level of pollution at time t and R = F/V, where F denotes the constant flow rate of fresh water into the lake and V denotes the volume of the lake.
7. Write MATLAB code to plot the solution of the exponential decay differential equation dN/dt = −kN with initial condition $n_0 = 15^5$ and k = 2.0.
8. Write MATLAB code to plot the solution of the differential equations dS/ dt = −βSI, dI/ dt = βSI−γI, dR /dt = γI of epidemic model of influenza, where the transmission coefficient parameter β = 2.18×10−3/ day and removal rate γ = 0.44 / day with initial conditions I(0) = 1 and S(0) = 762. Here S(t) denote number of susceptible persons, I(t) denotes number of infective persons and R(t) denotes number of recovered persons at time t.
9. Write MATLAB code to plot the solution of the differential equations dX/ dt = β_1 X − c_1 XY,dY/ dt = c_2 XY –α_2 Y of predator-prey model, where $\beta_1 = 1$,$\alpha_2 = 0.5$, $C_1 = 0.01$,$c_2 = 0.005$ with initial population $x_0 = 200$, $y_0 = 80$. Here X denotes number of prey per unit area and Y denotes number of predators per unit area.
10. Verify the convergence of the sequence $S_n = (1 + \sqrt{n})^{n^{\frac{3}{2}}}$ by plotting the members of the sequence and compare it with Cauchy root test.
11. Write MATLAB code to plot the 50 terms in the sequence defined recursively by $a_n = \frac{1}{2}(1 + a_{n-1})$with $a_1 = 0$.
12. Write MATLAB code to study the convergence/ divergence of the infinite series $\sum_{k=0}^{\infty} \frac{1}{2^{k+1}}$ by plotting the required number of terms of the sequence of its partial sums.
13. Consider the sequence $a_n = (-1)^n$. Verify Bolzano Weierstrass theorem by plotting the sequence and identify a convergent subsequence for the plot.
14. Write MATLAB code to find the addition, multiplication, inverse and transpose of a matrix.
15. Write MATLAB code to generate 4×4 matrix and find the eigenvalues and eigenvectors of the same.

Students are required to maintain practical records

PROBABILITY and MODELLING

Course No: M-542 **Credits-4**

Objective:

1,To introduce probability concepts using measure theory.

2.To illustrate basics of various random processes such as Markov Chains,Poisson processes, renewal processes and Brownian motion etc for application

Expected Outcomes:

After taking this course the students will be able to understand various applications of stochastic processes in Mathematical finance, physical sciences, communication engineering and computer science.This will also
add to their knowledge in analytics.

Unit-I

Basics of Measure theory, σ fields,Borel fields. Probability measure and Probability space,Sample space, Probability axioms,Independence of events.Bayes' theorem, measurable functions,Random variables,Discrete and continuous random variables, Examples, probability Distribution and density functions, Joint distribution functions,integration thory,Expectation of a random variable, properties, variance, covariance Markov inequality,Chebyshev inequality, Jensen and Holder Inequalities,Borel cantelli Lemma

Unit-II

Independence,Kolmogorov 0-1 Law,Convergence of a sequence of random variables, Types of convergence, Convergence in probability, Almost sure convergence, convergence in mean, Conditional probability,Conditional expectation, Moment generating functions.Conditional distribution, weak law of large numbers,strong law of large numbers, Characteristic function and its properties,Central limit theorems

Unit-III

Definition, examples and classification of random(stochastic) processes according to state space and parameter space. Stationary Processes: Weakly stationary and strongly stationary processes, Discrete-time Markov Chains, Transition probability matrix, Chapman- Kolmogorov equations; n-step transition and limiting probabilities, ergodicity, stationary distribution,random walk and gambler's ruin problem, Continuous-time Markov Chains, birth-death processes, Branching Processes

Unit-IV

Counting processes,Poisson and exponential processes, Renewal Processes: Renewal function and its properties, renewal theorems, Brownian Motion, Wiener process as a limit of random walk; definition and examples of martingales, ,spectral representation of random processes, auto correlation process, Cross Correlations, Power Spectral Density, Gaussian Processes ,White Noise, applications in finance and communication engineering.

Books for reference

1. Ross S.M.: Introduction to probability models, 11th edition,Elsevier, 2014.
2. Papoulis A.: Probability,Random variables and stochastic processes ThirdEdition Mc Graw Hill
3. Billingsley P: Probability and measure Third edition Wiley India 2008
4. Ross S M: A First Course in probability 4th edition,Prentice Hall,
5. Chow Y. and Teicher H: Probability Theory Springer Intrnational Edition
6. S Karlin and H M Taylor:A First Course in Stochastic Processes, Academic press
7. J. Medhi:Stochastic Processes, 3rd Edition, New Age International, 2009.

MASTER OF SOCIAL WORK

Non-credit Optional Course (IT in Social Sector)

Introduction

This course is about basic of computer and communication technology and its application in different social sectors.

Objectives

- To create awareness of ICT technology
- Application of the learned skills in the field of development in social sectors

Unit-I: Basic Computer Organization: Components, Memory, Operating system, Computer Languages, Assembly, High level, Software.

Unit-II: Application of Software Packages: Word processing, Spreadsheet, Presentation.

Unit-III: Basic of Internet and Application: LAN, WAN concept, WWW, Internet applications, e-learning.

Unit-IV: IT in Social Sector: IT in Municipality, IT in Villages, IT in GOVT offices, IT in Education, IT in Health care, IT in Social services, IT in Community development.

Recommended Books:

Subhash Bhatnagar. 2004. *E-government From Vision to Implementation*. New Delhi: Sage

Sinha, P.K. and Priti Sinha. 2003. *Computer Fundamentals*. BPB.

V Gupta. 2006. *Comdex Computer Course Kit*. Dreamtech.

Non-credit Course-I: (Community Intervention and Entrepreneurship Development)

Introduction

This course aims to expose the learners to view entrepreneurship as a desirable and feasible career option; in particular the paper seeks to build the necessary competencies and motivation for a career in entrepreneurship in developing countries with special reference to India.

Objectives

- Expose the students to the managerial aspect of new enterprise
- Motivating learners to become entrepreneurship
- create sustainable livelihood options and contribute to social development
- Involving them in the process of innovation, adaptation and learning to give a new dimension to livelihood conditions of people.

Unit-I: Entrepreneurship: General introduction to entrepreneurship, theories & concepts, Entrepreneurship and entrepreneurs: early thought and recent concerns the innovative activity Entrepreneurs and managers.

Unit-II: Entrepreneurship in India: Opportunities and challenges Entrepreneurship: Indian Experience, Micro Enterprises, policy and programmes Managerial Process and Issues in Enterprise Development.

Unit-III: Entrepreneurship: Innovation and development: Business opportunity

Unit-IV: Project Formulation: Development and presentation.
Panel Discussion: Challenges of Entrepreneurship

Non-credit Course (Disaster Preparedness and Management)

Introduction

This course provides the learner an understanding of the process of disaster-management.

Objectives

- Develop skills to analyse factors contributing to disaster.
- Develop an understanding of the process of disaster-management.
- Develop skills to participate in disaster management.
- Develop an understanding of the social worker's role in the team for disaster-management.

Unit I: Disaster: Meaning, Definition, Global trends of disaster, Disaster and development. Hazard and disaster, Vulnerability and Risk.

Unit-II: Types of disaster: Natural- famine, drought, floods, cyclones and earthquakes, tsunami and land slide. Man-made disaster- riots, biological warfare, militancy.

Unit-III: Indian rural society and its vulnerability to disaster, Disaster preparedness, Preparedness plan. Disaster Management: Proactive strategies, Response to Disaster and Post-disaster rehabilitation, mitigation of negative effects.

Unit IV: Intervening parties: International agencies, Government organisation, voluntary organisation, local groups, community participation, Disaster management planning at village level. Role of social workers in disaster management.

Recommended Books:

Birnabaum, F et al.1973, *Crisis Intervention after Natural Disaster,* Social Case Work, 54 (9): 545-551.

Blaufard, H. and J. Levine.1972, "*Crisis Intervention in Earthquake*," Social Work, 17 (4)16-19

Chen, L. 1973, *Disaster in Bangladesh: Health Crisis in a Developing Nation*. New York: Oxford University Press.

Grossman, L. 1973, "*Train Crash: Social Work and Disaster Services," Social Work,* 18 (5)38-44

Gangrade, K.D and S. Dhadde.1973, *Challenge and Response*. Delhi: Rachna Publication.

Wolfenstien, M. 1977, *Disaster: A Psychological Essay*. New York: Aron Press.

Hoff, A. 1978, *People in Crisis: Understanding and Helping*. California: Addison Wesley Publishing Company.

Lindomann, E. 1944, "*Symptomology and Management of Acute Grief*," American Journal of Psychiatry, 101: 141-148

Shader, I. and Schwartz, A. 1966, *Management of Reaction to Disaster*.

Non-credit Course-I (Fundamentals of Medical Social Work)

Introduction

This course extends and elaborates the generalist Social Work approach to a special field practice. The purpose of this course is to introduce the students to the social worker's role in a variety of health care settings. Students will gain knowledge about health and disease, policies, programs and service delivery systems relevant to the health practice field and their roles and responsibilities.

Objectives

- Introduce and understand the various roles and functions of the social worker in health care settings.

- Begin to understand and use basic medical terminology and hospital sociology.

- Understand the theoretical perspectives and knowledge base of social work practice in health care settings as they apply to generalist problem solving skills.
- Gain knowledge of resources and services particularly in the rural area, to be utilized by consumers and medical social workers
- Understand the historical and current policy context as it shapes health care and the role of the social worker
- Integrate knowledge of the meaning of illness, disability and loss for patients and families with general clinical understanding of human behaviour and thelife cycle to form a base of social work practice in health care settings.
- Understand ethical dilemmas related to health care.
- Understand holistic health care needs as it relates to diverse cultures and at risk populations.

Unit-I: Concept of Health and Disease: Dimensions, Determinants and Indicators of Health, Natural History of Disease, Concept of Control and Prevention, Dynamics of Disease transmission, common Communicable diseases and Non Communicable diseases.

Unit-II: Hospital Sociology: Social structure and functions of Hospital, Functions of Physician, Staffs in the Hospital, Doctor-patient relationship, Patient's rights and duties, Common problems in hospital and possible solutions, Community participation in hospital management.

Unit-III: Health Care Delivery System in India: Levels of Health Care, Health Care Delivery System in India, Voluntary Health Agencies, National Health programs and policies, Public –Private Partnership,

Unit-IV: Social Work Practice in Health Care Setting: The Changing Face of Health Care Social Work, Functions of medical social worker, Standards, Values, and Ethics in Clinical Health. Considerations & Methods for Health Care Social Workers, Documentation & Record-Keeping in the Health Care Setting.

Recommended Books

Dhooper, S.S. 1997. Social *Work in Health Care in the 21st Century*. Thousand Oaks, CA: Sage

Dziegielewski, S. F. 2004. *The Changing Face of Health Care Social Work: Professional Practice in Managed Behavioral Health Care*. New York: Springer.

Hasan, K.A. 1967. *The Cultural Frontiers of Health in Village India*. Bombay: Manaktalas.

Kishore, J. 2007. *National Health Program: National Policies and Legislations Related to Health* (revised edition). New Delhi: Century Publications.

____. 2005. *A Text Book of Health for Health Workers* (revised edition). New Delhi: Century Publications.

Lynch, V. (ed.) 2000. *HIV/AIDS at Year 2000: A Sourcebook for Social Workers*. Boston: Allyn & Bacon

Park, K. 2006. *Park's Text Book of Preventive and Social Medicine* (18th ed.) Jabalpur: Banarasidas Bhanot Publishers.

Rothman, J. & J.S. Sager 1998. *Case Management: Integrating Individual and Community Practice (*2nd ed.). Boston: Allyn & Bacon

MSW 523 – (Poverty Reduction and Livelihood Promotion)

Introduction

The course will introduce the concept livelihood and analyze the various polices of livelihood in rural context. It will critically examine the impact of macro-economy and current political trends on rural livelihood.

Objectives

- Overview of concept of livelihood/rural livelihood, Policy
- Neo classical model and principal –agency paradigm.
- Understand Macro-economic/political trends and implication for/impact on rural livelihood, people wise, sector wise

Unit-I: Concept of Poverty and Poverty line, Causes and Implications of poverty, Programmes and policies for poverty alleviation: Targeted poverty alleviation programmes, Institutional interventions, Social mobilization, empowerment and poverty alleviation.

Unit-II: Livelihood analysis: portfolio, magnitude and sustainability, Sub-sector analysis and Livelihood promotion - a strategic exercise at micro level, Formulating livelihood intervention measures: On-farm, Off-farm and Non-farm sectors, Delineating micro credit and micro enterprise as promotional tools for livelihood

Unit-III: Micro-credit: Definition, objectives and social implication. Self-Help groups (SHG), The Grameen Bank in Bangladesh, Case studies of Co - operative and producer companies

Unit-IV: Institutional credit and NABARD, Micro-finance for rural entrepreneurs: issues and strategies, Narasimham Committee, 1991 and Gupta Committee, 1998, Livelihood displacement and effective rehabilitation strategy,

Recommended Books

Chambers, Robert. *Beyond Farmers First*
DFID Manual on Livelihood
Mahajan, Vijaya and Asok Sing. *Forgotten Sector*.
Sen, Amartya. *Inequity Examined*
Sing, Kartar. *Rural Livelihood*.
Kapila, Uma., *Indian Economy*. New Delhi: Academic Foundation.
Dutta and Sunderram, *Indian Economy*. New Delhi: S. Chand Publication.
Mishra and Puri, *Indian Economy*.
Annual Report, Ministry of Rural Development. New Delhi.
R.Radhakrishna and S. Ray, *Handbook of Poverty- Perspectives, Policies and Programmes,* Oxford University Press.
Aurora, *Poverty & Economic reforms: Social concerns.*
Rural Poverty Report, 2001

MA Odia

DETAILED SYLLABUS SEMESTER-I

ORC-411 – ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ (ପ୍ରାଚୀନ, ସାରଳା, ପଞ୍ଚସଖା ଓ ରୀତିଯୁଗ)

(i) ପ୍ରାକ୍ ସାରଳା ସାହିତ୍ୟ, ସାରଳା ଯୁଗ

(ii) ପଞ୍ଚସଖା ଯୁଗ, ପ୍ରାକ୍ ରୀତିଯୁଗ

(iii) ରୀତିଯୁଗର ପୃଷ୍ଠଭୂମି, ରୀତିକାବ୍ୟର ସ୍ୱରୂପ

(iv) ଭକ୍ତ ଓ ସମସାମୟିକ କାବ୍ୟଧାରା, [illegible]

ORC-412 – ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ (ଆଧୁନିକ ରାଧାନାଥ ଯୁଗରୁ ସାମ୍ପ୍ରତିକ କାଳ ପର୍ଯ୍ୟନ୍ତ)

(i) ଆଧୁନିକ ସାହିତ୍ୟର ପୃଷ୍ଠଭୂମି ଓ ରାଧାନାଥ ଯୁଗ

(ii) ସତ୍ୟବାଦୀ, ସବୁଜ ଓ ପ୍ରଗତିବାଦୀ ଓଡ଼ିଆ ସାହିତ୍ୟ

(iii) ସ୍ୱାଧୀନତା ପରବର୍ତ୍ତୀ ଓଡ଼ିଆ ଗଦ୍ୟ ସାହିତ୍ୟର ସ୍ୱରୂପ

(iv) ସାମ୍ପ୍ରତିକ ଓଡ଼ିଆ ପଦ୍ୟ ସାହିତ୍ୟର ସ୍ୱରୂପ

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ – ଡ. ମାୟାଧର ମାନସିଂହ
୨) ଓଡ଼ିଆ ସାହିତ୍ୟର କ୍ରମପରିଣାମ (୧ମ, ୨ୟ) – [illegible]
୩) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ (ଆଦି ଓ ମଧ୍ୟଯୁଗ) – [illegible]
୪) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ (୧ମ, ୨ୟ, ୩ୟ, ୪ର୍ଥ) – ପଣ୍ଡିତ ସୂର୍ଯ୍ୟନାରାୟଣ ଦାଶ
୫) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ (୧ମ, ୨ୟ, ୩ୟ) – ଡ. [illegible]
୬) ଓଡ଼ିଆ ସାହିତ୍ୟର ଉନ୍ମେଷ ଓ ବିକାଶ (୧ମ, ୨ୟ, ୩ୟ) – ଡ. [illegible]
୭) ଓଡ଼ିଆ ସାହିତ୍ୟର ସଂକ୍ଷିପ୍ତ ପରିଚୟ – [illegible]
୮) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ – ଡ. କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ
୯) ଓଡ଼ିଆ ରୀତିସାହିତ୍ୟ : ପରମ୍ପରା ଓ ପ୍ରୟୋଗଦୃଷ୍ଟି – ଡ. କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ
୧୦) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ – ଡ. ସୁରେନ୍ଦ୍ର ମହାନ୍ତି
୧୧) ଓଡ଼ିଆ ସାହିତ୍ୟର ଇତିହାସ – ଡ. ବଉରୀବନ୍ଧୁ କର
୧୨) ଇଂରାଜୀ ସାହିତ୍ୟର ଇତିହାସ – ଶ୍ୟାମସୁନ୍ଦର ମହାପାତ୍ର
୧୩) କବିତା-୧୯୬୨ (ଭୂମିକା) – ସଚ୍ଚିଦାନନ୍ଦ ରାଉତରାୟ
୧୪) ସବୁଜରୁ ସାମ୍ପ୍ରତିକ – ଡ. ନିତ୍ୟାନନ୍ଦ ଶତପଥୀ
୧୫) ସବୁଜରୁ ସହସ୍ରାବ୍ଦୀ – ଡ. ନିତ୍ୟାନନ୍ଦ ଶତପଥୀ
୧୬) ଓଡ଼ିଆ ସାହିତ୍ୟ ପରିକ୍ରମା – ଡ. ଜାନକୀବଲ୍ଲଭ ମହାନ୍ତି
୧୭) ସାମ୍ପ୍ରତିକ ଓଡ଼ିଆ ସାହିତ୍ୟ – ସାରଳା ସାହିତ୍ୟ ସଂସଦ
୧୮) ଆଧୁନିକ ଓଡ଼ିଆ ସାହିତ୍ୟର ଭୂମି ଓ ଭୂମିକା – ଡ. ବୈଷ୍ଣବ ଚରଣ ସାମଲ
୧୯) ଉତ୍ତର ଆଧୁନିକତା : ଏକ ପରିଚିତି – ଡ. ଦେବୀପ୍ରସନ୍ନ ପଟ୍ଟନାୟକ, କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ
୨୦) ଓଡ଼ିଆ କ୍ଷୁଦ୍ରଗଳ୍ପର ଇତିହାସ (୧ମ ଓ ୨ୟ) – ଡ. [illegible]
୨୧) ଓଡ଼ିଆ ଉପନ୍ୟାସର ଇତିବୃତ୍ତ – ଡ. [illegible] ନାୟକ
୨୨) ଓଡ଼ିଆ ପ୍ରବନ୍ଧ ଓ ସମାଲୋଚନା ସାହିତ୍ୟର ପରିଚୟ – ଡ. ପଠାଣି ପଟ୍ଟନାୟକ

ORC-413 –

(i) ଚର୍ଯ୍ୟାଗୀତିକା : କାହ୍ନୁପାଦ – [illegible]

କୁକ୍କୁରୀପାଦ – [illegible] ଚର୍ଯ୍ୟା

କଳସା ଚଉତିଶା – ବତ୍ସା ଦାସ

[illegible] ଉପାଖ୍ୟାନ – ସାରଳା ଦାସ

କେଶବ କୋଇଲି – ମାର୍କଣ୍ଡ ଦାସ

ଭାଗବତ – ଏକାଦଶ ସ୍କନ୍ଧ – ଜଗନ୍ନାଥ ଦାସ ([illegible]) – [illegible]

(ii) ପ୍ରେମସୁଧାନିଧି ([illegible]) – ଉପେନ୍ଦ୍ର ଭଞ୍ଜ

ରସକଲ୍ଲୋଳ (୧-୪ ଛାନ୍ଦ) – ଦୀନକୃଷ୍ଣ ଦାସ

ବିଦଗ୍ଧ ଚିନ୍ତାମଣି (ପ୍ରଥମ ଛାନ୍ଦ) – ଅଭିମନ୍ୟୁ ସାମନ୍ତସିଂହାର

(iii) ଆହେ ନୀଳ ଶଇଳ – ସାଲବେଗ

କିଶୋରଚନ୍ଦ୍ରାନନ୍ଦ ଚମ୍ପୂ (ପ୍ରଥମ ପାଞ୍ଚ) – ବଳଦେବ ରଥ

ଜଗନ୍ନାଥ ଥରେ ଚାହିଁ ମାଗୁନାହିଁ ତତେ - ବନମାଳୀ
ଚନ୍ଦ୍ରଭାଗରୁ ପାସୋରିନା - ଗୋପାଳକୃଷ୍ଣ
(iv) ମାଦଳାପାଞ୍ଜି (ଅନଙ୍ଗଭୀମଦେବ) - ପ୍ରାଚୀନ ଗଦ୍ୟପଦ୍ୟାଦର୍ଶ
ରୁଦ୍ରସୁଧାନିଧି
ଚତୁର ବିନୋଦ - [illegible]

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ଆଶ୍ଚର୍ଯ୍ୟ ଚର୍ଯ୍ୟାଚୟ - କରୁଣାକର କର
୨) ଚର୍ଯ୍ୟାଗୀତିକା - ଖଗେଶ୍ୱର ମହାପାତ୍ର
୩) ପ୍ରାଚୀନ ଓଡ଼ିଆ ଗଦ୍ୟ-ସାହିତ୍ୟର ସ୍ୱରୂପ - କୁଞ୍ଜ ବିହାରୀ ତ୍ରିପାଠୀ
୪) କବିସୂର୍ଯ୍ୟ କାବ୍ୟବିଚାର - ଦାଶରଥି ଦାସ
୫) ଲଳିତ ଲୁହର ଭାରତୀରେ - ଅଶୋକ କୁମାର ଦାସ
୬) ଭଞ୍ଜୀୟ କାବ୍ୟ ଭାବନା - ବେଣୀମାଧବ ପାଢ଼ୀ
୭) ବୈଷ୍ଣବରେ ଭଞ୍ଜ - ପ୍ରସନ୍ନ କୁମାର ପଟ୍ଟନାୟକ
୮) ଉପେନ୍ଦ୍ର ଭଞ୍ଜଙ୍କ ସମୀକ୍ଷା - ଜୟକୃଷ୍ଣ ମିଶ୍ର
୯) ଚଉତିଶା ସାହିତ୍ୟ ସମ୍ଭାର - ନଟବର ସାମନ୍ତରାୟ
୧୦) କିଶୋର ଚନ୍ଦ୍ରାନନ୍ଦ ଚମ୍ପୂ - ଡ. କୃଷ୍ଣଚରଣ ବେହେରା
୧୧) ଶ୍ରୀ ଜଗନ୍ନାଥ ପଦ୍ୟାବଳୀ (୧-୪) - ଡ. କ୍ଷେତ୍ରବାସୀ ନାୟକ
୧୨) ଦୃଷ୍ଟି ସୃଷ୍ଟି ଓ ସମୀକ୍ଷା - [illegible] ମୁଦୁଲି
୧୩) ଜାତିର ମହାଶକ୍ତି ସରଳା ଦାସ - ମାୟାଧର ମାନସିଂହ
୧୪) ଅଭିନବ କାବ୍ୟ-ଚର୍ଯ୍ୟା - [illegible] ସାହିତ୍ୟ ସଂସଦ

ORC-414 – ଆଧୁନିକ ଓଡ଼ିଆ କାବ୍ୟ-କବିତା (ପ୍ରଥମ ପର୍ବ)

(i) ଆଧୁନିକତା ଓ ଓଡ଼ିଆ ଆଧୁନିକ ସାହିତ୍ୟ
ଆଧୁନିକ ଓଡ଼ିଆ କାବ୍ୟ-ସାହିତ୍ୟର ଧାରା

(ii) ମହାଯାତ୍ରା - (ପ୍ରଥମ ସର୍ଗ) - ରାଧାନାଥ ରାୟ
[illegible] - ମଧୁସୂଦନ ରାଓ
ପ୍ରଭାତ ଅବସାନ - ନନ୍ଦକିଶୋର ବଳ
[illegible] - [illegible]

(iii) [illegible] - ଗଙ୍ଗାଧର ମେହେର
ଅମୃତମୟ - ଗଙ୍ଗାଧର ମେହେର

(iv) ଦୁଃଖମୋଚନ - ଗୋଦାବରୀଶ ମିଶ୍ର
ଶେଫାଳି ପ୍ରତି - କୁନ୍ତଳ କୁମାରୀ ସାବତ
ଯାତ୍ରା ସଙ୍ଗୀତ - ବୈକୁଣ୍ଠନାଥ ପଟ୍ଟନାୟକ
ଛଳାବୃତ୍ତ - ବିନୋଦ ଚନ୍ଦ୍ର ନାୟକ
ଝରଣେ ଶୁଣ - ଅନନ୍ତ ପଟ୍ଟନାୟକ

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ଆଧୁନିକ ଓଡ଼ିଆ କାବ୍ୟଧାରା (୧ମ ଓ ୨ୟ) - ନିତ୍ୟାନନ୍ଦ [illegible]
୨) ମେହେର ସାହିତ୍ୟ - କେଶବ ଚନ୍ଦ୍ର ମେହେର
୩) ସାହିତ୍ୟ ସମୀକ୍ଷା - ଗୋବିନ୍ଦ ଚନ୍ଦ୍ର ଉଦ୍‌ଗାତା
୪) ଯୁଗପ୍ରବର୍ତ୍ତକ କବି ରାଧାନାଥ - ନଟବର ସାମନ୍ତରାୟ
୫) ଯୁଗଜ୍ୟୋତି ରାଧାନାଥ - ଦେବେନ୍ଦ୍ର ମହାନ୍ତି
୬) ସତ୍ୟବାଦୀ ଯୁଗ - ବୃନ୍ଦାବନ ଚନ୍ଦ୍ର ଆଚାର୍ଯ୍ୟ
୭) ଗୋପବନ୍ଧୁ ସାହିତ୍ୟ ଓ ଜୀବନ ଦର୍ଶନ - ଗୋପାଳ ଚନ୍ଦ୍ର ମିଶ୍ର
୮) ଆଧୁନିକ ଓଡ଼ିଆ କବିତାରେ ଶାଶ୍ୱତ ଚିନ୍ତାଧାରା - ପ୍ରସନ୍ନ କୁମାର ପଟ୍ଟନାୟକ
୯) ସୌନ୍ଦର୍ଯ୍ୟତତ୍ତ୍ୱ ଓ ଓଡ଼ିଆ କାବ୍ୟରେ ସୌନ୍ଦର୍ଯ୍ୟ ଚେତନା - ବୈରାଗୀ ଚରଣ ଜେନା
୧୦) ଆଧୁନିକତାର ସନ୍ଧାନ - ହରପ୍ରସାଦ ଦାସ
୧୧) ସବୁଜରୁ ସାମ୍ପ୍ରତିକ - ନିତ୍ୟାନନ୍ଦ ଶତପଥୀ
୧୨) କଳ୍ପନା ଓ ଅଭିକ୍ଷେପ - ପ୍ରତିଭା ଶତପଥୀ
୧୩) ମୋ ଦୃଷ୍ଟିରେ ସାମ୍ପ୍ରତିକ ସାହିତ୍ୟ - ଡ. ପରୀକ୍ଷିତ ନନ୍ଦ

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୧୪) ଓଡ଼ିଆ ସାହିତ୍ୟରେ ପ୍ରଗତିବାଦୀ ଧାରା – ବିଜୟ କୁମାର ଶତପଥୀ
୧୫) କାବ୍ୟଶିଳ୍ପୀ ଗଙ୍ଗାଧର – ଗୋବିନ୍ଦ ଚନ୍ଦ୍ର ଉଦ୍‌ଗାତା
୧୬) ଗଙ୍ଗାଧର : କବିତା ଓ କବିଆତ୍ମା – ଦେବେନ୍ଦ୍ର କୁମାର ଦାଶ
୧୭) ମଧୁସୃଷ୍ଟି : ଅମୂର୍ତ୍ତ ଦୃଷ୍ଟି – ଶରତ ଚନ୍ଦ୍ର ପ୍ରଧାନ
୧୮) ଓଡ଼ିଆ ଗାଥା କାବ୍ୟ – ରବୀନ୍ଦ୍ର କୁମାର ପ୍ରହରାଜ
୧୯) ଆଧୁନିକ କାବ୍ୟ ସାହିତ୍ୟରେ ପାଶ୍ଚାତ୍ୟ ପ୍ରଭାବ – କ୍ଷେତ୍ରବାସୀ ନାୟକ
୨୦) ଯୁଗଲଙ୍କ କବି ଗଙ୍ଗାଧର – କେଶବ ଚନ୍ଦ୍ର ମେହେର
୨୧) ସାହିତ୍ୟ ବୀକ୍ଷା ଓ ସମୀକ୍ଷା – ପ୍ରସନ୍ନ କୁମାର ସ୍ୱାଇଁ
୨୨) ବୈକୁଣ୍ଠନାଥ ଦୃଷ୍ଟି ସମୀକ୍ଷା – ଓଡ଼ିଶା ସାହିତ୍ୟ [illegible]

ORC-415 – ଓଡ଼ିଆ ନାଟକ ଓ ଏକାଙ୍କିକା

(i) ଓଡ଼ିଆ ନାଟକର ଉଦ୍‌ଭବ ଓ ବିକାଶ
(ii) ରକ୍ତମାଟି – କାଳୀଚରଣ ପଟ୍ଟନାୟକ
(iii) ନନ୍ଦିକା କେଶରୀ – ମନୋରଞ୍ଜନ ଦାସ
(iv) ଏକାଙ୍କିକା – ଗୁରୁ କୁଡ଼ିବାସ – ପ୍ରମୋଦ କୁମାର ତ୍ରିପାଠୀ
ସମୁଦ୍ର ମନ୍ଥନ – ଗୋପାଳ ଚନ୍ଦ୍ର ଛୋଟରାୟ
ଉତ୍ତୁଙ୍ଗ ପାହାଡ଼ର ଦର୍ପ – ରମେଶ ଚନ୍ଦ୍ର ପାଣିଗ୍ରାହୀ

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<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ନାଟ୍ୟଶାସ୍ତ୍ର – ଭରତ
୨) ନାଟକ ବିଚାର – ଗିରିଜା ଶଙ୍କର ରାୟ
୩) ଭାରତ ନାଟ୍ୟ ପରମ୍ପରା – ରତ୍ନାକର ଚଇନି
୪) ଓଡ଼ିଆ ନାଟ୍ୟ ସାହିତ୍ୟ – ସର୍ବେଶ୍ୱର ଦାସ
୫) ମଞ୍ଚଧାରା – କାଳୀଚରଣ ପଟ୍ଟନାୟକ
୬) ନାଟ୍ୟ ସାହିତ୍ୟ ପରିଚୟ – କୃଷ୍ଣଚରଣ ବେହେରା
୭) ଓଡ଼ିଆ ନାଟକ – ଡ. ଆତ୍ମପ୍ରଜ୍ଞ ମିନା, ବଲାଙ୍ଗିର
୮) ନାଟକ ତତ୍ତ୍ୱ ବିଚାର – ନାରାୟଣ ସାହୁ
୯) ଓଡ଼ିଆ ନାଟକର ଉଦ୍‌ଭବ ଓ ବିକାଶ – ହେମନ୍ତ କୁମାର ଦାସ
୧୦) ଓଡ଼ିଆ ନାଟକର ଉଦ୍‌ଭବ ଓ ବିକାଶ – ରତ୍ନାକର ଚଇନି
୧୧) ସ୍ୱାଧୀନତା ପରବର୍ତ୍ତୀ ଓଡ଼ିଆ ନାଟକ – ନାରାୟଣ ପ୍ରସାଦ [illegible]
୧୨) ମଞ୍ଚ ଓ ନାଟକର କଳା କୌଶଳ – ନାରାୟଣ ସାହୁ
୧୩) ସ୍ୱାଧୀନତା ପରବର୍ତ୍ତୀ ଓଡ଼ିଆ ନାଟକ – ନାରାୟଣ ସାହୁ
୧୪) ଉତ୍ତର ଆଧୁନିକ ଓଡ଼ିଆ ନାଟକ – ହେମନ୍ତ କୁମାର ଦାସ

<u>SEMESTER-II</u>

ORC-421 – ଓଡ଼ିଆ ଉପନ୍ୟାସ

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(i) ଉପନ୍ୟାସ ତତ୍ତ୍ୱ ଓ ଓଡ଼ିଆ ଉପନ୍ୟାସର ବିକାଶ
(ii) ମାମୁଁ – ଫକୀରମୋହନ ସେନାପତି
ନେତି ନେତି – ସୁରେନ୍ଦ୍ର ମହାନ୍ତି
ନୟନତାରା – ଦୟାନିଧି ମିଶ୍ର
(iii) ପରଜା – ଗୋପୀନାଥ ମହାନ୍ତି
(iv) ନରକିନ୍ନର – ଶାନ୍ତନୁ କୁମାର ଆଚାର୍ଯ୍ୟ

<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ଓଡ଼ିଆ ଉପନ୍ୟାସ ସାହିତ୍ୟର ପରିଚୟ – ଡ. ପଠାଣି ପଟ୍ଟନାୟକ
୨) କଥାକାର ସୁରେନ୍ଦ୍ର ମହାନ୍ତି – ପୀତାମ୍ବର ପ୍ରଧାନ
୩) ଦେଶ ଓ ଭାଷାର କାରିଗର ଫକୀର ମୋହନ – କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ
୪) ସରସ୍ୱତୀ ଫକୀର ମୋହନ – ମାୟାଧର ମାନସିଂହ
୫) ସରସ୍ୱତୀ ଫକୀର ମୋହନ : ସାହିତ୍ୟ ଓ ବ୍ୟକ୍ତିତ୍ୱ – ଗିରୀନ୍ଦ୍ର ମୋହନ ଦାଶ
୬) କୃତି ଓ କୀର୍ତ୍ତି – ବାଳକୃଷ୍ଣ ଶତପଥୀ

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୭) ନବ୍ୟଗୌରବ - ଅଭିଜିତ ସାହୁ
୮) ଅମୃତ ସନ୍ଧାନ - ଡ. ପ୍ରସନ୍ନ କୁମାର ବର୍ମା
୯) ଉପନ୍ୟାସ ପୃଥ୍ୱୀ ବିସ୍ତୃତିର ଦାଗ - ଦେବୀପ୍ରସନ୍ନ ପଟ୍ଟନାୟକ
୧୦) ଔପନ୍ୟାସିକ ଗୋପୀନାଥ - ଚନ୍ଦ୍ରକାନ୍ତ ଦାସ
୧୧) ଗୋପୀନାଥଙ୍କ ଉପନ୍ୟାସର ମଣିଷ କଥା - ରାଜକିଶୋର ଦାସ
୧୨) ଓଡ଼ିଆ ଉପନ୍ୟାସ ସାହିତ୍ୟ ଓ ପରମ୍ପରା - ଶରତ ଚନ୍ଦ୍ର ଦାସ

ORC-422 – ଓଡ଼ିଆ କ୍ଷୁଦ୍ରଗଳ୍ପ

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(i) କ୍ଷୁଦ୍ରଗଳ୍ପର ସଂଜ୍ଞା ଓ ସ୍ୱରୂପ, ଓଡ଼ିଆ କ୍ଷୁଦ୍ରଗଳ୍ପ
(ii) ମା'ଙ୍କର ବିଳାପ - କାଳିନ୍ଦୀ ଚରଣ ପାଣିଗ୍ରାହୀ
ମଶାଣିର ଫୁଲ - ସଚ୍ଚିଦାନନ୍ଦ ରାଉତରାୟ
ଅୟାପଲ୍ଲୀ - ସୁରେନ୍ଦ୍ର ମହାନ୍ତି
(iii) ସବୁଠାରୁ ଦୀର୍ଘ ରାତି - ଚନ୍ଦ୍ରଶେଖର ରଥ
ଦୃଶ୍ୟାନ୍ତରର ଘୋଡ଼ା - ମନୋଜ ଦାସ
~~[illegible]~~ ଆଲ୍‌ବମ୍‌ରେ ସେଦେବି ମୁହଁ - ଜଗଦୀଶ ମହାନ୍ତି
(iv) ଦର୍ପଣରେ ନିଜ ମୁହଁ - ପୂର୍ଣ୍ଣାନନ୍ଦ ଦାଣୀ
ଭୋକଯୁଦ୍ଧ - ରାମଚନ୍ଦ୍ର ବେହେରା
ରେଖାଚିତ୍ର - ହୃଷୀକେଶ ପଣ୍ଡା

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<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ଫକୀରମୋହନ ସମୀକ୍ଷା - ସୁରେନ୍ଦ୍ର ମହାନ୍ତି
୨) ସୁରେନ୍ଦ୍ର ସାହିତ୍ୟ ସମୀକ୍ଷା - ଡ. ପ୍ରକାଶ କୁମାର ପରିଡ଼ା, ଡ. ସନ୍ତୋଷ ଚନ୍ଦ୍ର ଦାସ
୩) କଥାଶିଳ୍ପୀ ସେନାପତିଙ୍କ ଦୃଷ୍ଟି ଓ ଦିଗ୍‌ବଳୟ - ବୈଷ୍ଣବ ଚରଣ ଶତପଥୀ
୪) ଓଡ଼ିଆ ଗଳ୍ପ ଉପନ୍ୟାସର ନବ ଦିଗନ୍ତ - ଅଭିରାମ ସାହୁ
୫) ଓଡ଼ିଆ କ୍ଷୁଦ୍ରଗଳ୍ପ: ଗତି ଓ ପ୍ରକୃତି - ବୈଷ୍ଣବ ଚରଣ ସାମଲ
୬) ଗଳ୍ପ ଓ ଗାଳ୍ପିକ - ନିତ୍ୟାନନ୍ଦ ଶତପଥୀ
୭) ଆମ କଥା ସାହିତ୍ୟର କଥା - ମହାପାତ୍ର ନୀଳମଣି ସାହୁ
୮) ଭଲ ଗଳ୍ପ: ଭୂମି ଓ ଭୂମିକା - ଡ. ଗୌରହରି ଦାସ
୯) ଗଳ୍ପ ବନାମ ଗଳ୍ପ - କଇଳାଶ ପଟ୍ଟନାୟକ

ORC-423 – ଆଧୁନିକ ଓଡ଼ିଆ କବିତା (ଦ୍ୱିତୀୟ ପର୍ବ)

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(i) କୋଣାର୍କ - ସଚ୍ଚିଦାନନ୍ଦ ରାଉତରାୟ
ଅଙ୍ଗୁଳି କପୋତ ମୋର - ଗୁରୁପ୍ରସାଦ ମହାନ୍ତି
କୋଣାର୍କ - ଭାନୁଜୀ ରାଓ - ନନ୍ଦ ଆଚାରୀ
(ii) ଚନ୍ଦ୍ରମାର ବୁଡ଼ି - ରମାକାନ୍ତ ରଥ
ଦୁର୍ଯ୍ୟୋଧନ - ସୀତାକାନ୍ତ ମହାପାତ୍ର
ଅରଣ୍ୟ ମଞ୍ଜରି - ଦୀପକ ମିଶ୍ର
(iii) ପିଙ୍ଗଳାର ସୂର୍ଯ୍ୟ - ବେଣୁଧର ରାଉତ
ଅନ୍ଧ ମହୁମାଛି - ସୌଭାଗ୍ୟ କୁମାର ମିଶ୍ର
ମଞ୍ଜିଷ୍ଠିର ମୃତ୍ୟୁ - ରାଜେନ୍ଦ୍ର କିଶୋର ପଣ୍ଡା ଜୀବନ ପ୍ରତି
(iv) ଅଥ ଭୂରିଶ୍ରବା - ଶରତ ଚନ୍ଦ୍ର ପ୍ରଧାନ କୋଲନି ପ୍ରାର୍ଥନା (ପୁସ୍ତକ: ଅପୁସ୍ତକ) - ନବୀନ ନାୟକ
ପର୍ଯ୍ୟଟକର ଶେଷ ସଙ୍ଗୀତ - ପ୍ରସନ୍ନ କୁମାର ମିଶ୍ର ଗଣିତ ମାଷ୍ଟ୍ରେ (ପୁସ୍ତକ: ଆରୁ ଗୁଁ ଗୁଁ ନହେଁ) - ପ୍ରବୀଣ କୁମାର ଗନ୍ତା
ଜୀବନ - ଗୋପାଳ ରଥ - ବିପୁଳ ଦିଗନ୍ତ

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<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ସାହିତ୍ୟ ବିଚାର ଓ ମୂଲ୍ୟବୋଧ - ସଚ୍ଚିଦାନନ୍ଦ ରାଉତରାୟ
୨) କାବ୍ୟ ଓ କଳାକାର - ଚିନ୍ତାମଣି ବେହେରା
୩) କାବ୍ୟ ଜିଜ୍ଞାସା: ଚିତ୍ରକଳ୍ପ - ଦାଶରଥି ଦାସ
୪) ସବୁଜରୁ ସାମ୍ପ୍ରତିକ - ନିତ୍ୟାନନ୍ଦ ଶତପଥୀ
୫) ସ୍ଥିତ ପୂର୍ବ - ଅପୂର୍ବ ପୃଥ୍ୱୀ - ଡ. କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ

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୬) କବିତାର କଥା - ଚିରିବଳା ମହାନ୍ତି
୭) କବି, କବିତା ଓ ତାର ପୃଷ୍ଠଭୂମି - ତାପସ ମିଶ୍ର
୮) ପାଠକୀୟ ମନ୍ତବ୍ୟ - କୁମୁଦ ରଞ୍ଜନ ପାଣିଗ୍ରାହୀ

ORC-424 – ଓଡ଼ିଆ ଗଦ୍ୟ ସାହିତ୍ୟ(୧)

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(i) ଓଡିଆ ପ୍ରବନ୍ଧ ସାହିତ୍ୟର ବିକାଶଧାରା
(ii) ସୌନ୍ଦର୍ଯ୍ୟ ଓ ପ୍ରେମ - ଶଶୀଭୂଷଣ ରାୟ
ମହାଶ୍ୱେତା - ବିଶ୍ୱନାଥ କର
ମନ୍ତବ୍ୟ ପ୍ରକାଶ - ଚନ୍ଦ୍ରାକର ପତି
(iii) ବାଇ ମହାନ୍ତି ପାଖି (ପଞ୍ଚମ ବିନ୍ଦା) - ଗୋପାଳ ଚନ୍ଦ୍ର ମୁହରାଜ
ତଟୁଆ - ଗୋବିନ୍ଦ ଚନ୍ଦ୍ର ତ୍ରିପାଠୀ
ତରଙ୍ଗ ଓ ତଡିତ - ଚିତ୍ତରଞ୍ଜନ ଦାସ
(iv) ଓଡିଆ ସମାଲୋଚନା ସାହିତ୍ୟର ବିକାଶଧାରା

SM

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ଆଧୁନିକ ଓଡିଆ ଗଦ୍ୟ ସାହିତ୍ୟ - ଶ୍ରୀନିବାସ ମିଶ୍ର
୨) ଆଧୁନିକ ଓଡିଆ ସାହିତ୍ୟ - ଜାନକୀ ବଲ୍ଲଭ ମହାନ୍ତି
୩) ଓଡିଆ ପ୍ରବନ୍ଧ ସାହିତ୍ୟର ଇତିହାସ - ଅସିତ କବି
୪) ଓଡିଆ ସାହିତ୍ୟ ସମାଲୋଚନାର ଇତିହାସ - ଅସିତ କବି
୫) ସମାଲୋଚନା ଏ ହିତ୍ୟ - ଓଡିଶା ସାହିତ୍ୟ ଏକାଡେମୀ
୬) ଓଡିଆ ପ୍ରବନ୍ଧ ଓ ସମାଲୋଚନା ସାହିତ୍ୟର ପରିଚୟ - ଡ. ଠାକୁର ପାଟ୍ଟନାୟକ

ORC-425 – ଓଡ଼ିଆ ଗଦ୍ୟ ସାହିତ୍ୟ(୨)

NH
(i) ଭ୍ରମଣ କାହାଣୀ, କାହାଣୀ ଓ ଆତ୍ମଜୀବନୀ :ସଂଜ୍ଞା ଓ ସ୍ୱରୂପ
(ii) ଲଣ୍ଠନ ଚିଠି - ଗୋଲକ ବିହାରୀ ଧଳ
(iii) ସଗଡ଼ତୀ ଫକୀର ମୋହନ - ମାୟାଧର ମାନସିଂହ
(iv) ଗାଁର ଡାକ - ଭୁବନେଶ୍ୱର ବେହେରା

NH

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ଚରିତ ସାହିତ୍ୟ - ଲାବଣ୍ୟ ନାୟକ
୨) ଓଡିଆ ଜୀବନୀ ସାହିତ୍ୟ - ପଠାଣି ପଟ୍ଟନାୟକ
୩) ସମୀକ୍ଷାଲୋକ - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ
୪) ଆଧୁନିକ ଓଡିଆ ସାହିତ୍ୟର ଭୂମି ଓ ଭୂମିକା - ଡ. ବୈକୁଣ୍ଠ ଚରଣ ସାମଲ

SEMESTER-III

ORC-511 – ପ୍ରାଚ୍ୟ ଓ ପାଶ୍ଚାତ୍ୟ ସାହିତ୍ୟ ତତ୍ତ୍ୱ

G.B.
(i) ରସ, ରୀତି, ଅଳଙ୍କାର
(ii) ଧ୍ୱନି, ବକ୍ରୋକ୍ତି, ଔଚିତ୍ୟ
(iii) ଶୈଳୀ ଓ ଶୈଳୀତତ୍ତ୍ୱ (Style & Stylistics)

SM.
ସୌନ୍ଦର୍ଯ୍ୟ ତତ୍ତ୍ୱ (Aesthetics)
ଧ୍ରୁପଦୀବାଦ (Classicism)
ସ୍ୱୈରବାଦ (Romanticism)
(iv) ଅସ୍ତିତ୍ୱବାଦ (Existentialism)
ପ୍ରତୀକବାଦ (Symbolism)
ଅତିବାସ୍ତବବାଦ (Surrealism)
ପ୍ରକୃତିବାଦ (Naturalism)

ସଂରଚନାବାଦ (structuralism)
ନାରୀବାଦ (Feminism)

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<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ଧ୍ୱନ୍ୟାଲୋକ - ଆନନ୍ଦ ବର୍ଦ୍ଧନ
୨) ସାହିତ୍ୟ ଦର୍ପଣ - ବିଶ୍ୱନାଥ କବିରାଜ
୩) ଅଳଙ୍କାର ପ୍ରସଙ୍ଗ - ଗୋବିନ୍ଦ ଚନ୍ଦ୍ର ଉଦ୍‌ଗାତା
୪) ଓଡ଼ିଆ ରୀତି ସାହିତ୍ୟ: ପରମ୍ପରା ଓ ପ୍ରଯୋଗ - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ
୫) ଅଳଙ୍କାର ଶାସ୍ତ୍ର ପ୍ରବେଶ - ଅଭିନ୍ନ ଚନ୍ଦ୍ର ଦାସ
୬) ଆରିଷ୍ଟଟଲଙ୍କ କାବ୍ୟତତ୍ତ୍ୱ - ଅନନ୍ତ ଚରଣ ଶୁକ୍ଳ
୭) ଅସ୍ତିତ୍ୱବାଦର ମର୍ମକଥା - ଶରତ କୁମାର ମହାନ୍ତି
୮) କିରକେଗାର୍ଡ ସାହିତ୍ୟରେ ଅସ୍ତିତ୍ୱବାଦ - ଆଦିକନ୍ଦ ସାହୁ
୯) ଧର୍ମ, ସାହିତ୍ୟ ଓ ସାହିତ୍ୟତତ୍ତ୍ୱ - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ
୧୦) କାବ୍ୟଜିଜ୍ଞାସା: ଚିତ୍ରକଳ୍ପ - ଦାଶରଥି ଦାସ
୧୧) ନନ୍ଦନ ତାତ୍ତ୍ୱିକ ପ୍ରବନ୍ଧାବଳୀ - ବୈରାଗୀ ଚରଣ ଜେନା
୧୨) କାବ୍ୟିକ ସୌନ୍ଦର୍ଯ୍ୟ - ଗିରିବାଳା ମହାନ୍ତି
୧୩) ଔପନିବେଶିକ ସାହିତ୍ୟ - ବିଭୂତି ପଟ୍ଟନାୟକ
୧୪) ସାହିତ୍ୟ ତତ୍ତ୍ୱ: ପ୍ରାଚ୍ୟ ଓ ପାଶ୍ଚାତ୍ୟ - ଜ୍ୟୋତ୍ସ୍ନାମୟୀ ପ୍ରଧାନ
୧୫) କାବ୍ୟ-କଳ୍ପ: ପ୍ରାଚ୍ୟ ପାଶ୍ଚାତ୍ୟ - ଅଭୟ ଚାଟିକ
୧୬) Theory of Literature – Rene Wellek & Austen Wamen
୧୭) Use of Poetry use of criticism – T.S. Eliot
୧୮) Literary Criticism – W.K. Wimsatit, I.R. Cleanth Brooks

ORC-512 – ସମାଲୋଚନା ଓ ଅନୁବାଦ ସାହିତ୍ୟ

N.H.
(i) ସାହିତ୍ୟ ସମାଲୋଚନାର ସ୍ୱରୂପ ଓ ପ୍ରକାରଭେଦ
(ii) ଓଡ଼ିଆ ସମାଲୋଚନାର ବିକାଶଧାରା କ୍ରମରେ ଆର୍ତ୍ତବଲ୍ଲଭ ମହାନ୍ତି, ନଟବର ସାମନ୍ତରାୟ, ଚିନ୍ତାମଣି ବେହେରା, ଦାଶରଥି ଦାସ ପ୍ରମୁଖ
(iii) ଅନୁବାଦ କଳା
(iv) ଓଡ଼ିଆ ଅନୁବାଦ ସାହିତ୍ୟର ବିକାଶ କ୍ରମରେ ଉଦୟନାଥ ଷଡ଼ଙ୍ଗୀ, ଲକ୍ଷ୍ମୀନାରାୟଣ ମହାନ୍ତି, ଯୁଗଳ କିଶୋର ଦତ୍ତ, ରାମ ଶଙ୍କର ପଣ୍ଡା, ଶ୍ରୀନିବାସ ଉଦ୍‌ଗାତା ପ୍ରମୁଖ

<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ସମାଲୋଚନା ସାହିତ୍ୟ - ସଂ. ଓଡ଼ିଶା ସାହିତ୍ୟ ଏକାଡେମୀ, ଭୁବନେଶ୍ୱର
୨) ଓଡ଼ିଆ ସାହିତ୍ୟ ସମାଲୋଚନାର ଇତିହାସ - ଅଜିତ କର
୩) ଗବେଷଣା ପ୍ରକରଣ: ସମ୍ପାଦନା ଓ ଅନୁବାଦ ପ୍ରବିଧି - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ ଓ ନିର୍ମଳା କୁମାରୀ ରାଉତ
୪) ଗବେଷଣା ପ୍ରବିଧି: ସମ୍ପାଦନା ଓ ଅନୁବାଦ କଳା - ସୁବୋଧ କୁମାର ଚାଟାର୍ଜୀ
୫) ଅନୁବାଦ ଓ ଅନୁବାଦ କଳା - ଶକୁନ୍ତଳା ବଳିଆରସିଂ
୬) ଅନୁବାଦ ତତ୍ତ୍ୱ ଓ ପ୍ରୟୋଗ - ସଂ. ମନୋରଞ୍ଜନ ପ୍ରଧାନ
୭) ସାହିତ୍ୟ ତତ୍ତ୍ୱ: ପ୍ରାଚ୍ୟ ଓ ପାଶ୍ଚାତ୍ୟ - ଜ୍ୟୋତ୍ସ୍ନାମୟୀ ପ୍ରଧାନ
୮) ଧର୍ମ, ସାହିତ୍ୟ ଓ ସାହିତ୍ୟ ତତ୍ତ୍ୱ - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ

ORC-513 – ଓଡ଼ିଆ ସମ୍ବାଦ ଓ ସାମ୍ବାଦିକତା

S.M.
(i) ଗଣମାଧ୍ୟମ ଓ ସାମ୍ବାଦିକତାର ବିକାଶଧାରା
(ii) ସମ୍ବାଦ ରଚନା ବିଧି

G.B.
(iii) ଲଘୁ ନିବନ୍ଧ ରଚନା ବିଧି
(iv) ରେଡ଼ିଓ ସାହିତ୍ୟ ଓ ଟେଲିଭିଜନ ଚିତ୍ରନାଟ୍ୟ ରଚନା ବିଧି

<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ଓଡ଼ିଶା ପ୍ରକାଶନ ଓ ପ୍ରସାରଣର ଇତିହାସ - ଶ୍ରୀଧର ମହାପାତ୍ର
୨) ସମ୍ବାଦପତ୍ର ଓ ସାମ୍ବାଦିକ - ଚନ୍ଦ୍ରଶେଖର ମହାପାତ୍ର ଓ ମିତା ଦେବତା
୩) ଓଡ଼ିଆ ସାମ୍ବାଦିକତାର କ୍ରମ ବିକାଶରେ ଉତ୍କଳଦୀପିକାର ଭୂମିକା - ପ୍ରଦୀପ ମହାପାତ୍ର
୪) Fundamentals of Good Writing: A Handbook of Modern Rhetoric – Brooks, Clinth & Robert Penn Warren.
୫) Creative Interviewing, The writers guide to gathering information by asking questions – Ken, Metezler.

ବିଶେଷ ପତ୍ର

SPECIAL PAPER

Group – A

ପ୍ରାଚୀନ ଓ ମଧ୍ୟଯୁଗୀୟ ଓଡ଼ିଆ କାବ୍ୟ ସାହିତ୍ୟ

ORE-514 (A) ରୀତି ପୂର୍ବ ପ୍ରାଚୀନ କାବ୍ୟ

(i) ପ୍ରାଚୀନ କାବ୍ୟ କବିତା ଓ ତାର ଧାର୍ମିକ ତଥା ସାଂସ୍କୃତିକ ପୃଷ୍ଠଭୂମି
(ii) ଓଡ଼ିଆ ପୌରାଣିକ ଓ ତାନ୍ତ୍ରିକ କାବ୍ୟଧାରା
(iii) ସରଳା ଓ ସମସାମୟିକ ଓଡ଼ିଆ କାବ୍ୟଧାରା
(iv) ଆଖ୍ୟାୟିକା କାବ୍ୟ ତଥା ପ୍ରାଚୀନ [illegible]

ORE-515 (A) ରୀତିଯୁଗ ଓ ବୈଷ୍ଣବ କାବ୍ୟ ସାହିତ୍ୟ

(i) ଓଡ଼ିଆ ରୀତିଯୁଗୀୟ କାବ୍ୟାଦର୍ଶ
(ii) ଓଡ଼ିଆ ବୈଷ୍ଣବ ସାହିତ୍ୟ
(iii) ରୀତି ଯୁଗର ଅନ୍ୟାନ୍ୟ ସାହିତ୍ୟିକ ଧାରା
(iv) ଦୀନକୃଷ୍ଣ, ଉପେନ୍ଦ୍ର, ଅଭିମନ୍ୟୁ, କବିସୂର୍ଯ୍ୟଙ୍କ [illegible]

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) [illegible]
୨) ଭଞ୍ଜ ଭୂମିକା - ଗୌରୀ କୁମାର ବ୍ରହ୍ମା
୩) ଉପେନ୍ଦ୍ର ଭଞ୍ଜ - ଏକ ସମୀକ୍ଷା - ଜୟକୃଷ୍ଣ ମିଶ୍ର
୪) କହେ କୃଷ୍ଣ ଦାସ କବି - କୃଷ୍ଣ ଚରଣ ସାହୁ
୫) ରୀତି ଯୁଗର କବି ଓ କାବ୍ୟ - କୁଳମଣି ମହାପାତ୍ର
୬) ରସିକ କବି ଅଭିମନ୍ୟୁ - ବୃନ୍ଦାବନ ଚନ୍ଦ୍ର ଆଚାର୍ଯ୍ୟ
୭) ଓଡ଼ିଆ କାବ୍ୟ କୌଶଳ - ସୁଦର୍ଶନ ଆଚାର୍ଯ୍ୟ
୮) କବି ସମ୍ରାଟ ଉପେନ୍ଦ୍ର ଭଞ୍ଜ - ଅନନ୍ତ ଚନ୍ଦ୍ର ପଟ୍ଟନାୟକ

Group – B

ଆଧୁନିକ ଓଡ଼ିଆ କାବ୍ୟ ସାହିତ୍ୟ

ORE-514 (B) ୧୯୨୦ ମସିହା ପର୍ଯ୍ୟନ୍ତ -

(i) ରାଧାନାଥ କାବ୍ୟାଦର୍ଶ
(ii) ମଧୁସୂଦନ, ଫକିର ମୋହନ, ଚିନ୍ତାମଣି, ନନ୍ଦକିଶୋର ଓ ପଲ୍ଲୀ କବି, ଅନ୍ୟାନ୍ୟ ଗୌଣ କବି
(iii) ଗଙ୍ଗାଧର ମେହେରଙ୍କ କାବ୍ୟ କବିତାର ବିଶେଷ ଅନୁଶୀଳନ
(iv) ଜାତୀୟ ଓ ଆନ୍ତର୍ଜାତୀୟ କାବ୍ୟଚେତନା ପ୍ରଭାବ ଓ ପରିପ୍ରେକ୍ଷ

ORE-515 (B) ୧୯୨୦ ମସିହାରୁ ସ୍ୱାଧୀନତା ପର୍ଯ୍ୟନ୍ତ -

(i) ସତ୍ୟବାଦୀ ଯୁଗର କାବ୍ୟ କବିତା
(ii) ସବୁଜ ଚେତନା
(iii) ପ୍ରଗତିବାଦୀ ଚେତନା ପୁଷ୍ଟ ଓଡ଼ିଆ କବିତା
(iv) ସ୍ୱୈରବାଦୀ ଯୁଗ (ମାୟାଧର, ରାଧାମୋହନ, [illegible] ତ୍ରିପାଠୀ, [illegible])

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ଆଧୁନିକ ଓଡ଼ିଆ କାବ୍ୟଧାରା (୧ମ ଓ ୨ୟ) - [illegible] ମିଶ୍ର
୨) ମେହେର ସାହିତ୍ୟ - କେଶବ ଚନ୍ଦ୍ର ମେହେର
୩) ତପସ୍ୱିନୀ ଓ ମେହେର ସାହିତ୍ୟ - ଗୌରୀ କୁମାର ବ୍ରହ୍ମା
୪) କାବ୍ୟଶିଳ୍ପୀ ଗଙ୍ଗାଧର - ଗୋବିନ୍ଦ ଚନ୍ଦ୍ର ଉଦ୍‌ଗାତା
୫) ଯୁଗପ୍ରବର୍ତ୍ତକ ସ୍ରଷ୍ଟା ରାଧାନାଥ - ନଟବର ସାମନ୍ତରାୟ
୬) ସତ୍ୟବାଦୀ ଯୁଗ - ବୃନ୍ଦାବନ ଚନ୍ଦ୍ର ଆଚାର୍ଯ୍ୟ

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୭) ପଦ୍ୟ ଗୌରବ - ଆଦିକନ୍ଦ ସାହୁ
୮) ଆଧୁନିକ ଓଡ଼ିଆ କବିତାରେ ବାସ୍ତବ ଚିନ୍ତାଧାରା - ପ୍ରସନ୍ନ କୁମାର ପଟ୍ଟନାୟକ
୯) ସବୁଜରୁ ସାମ୍ପ୍ରତିକ - ନିତ୍ୟାନନ୍ଦ ଶତପଥୀ
୧୦) ଓଡ଼ିଆ ସାହିତ୍ୟର ପ୍ରଗତିବାଦୀ ଧାରା - ବିଜୟ କୁମାର ଶତପଥୀ
୧୧) କବିତା - ୧୯୬୨ ର ମୁଖବନ୍ଧ - ସଚ୍ଚିଦାନନ୍ଦ ରାଉତରାୟ
୧୨) ଶବ୍ଦ ସବୁ ମରିଗଲେ - ସୌରୀନ୍ଦ୍ର ବାରିକ
୧୩) ଆଧୁନିକ କବିତାର ଦିଗ ଦିଗନ୍ତ - (ସଂ) - ଅପୂର୍ବ ରଞ୍ଜନ ରାୟ
୧୪) ମୋ ମନ ପସନ୍ଦର କବି ଓ ଅନ୍ୟାନ୍ୟ ନିବନ୍ଧ - ଆଦିକନ୍ଦ ସାହୁ
୧୫) ମୋ ଦୃଷ୍ଟିରେ ସାମ୍ପ୍ରତିକ ସାହିତ୍ୟ - (ସଂ) ପରୀକ୍ଷିତ ନନ୍ଦ

Group -- C

ଓଡ଼ିଆ କଥା ସାହିତ୍ୟ

ORE-514 (C) **ସ୍ୱାଧୀନତା ପୂର୍ବବର୍ତ୍ତୀ ଓଡ଼ିଆ ଉପନ୍ୟାସ -**

NH (i) ଫକୀର ମୋହନଙ୍କ ପୂର୍ବବର୍ତ୍ତୀ ସମସାମୟିକ ଓଡ଼ିଆ ଉପନ୍ୟାସ
(ii) ଫକୀର ମୋହନଙ୍କ ଉପନ୍ୟାସ .

GB (iii) ଦୟାନିଧି ମିଶ୍ର, କୁନ୍ତଳା କୁମାରୀ, କାନ୍ତକବି, କାଳିନ୍ଦୀ ଚରଣ ପ୍ରମୁଖଙ୍କ ଉପନ୍ୟାସ
(iv) ସ୍ୱାଧୀନତା ପୂର୍ବ ଓଡ଼ିଆ ଉପନ୍ୟାସର ଧାରା ଓ ବୈଶିଷ୍ଟ୍ୟ

ORE-515 (C) **ସ୍ୱାଧୀନତା ପୂର୍ବବର୍ତ୍ତୀ ଓଡ଼ିଆ କ୍ଷୁଦ୍ରଗଳ୍ପ -**

(i) ଫକୀର ମୋହନଙ୍କ କ୍ଷୁଦ୍ରଗଳ୍ପ
(ii) ଫକୀର ମୋହନଙ୍କ ସମସାମୟିକ କ୍ଷୁଦ୍ରଗଳ୍ପ (ଚନ୍ଦ୍ରଶେଖର ନନ୍ଦ, ଦୟାନିଧି ମିଶ୍ର, ଗୋଦାବରିଶ ମିଶ୍ର, ଗୋଦାବରିଶ ମହାପାତ୍ର, କାଳିନ୍ଦୀ ଚରଣ, ଭଗବତୀ ପ୍ରମୁଖ)
(iii) ଫକୀର ମୋହନ ପରବର୍ତ୍ତୀ ଗଳ୍ପ ଓ ଗାଳ୍ପିକ
(iv) ସ୍ୱାଧୀନତା ପୂର୍ବ ଓଡ଼ିଆ କ୍ଷୁଦ୍ର ଗଳ୍ପର ପ୍ରମୁଖ କଥାବସ୍ତୁର ଧାରା

<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ଓଡ଼ିଆ ଉପନ୍ୟାସ - କୃଷ୍ଣ ଚରଣ ବେହେରା
୨) ଓଡ଼ିଆ ଉପନ୍ୟାସ ପରିଚୟ - (ସଂ) ଅଭ୍ୟୁଦୟ ସାହିତ୍ୟ ସମାଜ
୩) ଫକୀର ମୋହନ ସମୀକ୍ଷା - ସୁରେନ୍ଦ୍ର ମହାନ୍ତି
୪) କଥାଶିଳ୍ପୀ ସେନାପତୀଙ୍କ ଦୃଷ୍ଟି ଦିଗବଳୟ - ବାଳକୃଷ୍ଣ ଶତପଥୀ
୫) ଓଡ଼ିଆ ଗଳ୍ପ ଉପନ୍ୟାସର ନବଦିଗନ୍ତ - ଆଦିକନ୍ଦ ସାହୁ
୬) ସାହିତ୍ୟ ସାଧକ ଫକୀର ମୋହନ - ଚିନ୍ତାମଣି ଦାସ
୭) ଓଡ଼ିଆ ଐତିହାସିକ ଉପନ୍ୟାସ (୧ମ, ୨ୟ) - ପୂର୍ଣ୍ଣାନନ୍ଦ ଦାନୀ
୮) ଗାଳ୍ପିକ ସୁରେନ୍ଦ୍ର ମହାନ୍ତି - ମଣିନ୍ଦ୍ର କୁମାର ମହାନ୍ତି
୯) ନବ ପତ୍ର (ବିଶେଷାଙ୍କ)
୧୦) ସୁରେନ୍ଦ୍ର ସାହିତ୍ୟ ସମୀକ୍ଷଣ - (ସଂ) ପ୍ରକାଶ କୁମାର ପରିଡ଼ା, ହିମାଂଶୁ ଚନ୍ଦ୍ର ସାହୁ
୧୧) ସୁରେନ୍ଦ୍ର ସମୀକ୍ଷା - (ସଂ) ବାଉରୀ ବନ୍ଧୁ କର
୧୨) Aspects of the Novel – E.M. Foster
୧୩) The Anatomy of the Novel – Meriovie Boulton

Group – D

ଓଡ଼ିଆ ନାଟ୍ୟ ସାହିତ୍ୟ

ORE-514 (D) **୧୯୨୦ ମସିହା ପର୍ଯ୍ୟନ୍ତ ଓଡ଼ିଆ ନାଟକ / ଏକାଙ୍କିକାର ସ୍ୱରୂପ -**

(i) ଓଡ଼ିଆ ନାଟ୍ୟ ସାହିତ୍ୟରେ ପ୍ରାଚ୍ୟ ପାଶ୍ଚାତ୍ୟଧାରା
(ii) ଆଦି ସ୍ତରର ଓଡ଼ିଆ ନାଟକ
(iii) ଭିକାରୀ ଚରଣ ଓ ତାଙ୍କ ସମସାମୟିକ ନାଟ୍ୟ ଧାରା
(iv) ଏକାଙ୍କିକାର ସଂଜ୍ଞା, ସ୍ୱରୂପ, ପ୍ରକାରଭେଦ । ଏକାଙ୍କିକା ଏବଂ ନାଟକ ମଧ୍ୟରେ ସାମ୍ୟବୈଷମ୍ୟ । ଏକାଙ୍କିକାର ଆଙ୍ଗିକ ଓ ଆତ୍ମିକ ଦିଗ ।

ORE-515 (D) ୧୯୨୧ ମସିହାରୁ ସ୍ୱାଧୀନତା ପର୍ଯ୍ୟନ୍ତ ଓଡ଼ିଆ ନାଟକ ଓ ଏକାଙ୍କିକା

(i) ନାଟ୍ୟକାର ଅଶ୍ୱିନୀ କୁମାର ଓ ସମସାମୟିକ ନାଟକ

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(ii) [illegible]

(iii) ନାଟ୍ୟକାର ରାମଚନ୍ଦ୍ର ମିଶ୍ର, ଗୋପାଳ ଛୋଟରାୟ

(iv) ଭଞ୍ଜ କିଶୋର ପଟ୍ଟନାୟକ, ପ୍ରାଣବନ୍ଧୁ କର

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ନାଟକ ବିଚାର - [illegible]
୨) ନାଟ୍ୟ ଶାସ୍ତ୍ର - ଭରତ
୩) ଓଡ଼ିଆ ନାଟକର ଉଦ୍ଭବ ଓ ବିକାଶ - [illegible]
୪) ଭାରତ ନାଟ୍ୟ ପରମ୍ପରା - ରତ୍ନାକର ଚଇନି
୫) ଓଡ଼ିଆ ନାଟକର ଉଦ୍ଭବ ଓ ବିକାଶ - ହେମନ୍ତ କୁମାର ଦାସ
୬) ଓଡ଼ିଆ ନାଟ୍ୟ ସାହିତ୍ୟ - ସର୍ବେଶ୍ୱର ଦାସ
୭) ମଞ୍ଚଧାରା - କାଳୀ ଚରଣ ପଟ୍ଟନାୟକ
୮) ନାଟ୍ୟ ସାହିତ୍ୟ ପରିଚୟ - କୃଷ୍ଣ ଚରଣ ବେହେରା
୯) ଓଡ଼ିଆ ନାଟକ - (ସଂ) [illegible]
୧୦) ନାଟକ ତତ୍ତ୍ୱ ବିଚାର - ନାରାୟଣ ସାହୁ

Group - E
ତୁଳନାତ୍ମକ ସାହିତ୍ୟ

ORE-514 (E) ତୁଳନାତ୍ମକ ସାହିତ୍ୟ ତତ୍ତ୍ୱ -

(i) ତୁଳନାତ୍ମକ ସାହିତ୍ୟର ଲକ୍ଷ୍ୟ ଓ ସ୍ୱରୂପ

(ii) ତୁଳନାତ୍ମକ ସାହିତ୍ୟର ଉପାଦେୟତା

(iii) ତୁଳନାତ୍ମକ ଭାରତୀୟ ସାହିତ୍ୟ, ଓଡ଼ିଶାରେ ତୁଳନାତ୍ମକ ସାହିତ୍ୟ ଚର୍ଚ୍ଚାର ପରମ୍ପରା, ଜାତୀୟ ସାହିତ୍ୟ ଓ ବିଶ୍ୱ ସାହିତ୍ୟ ବୋଧ

(iv) ତୁଳନାତ୍ମକ ସାହିତ୍ୟ ଅଧ୍ୟୟନରେ ଅନୁବାଦର ଭୂମିକା

ORE-515 (E) ବିଷୟ ଓ ଭାବ ଚେତନା ଦୃଷ୍ଟିରୁ ସାହିତ୍ୟ କୃତିର ତୁଳନାତ୍ମକ ଅନୁଶୀଳନ

(i) ଛମାଣ ଆଠଗୁଣ୍ଠ - ଫକୀର ମୋହନ ସେନାପତି
ଗୋଦାନ - ପ୍ରେମଚନ୍ଦ

(ii) ଅମୃତର ସନ୍ତାନ - ଗୋପୀନାଥ ମହାନ୍ତି
ଗଣଦେବତା - ତାରାଶଙ୍କର ବନ୍ଦୋପାଧ୍ୟାୟ

(iii) ଅନ୍ଧ ଦିଗନ୍ତ - ସୁରେନ୍ଦ୍ର ମହାନ୍ତି
ମୈଲାଆଞ୍ଚଲ - ଫଣୀଶ୍ୱର ନାଥ ରେଣୁ

(iv) କଥା ଓ କାହାଣୀ - ମନୋଜ ଦାସ
ତିନି ଗୋଟା କାହାଣୀ - ମାଣିକ ବନ୍ଦୋପାଧ୍ୟାୟ

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) Comparative Literature and Literary Theory – Ulrich Weisstein
୨) The Study of Comparative Literature - Rolf Hankle
୩) Comparative Indian Literature - Amiya Dev
୪) ଅନୁବାଦ ତତ୍ତ୍ୱ ଓ ପ୍ରୟୋଗ - ମନୋରଞ୍ଜନ ପ୍ରଧାନ
୫) ତୁଳନାତ୍ମକ ସାହିତ୍ୟ - (ସଂ) ଓଡ଼ିଆ ଗବେଷଣା ପରିଷଦ, [illegible]
୬) ଭାଷା ଦର୍ପଣ - ଅରବିନ୍ଦ ସାହୁ

Group - F
ଲୋକ ସାହିତ୍ୟ

ORE-514 (F) ଲୋକ ସାହିତ୍ୟ ତତ୍ତ୍ୱ ଓ ଓଡ଼ିଶାର ଲୋକକଥା

(i) ଲୋକଧାରା ବା ଲୋକସଂସ୍କୃତିର ଲକ୍ଷଣ, ସ୍ୱରୂପ, ପରିସର ଓ ପ୍ରକାର ଭେଦ ; ଶିଷ୍ଟ ସାହିତ୍ୟ ଓ ଲୋକ ସାହିତ୍ୟ

(ii) ଲୋକଧାରା ବା ଲୋକ ସଂସ୍କୃତିର ଅଧ୍ୟୟନ ପଦ୍ଧତି (ସୌର ପୁରାଣତତ୍ତ୍ୱ ମତବାଦ (Theory of Solar Mythology), ତୁଳନାତ୍ମକ ପଦ୍ଧତି, ଅଭିଯାତ୍ରା ପଦ୍ଧତି (Migrational Theory) ଐତିହାସିକ ଭୌଗୋଳିକ ପଦ୍ଧତି, ନୃ-ତାତ୍ତ୍ୱିକ ପଦ୍ଧତି, ମନସ୍ତାତ୍ତ୍ୱିକ ପଦ୍ଧତି, ସଂରଚନା ପଦ୍ଧତି, ପ୍ରସଙ୍ଗ ଭିତ୍ତିକ ଅଧ୍ୟୟନ

(iii) ଓଡ଼ିଶାରେ ପ୍ରଚଳିତ ଲୋକକଥାର ସ୍ୱରୂପ, ପ୍ରକାର ଭେଦ ଓ ତାର କଥାର ବିଭିନ୍ନ ରୂପ

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(iv) ଲୋକକଥାର ବିଭିନ୍ନ ଦିଗ (ସାମାଜିକ, କଳାତ୍ମକଦିଗ, ଲୋକକଥାରେ ଚରିତ୍ର, ଲୋକକାହାଣୀର ବୈଶିଷ୍ଟ୍ୟ), ଲୋକକଥାର ମୋଟିଫ୍ (କଥାଭିପ୍ରାୟ) ଓ ଟାଇପ୍ (କଥାରୂପ) ୧୨

ORE-515 (F) ଓଡିଶାର ଲୋକଗୀତ, ଲୋକୋକ୍ତି ଓ ଓଷାବ୍ରତ

(i) ଲୋକଗୀତର ବୈଶିଷ୍ଟ୍ୟ ଓ ବିବିଧ ରୂପ, ପଶ୍ଚିମ ଓଡିଶାରେ ପ୍ରଚଳିତ ଲୋକଗୀତର ସ୍ୱରୂପ

(ii) ଲୋକଗୀତର ସାମାଜିକ ଓ କଳାତ୍ମକ ଦିଗ, ଲୋକଗୀତରେ ଇତିହାସ, ଲୋକଗୀତରେ ନାରୀମାନସିକତା

(iii) ଓଡିଶାରେ ପ୍ରଚଳିତ ଢଗଢମାଳି, ପହେଲି ଆଦିର ସ୍ୱରୂପ

(iv) ଓଡିଶାରେ ପ୍ରଚଳିତ ଓଷାବ୍ରତର ସ୍ୱରୂପ, ପ୍ରକାରଭେଦ; ଓଷାବ୍ରତର ସାମାଜିକ ଆଭିମୁଖ୍ୟ, ଓଷାବ୍ରତର ଚରିତ୍ର

<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧) ଲୋକ ସାହିତ୍ୟ ତତ୍ତ୍ୱ – ଶ୍ୟାମ ସୁନ୍ଦର ମହାପାତ୍ର

୨) ଓଡିଆ ଲୋକଗୀତ ଓ କାହାଣୀ – କୁଞ୍ଜ ବିହାରୀ ଦାଶ

୩) ସାହିତ୍ୟ ସ୍ନାନ - ଶ୍ୟାମ ସୁନ୍ଦର ମହାପାତ୍ର

୪) ଲୋକ ସାହିତ୍ୟ ଚର୍ଚ୍ଚା – କୈଳାଶ ପଟ୍ଟନାୟକ

୫) ପଶ୍ଚିମ ଓଡିଶାର ଲୋକ ସାହିତ୍ୟର ସ୍ୱରୂପ - ନିର୍ମଳ ଚରଣ ପଣ୍ଡା

୬) ପଶ୍ଚିମ ଓଡିଶାର ଲୋକସଂସ୍କୃତି – ମହେନ୍ଦ୍ର କୁମାର ମିଶ୍ର

୭) ଲୋକ ସାହିତ୍ୟ ବିଜ୍ଞାନ (ହିନ୍ଦୀ) – ସତ୍ୟେନ୍ଦ୍ର

୮) ଭାରତୀୟ ଲୋକ ସାହିତ୍ୟ (ହିନ୍ଦୀ) – ଶ୍ୟାମ ପରମାର

୯) ଲୋକ ସାହିତ୍ୟ ସିଦ୍ଧାନ୍ତ ଔର ପ୍ରୟୋଗ (ହିନ୍ଦୀ) - ଶ୍ରୀରାମ ଶର୍ମା

୧୦) ଆଲୋଚକ ଓ ଆଲୋଚନା – କୁମୁଦ ରଞ୍ଜନ ପାଣିଗ୍ରାହୀ

୧୧) ସମ୍ବଲପୁର – ଭାଷା, ସାହିତ୍ୟ ଓ ସଂସ୍କୃତି – (ସଂ) ସମ୍ବଲପୁର ବିଶ୍ୱବିଦ୍ୟାଳୟ

୧୨) ସମ୍ବଲପୁରୀ ଲୋକ ସାହିତ୍ୟ – କୁମାର ହସନ୍

୧୩) A Study of Orissan Folklore – K.B. Dash

୧୪) Indian Folklore – J. Handoo

୧୫) ପଲ୍ଲୀଗୀତ ସଂଚୟନ (୧ମ, ୨ୟ, ୩ୟ) - କୁଞ୍ଜ ବିହାରୀ ଦାଶ

୧୬) ଉତ୍କଳ ଗାଉଁଲି ଗୀତ -- ଚକ୍ରଧର ମହାପାତ୍ର

୧୭) ସମ୍ବଲପୁରୀ ଲୋକଗୀତରେ ସମାଜ ଚିତ୍ର - ଦ୍ୱାରିକା ନାଥ ନାୟକ

୧୮) ପଶ୍ଚିମ ଓଡିଶାର ଲୋକ କଥା (୧ମ, ୨ୟ) – (ସଂ) ଓଡିଆ ବିଭାଗ, ସମ୍ବଲପୁର ବିଶ୍ୱବିଦ୍ୟାଳୟ

୧୯) ପଶ୍ଚିମ ଓଡିଶାର ଲୋକଗୀତ – ଓଡିଆ ବିଭାଗ, ସମ୍ବଲପୁର ବିଶ୍ୱବିଦ୍ୟାଳୟ

୨୦) ଓଡିଆ ଢଗ ଢମାଳି ଲୋକଗୀତ – କୃପାସିନ୍ଧୁ ବିଶ୍ୱାଳ

୨୧) ଲୋକ ସାହିତ୍ୟ : ତତ୍ତ୍ୱରୂପ ଓ କଳାରୂପ - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ

୨୨) ଓଡିଆ ଲୋକ ସାହିତ୍ୟ ଓ ଲୋକ ସଂସ୍କୃତି - କୃଷ୍ଣ ଚନ୍ଦ୍ର ପ୍ରଧାନ

Group – G

ସାନ୍ତାଳୀ ଭାଷା ଓ ସାହିତ୍ୟ

ORE-514 (G)

(i) History of Santali Language and Literature – 20

(ii) Lita Godet (Kevya) – Sadhuram Chandra Nurma – 20

(iii) Lade Sarjom (Modern Poetry) – Arjun Ch. Hembram – 20

(iv) Sasnok (Drama) – Dhogla Soren

ORE-515 (G) Santali Folklore

(i) Art and Culture – 20

(ii) Literature – 20

(iii) Language and Script – 20

(iv) Religious Belief – 20

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SEMESTER-IV

ORC-521 – ଭାଷାତତ୍ତ୍ୱ ଓ ଭାଷାର ବିକାଶଧାରା

(i) ଭାଷାତତ୍ତ୍ୱ ଅଧ୍ୟୟନର ପ୍ରକାର ଓ ପରିସର

(ii) ଭାଷାର ସଂଜ୍ଞା ଓ ଭାଷାର ଶ୍ରେଣୀବିଭାଜନ

(iii) ଭାଷାର ଉତ୍ପତ୍ତି ସମ୍ବନ୍ଧୀୟ ମତବାଦ, ପୃଥିବୀର ଭାଷାଗୋଷ୍ଠୀ (ପରିଚୟାତ୍ମକ)

(iv) ଧ୍ୱନି, ଧ୍ୱନି ଓ ଅର୍ଥ ପରିବର୍ତ୍ତନର କାରଣ ଓ ସ୍ତ୍ରୂପ

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୧) ମଣିଷର ଭାଷା – ଗୋକୁଳ ବିହାରୀ ଧଳ

୨) ଭାଷାଶାସ୍ତ୍ର ପରିଚୟ - ଗୋକୁଳ ବିହାରୀ ଧଳ

୩) ଧ୍ୱନି ବିଜ୍ଞାନ - ଗୋକୁଳ ବିହାରୀ ଧଳ

୪) ଭାଷାବିଜ୍ଞାନର ରୂପରେଖ – ବାସୁଦେବ ସାହୁ

ORC-522 – ଓଡିଆ ଭାଷାର ସ୍ୱରୂପ

(v) ପ୍ରାଚୀନ ଭାରତୀୟ ଆର୍ଯ୍ୟଭାଷା, ମଧ୍ୟଭାରତୀୟ ଆର୍ଯ୍ୟଭାଷା ଓ ନବଭାରତୀୟ ଆର୍ଯ୍ୟଭାଷା

(vi) ଓଡିଆ ଭାଷାର ଉଦ୍ଭବ ଓ କ୍ରମବିକାଶ

(vii) ଓଡିଆ ବିଭକ୍ତି ପ୍ରତ୍ୟୟ, ସର୍ବନାମ, ଅବ୍ୟୟ

(viii) ଓଡିଆ ଶବ୍ଦ ଭଣ୍ଡାର

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

୯) ଓଡିଆ ଧ୍ୱନିତତ୍ତ୍ୱ ଓ ଶବ୍ଦ ଭଣ୍ଡାର - ଧନେଶ୍ୱର ମହାପାତ୍ର

୧୦) ଓଡିଆ ଭାଷାତତ୍ତ୍ୱ – ଗୋପୀନାଥ ନନ୍ଦ

୧୧) ଓଡିଆ ଭାଷାର ରୂପତତ୍ତ୍ୱ – ବେଣୀ ମାଧବ ପାଢୀ

୧୨) ଓଡିଆ ଭାଷା ଓ ଲିପିର ବିକାଶ – କୁଞ୍ଜ ବିହାରୀ ତ୍ରିପାଠୀ

୧୩) ଓଡିଆ ଭାଷାର ଉତ୍ପତ୍ତି ଓ କ୍ରମବିକାଶ – ବଂଶୀଧର ମହାନ୍ତି

୧୪) ଓଡିଆ ଭାଷାର ଉନ୍ମେଷ ଓ ବିକାଶ – ବାସୁଦେବ ସାହୁ

୧୫) Evolution of Oriya Language and Script – K.B. Tripathy

ORC-523 – କମ୍ପ୍ୟୁଟର ପ୍ରୟୋଗ ଶିକ୍ଷା

(v) Computer Fundamental and Window Operating System

(vi) M.S. Word, Excel, Power Point

(vii) Database Management (MS-Access)

(viii) Oriya DTP

ଗବେଷଣା ପଦ୍ଧତି (Research Methodology) 60+40 Int

(i) ଗବେଷଣା ପଦ୍ଧତି : ପ୍ରକୃତି, ଉଦ୍ଦେଶ୍ୟ ଓ ପ୍ରକାର

(ii) ସାହିତ୍ୟ ତିତ୍ତିକ ଗବେଷଣା ପଦ୍ଧତି ପ୍ରକାରଭେଦ

(iii) ତଥ୍ୟ ସଂଗ୍ରହ ଉତ୍ସ, ତଥ୍ୟସଂଗ୍ରହ ଓ ପ୍ରକାରଭେଦ

(iv) ଗବେଷଣାରେ ପ୍ରକାଶନ ପଦ୍ଧତି ସମସ୍ୟା

ବିଶେଷ ପତ୍ର

SPECIAL PAPER

Group – A

ପ୍ରାଚୀନ ଓ ମଧ୍ୟଯୁଗୀୟ ଓଡିଆ ସାହିତ୍ୟ

ORE-524 (A) ଓଡିଆ ପଦାବଳୀ ସାହିତ୍ୟ

ପଦାବଳୀ ସାହିତ୍ୟର ପରିପ୍ରେକ୍ଷୀ

ପଦାବଳୀ ସାହିତ୍ୟ ଓ ଭକ୍ତି ଭାବନା

ସାଲବେଗ, ବଳଦେବ ରଥଙ୍କ ପଦାବଳୀ ସାହିତ୍ୟ

ବାଳମାଳୀ, ଗୋପାଳକୃଷ୍ଣ ପ୍ରମୁଖ

ORE-525 (A) ପ୍ରକଳ୍ପ ପ୍ରସ୍ତୁତି ଓ ମୌଖିକ ପରୀକ୍ଷା

ବିଭାଗର ସାଂସ୍କୃତି କ୍ରମେ ନିର୍ଦ୍ଦିଷ୍ଟ ବିଶେଷ ପତ୍ରର କୌଣସି ବିଷୟ ଉପରେ ଗବେଷଣାମୂଳକ ନିବନ୍ଧ ପ୍ରସ୍ତୁତ କରିବାକୁ ହେବ । ବିଭାଗର ଶିକ୍ଷକଙ୍କ ତତ୍ତ୍ୱାବଧାନରେ ପ୍ରକଳ୍ପଟି ପ୍ରସ୍ତୁତ ହେବ ।

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6.1.2 ସମାଲୋଚନା ସାହିତ୍ୟ (Literacy Criticism)

I- ସମାଲୋଚନା: ସଂଜ୍ଞା ସ୍ୱରୂପ ଓ ପ୍ରକାରଭେଦ
ତୁଳନାତ୍ମକ ସମାଲୋଚନା, ରୂପତାତ୍ତ୍ୱିକ ସମାଲୋଚନା (ନୂତନ ସମାଲୋଚନା), ବାମାବାଦୀ ସମାଲୋଚନା, ସଂରଚନାତ୍ମକ ସମାଲୋଚନା, ମନସ୍ତାତ୍ତ୍ୱିକ ସମାଲୋଚନା, ମାର୍କସବାଦୀ ସମାଲୋଚନା, ସମାଜ ତାତ୍ତ୍ୱିକ ସମାଲୋଚନା ଇତ୍ୟାଦି ।

II - ସ୍ୱାଧୀନତା ପୂର୍ବବର୍ତ୍ତୀ ଓଡ଼ିଆ ସମାଲୋଚନାର ପ୍ରକୃତି

III- ସ୍ୱାଧୀନତା ପରବର୍ତ୍ତୀ ଓଡ଼ିଆ ସମାଲୋଚନାର ସ୍ୱରୂପ

IV- ଉତ୍ତର ଆଧୁନିକତା ଓ ଓଡ଼ିଆ ସାହିତ୍ୟରେ ଏହାର ରୂପରେଖ
ଓଡ଼ିଆ ଉପନ୍ୟାସ, କ୍ଷୁଦ୍ରଗଳ୍ପ, କବିତା ଏବଂ ନାଟକରେ ଏହାର ପ୍ରୟୋଗଶୈଳୀ ।

<u>ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ</u>

୧- ଉତ୍ତର ଆଧୁନିକତା ଏକ ପରିଚିତି – ଡ଼. ଦେବୀପ୍ରସନ୍ନ ପଟ୍ଟନାୟକ ଓ କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ
୨- ସାମ୍ପ୍ରତିକ ପାଶ୍ଚାତ୍ୟ ସାହିତ୍ୟ ତତ୍ତ୍ୱ – ଚିତ୍ତରଞ୍ଜନ ମିଶ୍ର
୩- ସାମ୍ପ୍ରତିକ ପାଶ୍ଚାତ୍ୟ ସମାଲୋଚନାତତ୍ତ୍ୱ – ଜିତେନ୍ଦ୍ର ନାରାୟଣ ପଟ୍ଟନାୟକ
୪- A Readers Guide to Contemporary Literacy Thought – Raman Selden
୫- Modern Criticism and Theory – Ed. David Lodge
୬- Problems of Feminist Criticism – Ed. Sally Minogue
୭- Literacy Theory : A Very Short Introduction – Jonathan Culler
୮- Literacy Theory : An Introduction – Tarry Eagleton

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P-612 - Literary Theory: ପ୍ରତ୍ୟେକ ଏକକ (Unit)ରୁ ଦୁଇଟି ଲେଖାଏ ପ୍ରଶ୍ନ ପଡ଼ିବ । ବିଦ୍ୟାର୍ଥୀମାନେ ପ୍ରତ୍ୟେକ ଏକକରୁ ଗୋଟିଏ କରି ପ୍ରଶ୍ନର ଉତ୍ତର ଦେବେ ।

Unit-I – ଲୋକତତ୍ତ୍ୱ :

(କ) ଲୋକ ସଂସ୍କୃତି / ଧାରାର ସ୍ୱରୂପ, ପରିସର ଓ ପ୍ରକାର ଭେଦ
ଲୋକ ସଂସ୍କୃତି / ଧାରା ଏବଂ ଲୋକ ସାହିତ୍ୟ

(ଖ) ଲୋକ ସଂସ୍କୃତି : ଅଧ୍ୟୟନ ପଦ୍ଧତି :
ତୁଳନାତ୍ମକ ପଦ୍ଧତି, ଐତିହାସିକ-ଭୌଗୋଳିକ ପଦ୍ଧତି, ମନସ୍ତାତ୍ତ୍ୱିକ ପଦ୍ଧତି, ସଂରଚନା ପଦ୍ଧତି, ପ୍ରସଙ୍ଗଭିତ୍ତିକ ପଦ୍ଧତି

Unit-II – କଥାତତ୍ତ୍ୱ:

(କ) ବିଶ୍ୱ ସାହିତ୍ୟରେ ଉପନ୍ୟାସର ଧାରା (ପରିଚୟାତ୍ମକ)
ଉପନ୍ୟାସର ଗଠନ କୌଶଳ, ଇଂରାଜୀ ସାହିତ୍ୟରେ ଉପନ୍ୟାସ; ରୋମାଣ୍ଟିକ୍ ଯୁଗ, ଭିକ୍ଟୋରିଆ ଯୁଗ, ବିଂଶ ଶତକର ଉପନ୍ୟାସ (୧୯୫୦ ପର୍ଯ୍ୟନ୍ତ)

(ଖ) ବିଶ୍ୱ କଥା ସାହିତ୍ୟରେ କ୍ଷୁଦ୍ରଗଳ୍ପର ଉନ୍ମେଷ ଓ ଉତ୍ତରଣ (୧୮୫୦-୧୯୫୦)

Unit-III – କବିତାତତ୍ତ୍ୱ :

(କ) ଆଧୁନିକ କବିତାରେ ବ୍ୟକ୍ତି, ବ୍ୟକ୍ତିତ୍ୱ ଓ ବିଶ୍ୱ; ରେନେସାଁ ଓ ଆଧୁନିକ ଓଡ଼ିଆ କବିତାରେ ତା'ର ପ୍ରଭାବ
କାବ୍ୟଶୈଳୀରେ ପାଶ୍ଚାତ୍ୟ ପ୍ରଭାବ: ସମ୍ବୋଧନ ଗୀତିକା, ଚତୁର୍ଦ୍ଦଶପଦୀ, ଶୋକ ଗୀତିକା, ଗାଥା କବିତା

(ଖ) ସାଂପ୍ରତିକ କାବ୍ୟଚେତନାରେ ପାଶ୍ଚାତ୍ୟ ପ୍ରଭାବ (ସ୍ୱାଧୀନତୋତ୍ତର କାଳ)
ବାମାବାଦୀ ଚେତନା, ସ୍ଥିତିବାଦୀ ଚେତନା, ମାର୍କସ୍‌ବାଦୀ ଚେତନା, ଦଳିତ ଚେତନା, ଗାନ୍ଧିବାଦୀ ଚେତନା

Unit-IV – ନାଟ୍ୟତତ୍ତ୍ୱ :

(କ) ନାଟକର ଗଠନକଳା

(ଖ) ପ୍ରୟୋଗବାଦୀ ନାଟ୍ୟଧାରା

(ଗ) ନାଟକର ବିଭିନ୍ନ ରୂପ : (ପରିଚୟାତ୍ମକ)

(A) (i) ମଞ୍ଚ ନାଟକ (ii) ଯାତ୍ରା ନାଟକ (iii) ବେତାର ନାଟକ
(iv) ଆର୍ଟ ଥିଏଟର (v) ପଥପ୍ରାନ୍ତ ନାଟକ (vi) ଅନ୍ୟାନ୍ୟ ନାଟ୍ୟଶୈଳୀ

(B) (i) ଏପିକଧର୍ମୀ ନାଟକ (ii) ମିଥଧର୍ମୀ ନାଟକ
(iii) ଲୋକଉପାଦାନ ଭିତ୍ତିକ ନାଟକ

ସହାୟକ ଗ୍ରନ୍ଥସୂଚୀ

- ଉପନ୍ୟାସ ତତ୍ତ୍ୱ ଓ ଓଡ଼ିଆ ଉପନ୍ୟାସ : କ୍ରମାଭିବ୍ୟକ୍ତି – ଲକ୍ଷ୍ମୀଧର ଦାସ
- ଓଡ଼ିଆ କ୍ଷୁଦ୍ରଗଳ୍ପ : ଉନ୍ମେଷ ଓ ବିକାଶ – ବୈଷ୍ଣବ ଚରଣ ସାମଲ
- ଅନ୍ଧାରର ଝୋଟିଚିତା – ସୀତାକାନ୍ତ ମହାପାତ୍ର
- କବିତାର ଅବବୋଧରେ – ବିପିନ ବିହାରୀ ପଲାଇ
- ଲୋକ ସାହିତ୍ୟ: ତତ୍ତ୍ୱରୂପ ଓ କଳାରୂପ - କୃଷ୍ଣଚନ୍ଦ୍ର ପ୍ରଧାନ
- ଲୋକ ସାହିତ୍ୟ ତତ୍ତ୍ୱ – ଶ୍ୟାମସୁନ୍ଦର ମହାପାତ୍ର
- ଲୋକ ସାହିତ୍ୟ ଚର୍ଚ୍ଚା – କଇଳାଶ ପଟ୍ଟନାୟକ
- ଲୋକ ସଂସ୍କୃତି ପରିକ୍ରମା – ମହେନ୍ଦ୍ର ମିଶ୍ର
- ନାଟ୍ୟତତ୍ତ୍ୱ - ନାରାୟଣ ସାହୁ
- ନାଟକ ବିଚାର – ସର୍ବେଶ୍ୱର ଦାଶ
- ଓଡ଼ିଆ ନାଟକର ଉଦ୍ଭବ ଓ ବିକାଶ – ହେମନ୍ତ କୁମାର ଦାସ
- Aspects of Novel – E.M. Froster
- Character and the Novel – W.J. Harvey
- A Treatise on the Novel – Robert Liddel
- Folklore – An Introduction – J. Handoo
- The Study of Folklore – William R. Bascom
- The Meaning of Art – Herbert Read
- The Modern Short Story – H.E. Bates
- A New Study of English Poetry – Henry Newbolt
- New Bearings in English Poetry – F. R. Levis

614 Practical or Field Study or Essay Course.
Or Translation କ୍ଷେତ୍ରରେ ଯେ କୌଣସି ଇଂରାଜୀ ଉପନ୍ୟାସ, ଗଳ୍ପ, ନାଟକ, ପ୍ରବନ୍ଧ, କବିତା ଆଦିରୁ ୪୦୦୦ ରୁ ୫୦୦୦ ଶବ୍ଦ ମଧ୍ୟରେ ଅନୁବାଦ କରିବାକୁ ହେବ।

615 Review of research paper Published in referred journals.
Review Report, Seminar

Political science

PSC-304 DEMOCRACY AND HUMAN RIGHTS IN INDIA

Course Objective:

The course Human Rights and Democracy goes hand in hand as democracy is the political system that embodies the individual's autonomy inherent within the idea and concept of human rights. One possibility to legitimate human rights is on the legal or political dimension througha democratic process.

Course Outcome:

After completing the course, the students will build a conceptual understanding of human rights and critically examine critical issues and areas often discussed in human rights discourses. The students will learn about state actors and institutions, agencies and laws associated with them, which occupy the central place in the discussion. The Unit also engages with social, religious, politicaland economic ideologies that unleash several critical issues about human rights.

Unit-I

1. Concept of Human Rights: Western, Third World Context
2. Human Rights: National and International Dimensions

Unit-II

1. Human Rights & Constitutional- Legal Framework in India:
   Fundamental Rights, Directive Principles of State Policy (DPSP), Protection of Human Rights Act, 1993.
2. Issues & Challenges of Human Rights: Disabled Person, Caste, Tribe, Women, Minorities, Children, Old age.

Unit-III

1. State Response to Human Rights: Role of Police, Administration, Army, Paramilitary Forces,
2. Affirmative Action for Weaker Section and Other Developmental Strategy.

Unit-IV

1. Civil- Society and Human Rights: Media, Public Opinion, New Social Movement, Non-Governmental Organization (NGOs)
2. Democratic Institutions and Human Rights: NHRC and SHRC

Suggested Readings:

1. D.Bentham (ed): Politics and Human Right

2. Buergenthal: International Human Rights in a Nutshell

3. Buergenthal: International Protection of Human Rights

& L.B. Sohn

4. J.Donnelly: The Concept of Human Rights

5. T.Evans: The Politics of Human Right: A Global Perspective

6. J.F.Green: The United Nations and Human Rights

7. E.B.Hoas: Human Right and International Action: The Case of Freedom of Action

8.K.P.Saksena: Human Rights: Fifty Years of Indi's independence.

9.P.Thorbery: International Low and the Right of Minorities

1. A.Roses: The Strength of Diversity: Human Rights and Pluralist Democracy

PSC-305 INDIA AND THE WORLD

Course Objective:

This paper is about the internal and external determinants of Indian Foreign policy and its evolution since independence. It aims to make students aware of how India has sought to respond to them by involving itself and interrogating various regional and global groupings. Particular attention is paid to Indian post-cold War relations with multiple countries and regions.

Course Outcome:

Indian Foreign policy has emerged as a major thrust in contemporary academic discourse. The students preparing for Civil Services will be immensely benefitted from this course. The course has been designed to serve as a handbook on Indian Foreign Policy with its changes and continuity. It will be undoubtedly helpful for students preparing for UGC – JRF/NET examination. It will also be conducive to those students who want to conduct further research on themes of Indian Foreign Policy.

Unit-I

Indian Foreign Policy

Major Goals, Determinants, Continuity and Change.

India and the Non-Alignment Movement

Emergence, Relevance and Resurgence.

Unit-II India and Her Neighbors:

Contemporary Issues.

India and Regional Cooperation:

SAARC, BIMSTAC and ASEAN.

Unit-III

India's Post-Cold War Relations with:

a. the U.S.A

b. Russia

Unit-IV

India and the United Nations.

Nuclear Policy, the debate on nuclearization.

Suggested Readings:

1. Ahmed, Imtiaz., *State and Foreign Policy: India's Role in South Asia,* Delhi, Vikas Publishing House Ltd, 1993.
2. Bandyopadhyaya, Jayanta, *The Making of India's Foreign Policy.* New Delhi, Allied, 1970.

3. Bradnock, Robert. *India's Foreign Policy Since 1971.* London., Royal Institute for International Affairs, 1990.
4. Brands, H.W. *India and the United States: The Cold Peace.* Boston, Twayne Publishers, 1990.
5. Cohen, Stephen P., and Richard L. Park. *India: Emergent Power?* New York: Crane, Russak and Company, 1978.
6. Damodaran, AX and Rajpai. The U.S., (eds.), *Indian Foreign Policy: The Indira Gandhi years*. New Delhi, Radiant, 1990.
7. Ganguly, Sivaji, *U. S.Policy Toward South Asia,* Boulder, Westview,1990.
8. Ganguly, Sumit. *The Origins of War in South Asia,* Boulder, Westview, 1986.
9. Gordon Sandy and Henningham. Shepherd (eds.) *India Looks East An Emerging Power and Its Asia-Pacific Neighbours.* The Australian National University. Strategic and Defence Studies Centre, 1995.
10. Gould, Harold A. and Ganguly, Sumit, (eds.), *The Hope and the Reality: U.S – Indian Relations from Roosevelt to Bush.* Boulder. Westview, 1992.
11. Charles H., and Surjit Mansing. *A Diplomatic History of Modern India.* New Delhi, Allied, 1971.
12. Kapur, Ashok, *Pokhran and Beyond: India's Nuclear Behavior.* New Delhi, Oxford University Press, 2001.
13. Kapur, Ashok and Wilsen, A. J.. *Foreign Policy of India and her Neighbors.* Houndmills, Macmillan Press, 1996.

MA SOCIOLOGY

CORPORATE SOCIAL RESPONSIBILITY

Paper No. SOC. C-412 **Credit Hours- 4**

Study Objectives: It attempts to provide an adequate introduction to the world of corporate business locating it in the historical context of society. The overall framework encompasses political economy, sociology and law. An inter-disciplinary approach is adopted which is in keeping with the reality of the subject- matter.

Learning Outcomes: It will help the institute to establish the university-industries linkage and help the students for recruitments.

UNIT — I Basic Issues of corporate social responsibility (CSR)

- Definition and concepts
- Corporate social responsibility in Indian context and International
- Approaches of CSR
- Overview of corporate social responsibility and corporate social accountability

UNIT — II Business ethics and corporate social responsibility:

- Concept of business ethics — meaning, Importance and factors influencing business ethics.
- Corporate Governance — meaning & significance
- Principles and dimensions.
- Ethical decision - Consumer protection & environment protection

UNIT III Corporate governance:

11. Issues & implications
12. Theories and practices
13. Business benefits of CSR
14. Corporate democracy.

UNIT IV Corporate community participation

a. Corporate, NGO, Government, Citizen & need for partnership
b. Corporate perspective on building successful partnership, tools and techniques.
c. Roles and skills – Advocacy and administration
d. Marketing

References:

14. Baron, D. 2010.Business and its environment (6th ed.), Upper Saddle River,Pearson Prentice Hall.
15. Baxi, C.V. 2005.Corporate social responsibility – concepts and cases, Concept Pub., Delhi.
16. Bhatia, S.K. 2005. International Human resource management – Global perspective, Deep & Deep Publications Pvt. Ltd, Delhi .
17. Bhaves A.G. 2009. Experience of the Role of Government in Promoting CSR Initiatives in the Private Sector, Lund University Press, Sweden.
18. Craine, A. et al (eds), The Oxford Handbook of CSR, Oxford University Press, New York.
19. Hopkins, Michael. 2004. CSR –an issue paper, International Labour Organisation, Working Paper No.27.
20. Mahmoudi, M. 2005.Global strategic management, Deep & Deep Publications, Delhi
21. Moon, J. 2007.The contribution of CSR to Sustainable Development, *Sustainable Development,* Vol.15, pp.296-306
22. Srivastava, Harsh. 2000. The Business of Social Responsibility, Books for Change, Bangalore.

MEDICAL SOCIOLOGY -I

Paper No. SOC. E-425 (C) **Credit Hours- 4**

Study Objectives: The objective of the course is to introduce the students with the sociological perspectives of various health issues and developing their knowledge on relevant issues pertaining to healthcare system linking with the society for the protection and promotion of health.

Learning Outcomes: The students will be strongly benefited with a very relevant field of specialization and it will help them contribute for promoting a healthy society.

Unit-I: Introduction to Medical Sociology:

- Definition and Objectives
- Theoretical Approaches: Parsons and Cockerham
- Historical Development of Medical Sociology
- Contemporary Trends of Research.

Unit-II: Diseases and Treatment

- Diseases in Developed and Developing Countries
- Medical Pluralism
- Diseases in Rural and Urban India
- History of Public Health in India.

Unit-III: Health Planning and Management

- Health Planning in India.
- Approaches to Public Health

- Role of the Public and Private Agencies for Promotion of Health
- Millennium Development Goals (MDGs) and its Objectives.

Unit-IV: Community Health

- Community Health and Community Medicine
- Community Health Care Practices
- Levels of Health Care
- Role of Voluntary Agencies in Health Care

References:

- Albrecht,G.B.and Fitzpatrick 1994,Quality of Life in Health Care: Advances in MedicalSociology,Mumbai,Jai Press
- Anand, S., et al. 2006. Public Health: Ethics and Equity Oxford
- Coe, R.M., 19 99.Sociology &Medicine,NewYork, McGraw Hill
- Cockarham, W.C., 1978. Readings in Medical Sociology New Jersey,Prentice Hall 5.Conrad,P. et al.,2000. Handbook of Medical Sociology New Jarsey,Prentice Hall
- Fox,R.C.,1988 Essays in Medical Sociology, Journeysinto the Field, New York,TransactionPublishers.
- Nayar, K.R.,1998. Ecology and Health: A System1998 Approach,NewDelhi,APH Publishing Corporation.

7. Mehta,S.R. 2010. Society and Health: A Sociological Perspectives, New Delhi Vikas Pub.
8.Nagla, Madhu. 2018. Sociology of Health and Medicine, Rawat, Jaipur.

- Ramani, K.V. et al 2008 Strategic Issues and Challenges in Health Management Sage
- Rao, Mohan,1999 Disinvesting in Health: the World Bank's Prescription For Health, New-Delhi, Sage Publications.
- Verma, A. 2017. Women's Health and Nutrition, Rawat, Jaipur.

Medical Sociology-II

Paper No. SOC. E-515 (C) **Credit Hours- 4**

Study Objectives: The objective of the course is to introduce the students with the sociological perspectives of various health issues and developing their knowledge on relevant issues pertaining to healthcare system linking with the society for the protection and promotion of health.

Learning Outcomes: The students will be strongly benefited with a very relevant field of specialization and it will help them to understand different facets of health such as environment, gender and ageing and contribute for promoting a healthy society.

Unit-I: Health and Development

- Health Education and Development
- Health: Right to Development
- Health Communication
- Agencies of Rehabilitation

Unit-II: Environment and Health

5. Features of Environmental Health
6. Environment in Tribal Areas and Health
7. Environment in Rural Areas and Health
8. Environment in Urban/ Industrial Areas and Health

Unit-III: Gender and Health

(c) Health Indicators and Women's Health
(d) Health seeking Behaviour of Women

(e) Gender Inequality and Health
(f) Geriatric Heath Problems

Unit-IV: National Health Programme.

(c) Reproductive Child Health (RCH) Programme and Safe Motherhood
(d) National AIDS Control Programme
(e) National Rural Health Mission (NRHM)
(f) National Urban Health Mission (NUHM)

4. Albrecht,G.L.1984, Advances in Medical Sociology,Jai Press ,Bombay.
5. Cockerham,W.C1997.,Medical Sociology,Prentice Hall. New Jersey
3.Gunatillatic,G.1984,Intersectoral Linkages and Health Developments:Case Studies in India,Jamaica. Sri Lanka and Thailand (WHO Offset Series),Ganeve,WHO.
3. Bhatnagar,G.S.1978,Community Response to Health,SociologyDept.of Punjab University,Patiala.
4. Dubas,R.,2013, Man,Medicines and Environment, New York, Mentoy.
5. Nagla, Madhu 2018,Sociology of Health and Medicine, Rawat, Jaipur.
6. Park, K. 2010. Social Medicine and Preventive Health, Bhanot Publications, Jabalpur.
7. Parsons,T.,1951:The Social System, Illionis, Free Press.
8. Parker,R.etal.1982,—Relating Health Services to community Health Needs‖,Indian J.of Medical Research,Vol.60,No.12, Dec.
9. Schwata,Howard 1994,Dominant Issues in Medical Sociology New york,McGraw Hill. 11.Warren,D.M.et al.(ed.)1992,Indigeneous Knowledge system,The Cultural Dimention of Development,London ,Kegan Paul..
5. Verma, Arpita2017 Women's Health and Nutrition , Rawat, Jaipur.

MATHEMATICAL ANALYSIS

MSC-411 *4CH*

Objective: To introduce fundamental concept of Mathematical analysis such as sequence, series of real numbers and their convergence, continuity, differentiability of real valued functions.

CO-1	Remember and understand the basic concepts/Principles of Mathematical Analysis
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Sequences, subsequences, convergence, divergence, bounded sequences, limits superior and inferior, monotone sequences, Cauchy sequences, completeness, Series of real numbers.

Unit-II

Bounded and unbounded subsets of the line, intervals, closed and open sets, characterizations, limit points, closures, interiors. Denseness. Compact sets. Heine-Borel Theorem, BolzanoWeierstrass Theorem.

Unit-III

Functions: limits, continuity, uniform continuity, intermediate value theorem, Differentiability; Chain rule, mean value theorem, Taylor's theorem (statement), extreme, Multivariate calculus: partial, directional and total derivatives mean value theorem, Gamma function and Beta function, Multiple integrals, change of variables, Jacobian formula.

Unit- IV

Algebra of complex numbers, operations of absolute value and conjugate, standard inequalities for absolute value, concept of analytic functions via power series and differentiability methods, Exponential and logarithmic functions, trigonometric functions of a complex variable, complex line integral, Cauchy integral formula, Holomorphic functions, Laurent Series, Singularity, calculus of residues, evaluation of integration using contour integration.

Books Recommended

l. Bartle G.R. & Sherbert D. R. (2000): Introduction to Real Analysis- John Wiley & Son Inc.
2. Royden (1988): Principles of Real Analysis - Macmillian.
3. Widder (1989): Advanced Calculus - Dover Publication.
4. W, Rudin (2013): Real and Complex Analysis, Tata Mc-Graw Hill. 5. E. M. Strein, R, Shakarchi (2003): Complex Analysis, Princeton University Press.

STATISTICAL METHODS-I

MSC-412 **4CH**

Objective: To learn scientific view to conduct the survey in proper way to collect the data about specific perspective. To learn how to develop regression model and apply for the specific perspective data appropriate manner. To present the general theory of statistical distributions as well as the standard distributions found .

CO-1	Remember and understand the basic concepts/Principles of Statistical Methods-I

CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Introduction to different measures such as measures of location, dispersion and skew ness, Basic concept of discrete and continuous probability distributions and their properties. Basic discrete distributions:- Bernoulli, Binomial, Poisson, Negative Binomial, Uniform and Hyper geometric distributions, Computations of their moments , means , Variances and Beta-l and Beta-2 coefficients, recurrence relations between moments, M.G.F. and C.F. Basic continuous distributions: - Uniform and lognormal, Beta, Gamma, normal distributions their properties and applications. Computation of their M.G.F., C.F. and Moments.

Unit-II

Analytical Statistics: - Bivariate data, Scatter diagram, Simple correlations and linear regression. Their properties and applications. Curve fitting, linear and second degree curve and their applications. Associations of attributes: - Contingency table and coefficients of contingency and their interpretations.

Unit-III

Random vectors, joint distribution, joint M. G.F., Independence of random variables. Multinomial distributions and its mean vector and variance and co-variance matrix, bivariate normal distributions, conditional expectation and conditional variance. Its marginal and conditional distributions.

Unit-IV

Sampling distributions of Statistics: sampling distribution of functions of independent observations from univariate normal distributions such as linear and quadratic functions, Derivations of Chi- square, t and f distributions and their applications

Books Recommended:¬

(1) Yule, G.U and Kendall; M.G. (1953):- An introduction to theory of statistics,Charles Griffin.
(2) Rohategi; VK. and others: - Introduction to theory and Mathematical statistics,Wiley.
(3) Roo; C.R. (1975):- Linear Statistical inference and its applications; Wiley.

PROBABILITY-I

MSC-413 **4CH**

Objective: To understand the uncertain occurrence situations with logical manner.

CO-1	Remember and understand the basic concepts/Principles of Probability-I
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Algebra of sets, Fields and Sigma fields, Llimits of sequence of subsets, Sigma field generated by a class of subsets, Borel fields. Probability space, continuity of probability measure.

Unit-II

Sample space, Probability axioms, Conditional probability, Independence of events. Bayes' theorem, Real and vector valued random variables, Distribution function, Discrete and continuous random variables, Distribution of L.V.S. Marginal and conditional distribution. Independence of random variables.

Unit-III

Poisson theorem, Interchangeable events and their limiting properties, Expectation of a random variable. Linear properties of expectations. Conditional expectation, Moment generating function. Moment inequalities. Characteristic function and its properties.

Unit-IV

Convergence of a sequence of random variables, Convergence in distribution, Convergence in probability, Almost sure convergence and Convergence in quadratic mean and their interrelations. Monotone and dominated convergence theorem, Central limit theorem: Lindberg-Levy and Demoivre-Lapalce theorem.

Books Recommended:

1. Bhat, B.R. (1985): Modern probability theory (Wiley).
2. Billingsley, P. (1986): Probability and measure (Wiley).
3. Feller, W. (1969): Introduction to probability theory and applications, Vol . II (Wiley)
4. Rohatgi, V.K. (1976): Introduction to theory of probability and mathematical Statistics (Wiley).
5. H.G.Tucker(1967) : A graduate course in probability theory (AP)
6. Y.S.Chow and H Teicher(1979) : Probability theory (Springer-Verlag),

LINEAR ALGEBRA AND NUMERICAL ANALYSIS

MSC- 414 **4 CH**

Objective: To learn the basic ideas of abstract algebra and techniques with proof in pure mathematics and further, it can be use in many other courses. To provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration.

CO-1	Remember and understand the basic concepts/Principles of Linear Algebra and Numerical Analysis
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Vector Spaces, Subspaces. Linear independence, Basis, Dimensions, Calculus of subspaces, Algebra of matrices, Operation on matrices, Properties of matrix, operation and special structure. Rank ,row space,column space and inverse of a matrix. Rank factorization and rank of a sum and projectors. Elementary operation, Echolon, normal and Hermite canonical forms, linear equations.

Unit-II

Inner product, norm, orthogonality and orthogonal basis.Characteristic roots of real matrices, right and left characteristic vectors, Eigen values and Eigen vectors. Independence of characteristic vectors corresponding to distinct characteristic roots. Generalized inverse. Definition of a real quadratic form, Classification of quadratic forms.

Unit-III

Root finding using Newton-Raphson, Secant, Regula-Falsi methods and their convergence, Newton's method for system of nonlinear equations. Interpolation - Newton's formulae, Lagrange, Hermite, Spline interpolation with error analysis. Numerical differentiation.

Unit-IV

Numerical integration - Newton-Cotes formulae - open and closed type -Trapezoidal, Simpson and Weddle rules, Gaussian quadrature formulae -Gauss-Laguerre, Gauss-Hermite integration, Transcendental Algebraic equations- Gauss elimination, Jacobi, Gauss-Seidel, relaxation methods and their convergence.

Books Recommended:

1. Rao, A.R. and Bhimasankaram,P .(2000): Linear Algebra, Hindustan Book Agency, New Delhi.
2. Scoule, S.R. (1982): Matrix Algebra Useful for Statistics, John Wiley & Sons.
3. Rao, C.R. (1995): Linear Statistical Inference and its Applications (Wiley Eastern).
4. Hohn, F .E. (1973): Elements of Matrix Algebra, McMillan.
5. M.K. Jain, S.R.K. Iyengar, R.K. Jain (1995): Numerical Methods for Scientific and Engineering Computation, Willey Eastern Ltd, New Delhi.

DATA STRUCTURE AND PROGRAMMING IN C

MSC-415 **4CH**

Objective: To teach programming (with an emphasis on problem solving) and introduce elementary data structures.

CO-1	Remember and understand the basic concepts/Principles of Data Structure and Programming in C
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Introductory concepts, C fundamentals, Data types, Constant and variables, Operators, Operations and Expression, Data input and output, Control statements, Loops, Do loop, Do While Loop, For Loop, Switch case statement, break and continue statement

Unit-II

Overview of Functions, built in and user defined functions, recursive function, Function call by value and call by reference, Arrays and it's applications, Strings, Pointers, Structures and Unions, Data Files.

Unit-III

Time and space complexity of algorithm, Representation of stack and queue using arrays and it's operations, Conversion of Infix to Postfix expression, Evaluation of Postfix expression using stack. Single linked list and it's operations, Doubly linked list and it's operations

Unit-IV

Binary Tree representation, Binary Tree traversal methods and it's algorithm, Binary search tree and it's operations, Graph representation, Adjacency matrix, Depth first search, Breadth first search, Sequential and Binary Searching, Bubble sort, selection sort,

Books Recommended:

1. Balguruswamy E.: Programming in ANSI C; Tata-McGraw Hill New Delhi
2. Byron S. Gottfried: Theory and Problems of Programming wih C; Tata- McGraw Hill Edition (Schaum's Outline Series)

LABORATORY IN DATA STRUCTURE AND PROGRAMMING IN C

MSC-416 **2 CH**

Objective: Use of MS EXCEL to draw graphs, diagrams, charts, classification and tabulation of data, frequency distribution, computation of summary statistics and analytical statistics.

CO-1	Remember and understand the basic concepts/Principles of Lab in Data Structure and Programming in C
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Revision of C programming. Write following programs in both the languages.

1. Calculation of summary statistics (Mean, deviation, Median, Max, Min, Standard, near absolute Deviation, etc.)
2. Calculation of regression and correlation coefficients.
3. Numerical Integration by Simpson's Rule.
4. Preparation of frequency distributions. Random.
5. number generation.
6. Matrix Inversion.
7. Calculation of determinant.
8. Solution of simultaneous linear equations.
9. Fitting of curves and lines.
10. Formation of 2x2 contingency table. Create a linked list (i) Traverse it (ii) Insert a node (a) in the middle, (b) at beginning, (c) at the end. Join 2 linked list.
11. Search from a linked list.
12. Sorting of linked list.
13. Delete a node from a linked list. (i) Delete from beginning. (ii) Delete from middle (iii) Delete list node.
14. Polynomial representation.
15. Polynomial evaluation.
16. Addition of polynomial
17. Push and pop operation of stack.
18. Insert and delete operation of queue.

STATISTICAL METHODS-II

MSC-421 **4 CH**

Objective: To identify appropriate sources of data and to perform basic demographic analyses using various techniques across populations. To develop a deeper understanding of the linear and non-linear regression model and its limitations. To develop scientific view to analyze the industrial data about specific perspective. To learn the statistical quality control techniques used in industries such as control charts, acceptance sampling plans etc.

CO-1	Remember and understand the basic concepts/Principles of Statistical Methods-II
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Statistical data-: types, sources and their methods of collection, Statistical system in India and Orissa; Population statistics, Agricultural statistics, Functions of NSSO and CSO. Vital statistics-Rates, Ratios of Births and Deaths, Their merits, demerits, and relative comparisons.

Unit-II

Statistical Quality Control- Basic concept of SQC, Statistical Quality Control charts (X, R, P C. Acceptance sampling plans (single and double only).
Reliability- Hazards rate, IFR and DFR. Failure time distribution¬Normal, Exponential and Weibull. Reliability of systems.

Unit-III

Theory of residues and their properties. Multiple and partial correlation coefficients. Their relationship and properties. Rank correlation coefficient and correlation ratio. Their applications. Test of significance of multiple, partial and simple correlation coefficient. .

Unit-IV

statistics- Distribution of range, smallest and biggest observations, distribution of rth order statistics and their functions, probability integral transformation,
Curve fitting- Polynomial, Orthogonal, Exponential, Logarithmic and Growth curves. Their applications.

Books Recommended:

1. Introduction to Theory and Mathematical Statistics (1988) - Wiley Rohatgi,
2. V.K Statistical Theory of Reliability and Life Testing (1975) - Holt, Revehowlv Winston Barlow, R.E. And Proschan, F.
3. An Introduction to Theory of Statistics - Charles Griffiu Yale, G.U. and Kendall, M.G. (1953)
4. Probability and Statistics with Engineering and Computer Science Applications (2005) – Kalyani Swain, A.K.P.C.

STATISTICAL INFERENCE - I

MSC-422 **4 CH**

Objective: To derive suitable point estimators of the parameters of the distribution of a random variable and give a measure of their precision. To perform Test of Hypothesis as well as obtain MP, UMP tests. To derive suitable point estimators of the parameters of the distribution of a random variable and give a measure of their precision. To learn computational skills to implement various statistical inferential approaches.

CO-1	Remember and understand the basic concepts/Principles of Statistical Inference-I
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Parametric Point estimation: properties of estimators – Unbiasedness, Sufficiency, Completeness. Uniformly minimum variance unbiased estimators. Rao-Blackwell theorem. Cramer-Rao inequality. Fishers Information measure and its properties.

Unit-II

Asymptotic properties of estimators- Consistency and Efficiency. Their relationship and properties. Some special classes of distribution admitting complete sufficient statistics. Methods of estimation- Method of maximum likelihood estimation and it's properties. Methods of moments and it's properties.

Unit-III

Bayesian estimation, prior distributions, posteiror distributions, loss function and risk function, Quadratic loss function and other common loss functions. Bayes and minimax estimators and their inter relationship. Properties of Bayes and minimax estimators.

Unit-IV

Theory of Least squares. Gauss-Markov set-up, Normal equations, least squares estimators of linear parametric functions. Variances and Co¬variances of the estimators of linear parametric functions. Estimation of error vanance.

Books Recommended:

1. Linear Statistical Inference and its Applications (1973) - Wiley Eastern. Rao, C.R.
2. An Outline of Statistical Theory - Vol-II, World Press, Calcutta Goon, M.A., Gupta, M.K., and Dasgupta, B
3. Introduction to Theory of Probability and Mathematical Statistics (1970) - Wiley Rohatgi, V.K

SAMPLING METHODS

MSC-423 **4 CH**

Objective: To Learn variety of probability and non-probability sampling methods for selecting a sample from a population.

CO-1	Remember and understand the basic concepts/Principles of Sampling Methods
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Basic concepts in survey sampling. Major steps in sample survey. Basic methods of sample selection. Simple random sampling with and without replacement. Probability proportional to size sampling with and without replacement. DesRaj, murthy, and Rao Harthy cosmic estimation. Harvetz-Thompson estimator and its properties.

Unit-II

Stratification: Allocation problems and estimation problems, formation of strata and number of strata. Double sampling stratification, systematic sampling, Cluster sampling, Multi-stage sampling.

Unit-III

Use of supplementary information for estimation, ratio, product and regression estimators with their properties and generalizations. Double sampling reudeues, Estimators with mutli-auxiliary variables.

Unit-IV

Super-population regression models. Non-sampling error - response and non-response errors and their control, randomised response technique. Variance estimation Techniques.

Books Recommended:

1. Des, Raj and Chandok, P. (1998): Sample Survey Theory (Narosa).
2. Sukhatme, P.V; Sukhatme, B.V. and Asok, C. (1984): Sampling Theory of Surveys with Applications, Indian Soc. of Ag. Stats., New Delhi.
3. Cochran, W.G. (1984): Sampling Technique (Wiley).
4. Swain, A.K.P .C. (2003): Finite Population Sampling - Theory and Methods, South Asian Publishers.

APPLIED STATISTICS

MSC-424 **4CH**

Objective: To learn and develop scientific view to understand the time series data and its analysis.
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CO-1	Remember and understand the basic concepts/Principles of Applied Statistics
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

The Problem of Index Numbers, Calculation of Indices, Errors in Index numbers formulae, Different test of good index number, Cost of living Index number.

Unit-II

Decomposition of a Time series, Measurement of Trends, Seasonal Variation & Cyclic Components, Adoptive forecasting.

Unit-III

Deterministic and Stochastic Model, Stationary stochastic process in time series and stationary time series, Forecasting of future value of a time series, Different types of Stochastic Time series model.

Unit –IV

Auto covariance generating function of a general linear process, The spectral density function, Properties of the models, Moving Average Process, Auto covariance Function and Variance Function, Diagnostic Checking, Forecasting(Three form of forecast function, conducting and updating of forecast function)

Books Recommended:

1. Mukhopadhaya,P.(2005) : Applied Statistics, Books & Allied(P) Ltd.
2. Anderson, TW(1971) : Statistical Analysis of Time Series, Willey.
3. Box,GEP and Jenkins, GM and Reinsel,CG(1994) : Time Series Analysis- Forecasting and Control- Pearson Education.

PROBABILITY-II

MSC-425 **4CH**

Objective: to provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science like disease modeling, climate prediction and computer networks etc.

CO-1	Remember and understand the basic concepts/Principles of Probability-II
CO-2	Analyze the Various Concepts to understand them through case studies

CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Definition and properties of Lebegue integral, Monotone Convergence Theorem, Indefinite integral, Uniform integrability, Jensen's, Holder's, Cauchy and Schwartz, Luaponov inequalities.

Unit-II

Levy inversion Theorem and Levy continuity Theorem. Conditional expectation and properties, Three series theorem for independent random variables.

Unit-III

Bernoulli's Theorem, Borel Theorem, Borel-Canteili Lemma. Convergence of Distribution Functions. Reily-Compactness Theorem, Reily-Bray Theorem.

Unit-IV

Central Limit Theorem for binomial random variables. Law of Large Numbers and Law of the Iterated Logarithm.

Recommed Books:

1. Same as for Prob. Theory-I

OPTIMIZATION TECHNIQUE-I

MSC-511 *4CH*

Objective: To develop the optimization techniques that will be useful in the personal and professional life.

CO-1	Remember and understand the basic concepts/Principles of Optimization Technique-I
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Introduction to LPP, Mathematical fomulation, Standard form and canonical form, Graphical solution, Simplex Method including Big-M and two phase method, Degeneracy, Solution of simultaneous equations and inver~ion matrix by simplex method.

Unit-II

Duality in Linear Programming, Duality Theorems, Dual simplex method with justifications, Transportation and Assignment algorithms.

Unit-III

Introduction to sensitivity analysis, variation in cost and requirement vectors, coefficient matrix and applications, Parametric programming and revised siplplex methods.

Unit-IV

Game Theory, Two persons zero sum game, Maxmin Minimax principle, Mixed strategy, Graphical solutions, Dominance Property, Arithmatic Method and general solution.

Books recommended:

2. Kambo.,NS(1991) : Mathemetical Pro.gramming Tech., Affiliated
3. East-West press. Hadley, G. (1987): Linear Programming
4. Taha .A(l992) :.Operations Research, 5th Ed. (McMillan)

STATISTICAL INFERENCE-II

MSC-512 **4CH**

Objective: To learn computational skills to implement various statistical inferential approaches. To learn types of errors, non-parametric tests. ·

CO-1	Remember and understand the basic concepts/Principles of Statistical Inference-II
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Basic concept of test of Hypothesis, Neyman-Pearson Lemma. Most powerful (MP) test Application of Neyman-Pearson Lemma for the test of simple hypothesis, Generalised Neyman-Pearson Lemma Uniformly most powerful (UMP) test. UMPU tests. Similar Regions, Application of Neyman- Pearson Lemma for the test of composite hypothesis.

Unit-II

Non-parametric tests:- One sample problem, Goodness of fit, Kolmogrov test, Sign test, Run test, U statistic and its properties. Two sample problem- Kolmogrov-Smirnov test and its consistency, run test, Location problem, Wilcoxon-Mann Whitny test, median test, and their asymptotic normality.

Unit-III

Likelihood Ratio Test (LRT), Consistency of the test, Asymptotic distribution of LRT, Application of Likelihood Ratio Test (LRT), Comparison between Likelihood Ratio Test and Neyman-Pearson test procedure.

Unit-IV

Sequential probability ratio test (SPRT), procedures, Properties of SPRT, Fundamental identity of SPRT, Wald 's fundamental Identity. OC and ASN functions.

Books recommended :

1. An Outline of Statistical Theory - Vol-II, World Press, Calcutta Goon, M.A., Gupta, M.K., and Dasgupta, B
2. Non-parametric Methods in Statistics - Second Edition, Marcel Dekker Gibbons, J

3. Linear Statistical Inference and its Applications (1973) - Wiley Eastern. Rao, CR

DISCRETE MATHEMATICAL STRUCTURE

MSC-513 **4-CH**

Objective: To provide students with an overview of discrete mathematics. Students will learn about topics such as logic and proofs, sets and functions, probability, recursion, graph theory, matrices, Boolean algebra and other important discrete math concepts.

CO-1	Remember and understand the basic concepts/Principles of Discrete Mathematical Structure
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Review of set theory, Relation, Function, Methods of proof and problem solving strategies, Logic, FW1damentals of mathematical induction.

Unit-II

Basic terminology, Directed and Undirected graph, Paths and Circuits, Multi graph, Weighted graphs, Eulerian paths and circuits, Hamiltonian Paths and circuits, Trees, Rooted tree, Binary tree, Spanning tree, Cut set, Minimal spanning tree .

Unit-III

Basic ideas of Semi-groups and groups and application to coding,. Generating function and Recurrence relation as advanced counting techniques.

Unit-IV

Boolean Algebras: Lattices and Algebraic systems, Basic Properties of Algebraic systems defined by Lattices, Distributive and complemented Lattices, Boolean lattices and Boolean algebras, Uniqueness of finite Boolean algebra, Boolean function and Boolean expressions.

Books for Reference:

1. Discrete Mathematics for Computer scientists and Mathematician -: Mott, Kandell, Baker, Prentice Hall of India.
2. Applied Discrete Structure for Computer Science -: Doerr and Levasseur, Gagotia Publication PVT Ltd.
3. Elements of Discrete Mathematics -: Liu, Mc Grow Hill (International student edition)
4. Discrete Mathematics -: Nanda, Allied publication.

STOCHASTIC MODELING

MSC-514 **4CH**

Objective: To learn and to understand stochastic processes predictive approach. · To develop an ability to analyze and apply some basic stochastic processes for solving real life situations.

CO-1	Remember and understand the basic concepts/Principles of Stochastic Modeling
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Definition and classification of stochastic processes, Random walk, gambler's ruin problem, Poisson process, Markov chain - transition probabilities.

Unit-II

Classification of states of a markov chain, Periodicity, Recurrence, Basic limit theorems of markov chain, Absorption probability, Criteria for recurrence.

Unit-III

Birth and death processes, renewal processes.

Unit-IV

Martingale-Elementary results. Brownian Motion-Definition, Continuity of paths. Branching Processes-Definition, generating function relation.

Books Recommended:

1. Karlin, S and Taylor, H.M (1975): A First Course in Stochastic Processes. Academic Press.
2. Bhat, B.R.(2000): Stochastic Models: Analysis and application, New Age International Publication.

MSC 516 (C) STATISTICAL QUALITY CONTROL AND RELIABILITY

Objective: To learn the statistical quality control techniques used in industries such as control charts, acceptance sampling plans etc. To learn some advanced control charts, capability indices and the concept of six-sigma. To learn the reliability theory and to distinguish censored and uncensored data. To visualize and communicate time-to event data, to fit and interpret failure time model.

CO-1	Remember and understand the basic concepts/Principles of Statistical Quality Control & Reliability
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Acceptance sampling plans: classification and general properties of sampling plans by variables. Defmitions of O.C. and A.S.N. functions, AOQL and ATI. Single and double sampling plans, sequential sampling plan.

Unit-ll

Reliability concepts and measures components and systems, coherent systems, reliability of coherent systems, cuts and paths, life distributions, survival functions, Hazard rate, Hazard function and residual life time, survival function of residual life time, mean residual life function, one-one correspondence of these functions, common life distributions, Exponential, Weobull, Gama, Malhehom, Pareto, Releigh, Log-Normal etc.

Unit-III

Notation of aging: IFR, IFRA, DMRL, NBU, BBUE classes and their duals, exponential distribution and its no-aging properties, aging properties of other common life distribution, closure under formation of coherent structures, controlution and mixture of these cases.

Unit-IV

Reliability growth models, probability plotting techniques, parameteric inference from various life distributions, moments and maximwn likelihood estimation, likelihood ratio tests, tests based on MLE (Rao and Wald techiques) Type-I, Type-II and random censoring schemes, likelihood functions based on these sampling schemes, estimation based on these schemes for various parametric models.

Books Recommended:

1. RE. Ballo and F. Proschan: Statistical Theory of Reliability and Life Testing. Holt, Reinhart and Wonston
2. RC. Miller: Survival Analysis. John Wiley.
3. J.L. Bain: Statistical Analysis of Reliability and Life Testing Models. Morcel Bekker.
4. Gupta and Kapoor: Applied Statistics.
5. E.L. Groant and RS. Leavenworth: Statistical Quality Control. Sixth Edn., McGraw Hill Publication.

TIME SERIES AND FORECASTING

MSC-521 *4 CH*

Objective: To learn and develop scientific view to understand the time series data and its analysis. To learn stationary and non-stationary, and seasonal and nonseasonal time series models. Learn to estimate model parameters and compare different models developed for the same dataset in terms of their estimation and prediction accuracy.

CO-1	Remember and understand the basic concepts/Principles of Time Series and Forecasting
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Classical techniques. of time series analysis. Time series as discrete parameter stochastic process. Auto. covariance and auto correlation functions and their properties.

Unit-II

Stationary and Non stationary models. Detailed study of stationary processes - moving average (MA), Auto-regressive (AR), ARMA, AR integrated MA (ARIMA) models.

Unit-III

Spectral properties of stationary models, Forecasting, Periodgram and Correlogram.

Unit-IV

Linear non-stationary models-The auto-regressive integrated moving Average problem (ARIMA), three explicit forms of ARIMA, integrated moving average problems.

Books Recommended:

1. Box, GEP and Jenkins, G.M. (1976): Time Series Analysis - Forecasting and Control, Holdenday, Sanfransico.
2. Anderson, T.W. (1971): The Statistical Analysis of Time Series. Wiley.
3. Brockwell, P .J. and Davis, RA ( ): Time Series: Theory and Methods, 2nd Ed., Springer- Verlas.

MULTIVARIATE ANALYSIS

MSC-522 **4 CH**

Objective: To learn and develop scientific view to deal with multidimensional datasets and its uses in the analysis of research data. · To understand the extensions of univariate techniques to multivariate frameworks and learn to apply dimension reduction techniques used in the data analysis.

CO-1	Remember and understand the basic concepts/Principles of Multivariate Analysis
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I:

Multivariate normal distribution: probability density function, moment generating function. Distribution of linear and quadratic form of normal variables, Marginal and conditional distributions. Multiple Regression. Multiple and partial correlations and related tests.

Unit-II

Maximum likelihood estimators of parameters of multivariate normal distribution and their sampling distributions. Wishart distribution and its properties.

Unit-III

Tests on mean vector for one or two multivariate normal populations. Hotellings T^2 and Mahalanobes D^2 distributions (null case only) and related confidence regions. Rao's U -statistic au de to distribution, Introduction to canonical variables and canonical correlations. Cluster Analysis.

Unit-IV

Principal component analysis. Disciminant Analysis, Classification problems. Methods and applications of MANOV A (Derivation not included).

Books Recommended:

1. Anderson, T.W. (1984): Introduction to Multivariate Analysis, Wiley.
2. Kshirsagar, A.M. (1983): Multivariate Analysis, Marcel Dekkar.
3. Morrison, D.F. (1990): Multivariate statistical methods, McGraw Hill.
4. Rao, C .R. (1995): Linear statistical Inference and its Applications (Wiley).
5. Johnson, R.A. and Wichern, D.W. (1988): Applied Multivariate Statistical Analysis (Prentice Hall).

DESIGN AND ANALYSIS OF EXPERIMENTS

MSC-523 **4 CH**

Objective: To learn the basic principles in the design of simple experiments. · To learn different tests for comparing pairs of treatment means, ANCOVA, factorial experiments, fractional factorialexperiments, confounding, BIBD, PBIBD with solving real life examples. · To learn the applications of different designs in agriculture.

CO-1	Remember and understand the basic concepts/Principles of Design and Analysis of Experiments
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Linear estimation. Theory of least squares. Gauss Markov Theorem. Normal equations, least square estimators of linear parameteric functions. Variance and covariance of estimators.

Analysis of variance - fixed, random and mixed models. Analysis of variance. One-way and two-way classification with unequal and equal number of observation per cell. Basic principles ofdesigns - CRD, RBD and Latin square and their analysis - missing plot technique. Connectedness,balance, orthogonality.

Unit-II

Factorial experiments – 2^n and 3^2, 3^3 Presentation of main effects and interactions. Analysis. Asymmetrical factorial experiments.

Unit-III

Confounding - Total confounding of 2^n design in 2^P blocks, partial confounding in 2^P blocks. Fractional factorial experiments and their analysis, Total and partial confounding in 3^2 and 3^2 designs. Split plot designs.

Unit-IV

Incomplete block designs - BIBD and Lattice designs - Construction and analysis. Concept of rotable design. Control composite design. Response surface methodology.

Books Recommended:

1. Kshirasagar, A.M. (1983): Linear Models, Marcel Dekkar.
2. John, P. W.M. (1971): Linear Models, Wiley.
3. Montgomery, D.C. (2001). Design and Analysis of Experiments, Wiley.
4. Das, M.N. and Giri, N.C. ( ): Design of Experiments.

MSC526 (J) OPTIMIZATION-II

Objective: To learn the mathematical formulation of complex decision-making problems andarrives at optimal or near-optimal solutions using different techniques of operations research.

CO-1	Remember and understand the basic concepts/Principles of Optimization-II
CO-2	Analyze the Various Concepts to understand them through case studies

CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Unit-I

Markov process, transition matrix, transition diagram, construction of transition matrix, n-step transition prob. Equilibrium condition, Markov analysis algorithm, Nerwork Scheduling by PERT/CPM.

Unit-II

inventory decision, cost associated with inventory, factors affecting inventories, EOQ, deterministic inventories with no shortage and shortage, inventory with uncertain demand, systemof inventory control, Probabilistic inventory problems.

Unit-III

Queuing system, Operating characteristic, probability distribution, Classification of queuing models, transient and steady state, Poisson and non Poisson Queuing System, Cost model in queuing, Queuing control, queuing Theory and Inventory control.

Unit-IV

Formulation of Non Linear programming, Constrained optimization With equality constraint and inequality constraint, saddle point and NLLP. Graphical solution, Kuhn- Tucker conditions, Quadratic Programming,Wolfe's and Beales' method.

Books Recommended:

-I

Books recommended:

1. Kambo.,N.S. (1991) : Mathemetical Pro.gramming Tech., Affiliated
2. East-West press. Hadley, G. (1987): Linear Programming
3. Taha H.A(l992) :.Operations Research, 5th Ed. (McMillan)
4. Operations Research: Kanti Swarup; Gupta & Mohan (S. Chand)

MOC 248 Google Cloud Computing Foundations (MOOCs-1)

Objective: The course involves understanding concepts and perform hands-on training (via Qwiklabs platform) to practice the learning.

CO-1	Remember and understand the basic concepts/Principles of Google Cloud Computing
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Week 0 : Introduction to the course
Week 1 : So, What's the Cloud anyway? Start with a Solid Platform
Week 2 : Use GCP to build your Apps
Week 3 : Where do I store this stuff?
Week 4 : There's an API for that! You can't secure the Cloud right?
Week 5 : It helps to network!
Week 6 : It helps to network (continued)
Week 7 : Let Google keep an eye on things. You have the data, but what are you doing with it?
Week 8 : Let machines do the work

MOC 358 Soft Skills and Personality (MOOCs-2)

Objective: The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

CO-1	Remember and understand the basic concepts/Principles of Soft Skills and Personality
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1: Lecture 1: Introduction: A New Approach To Learning
Lecture 2: Planning And Goal-Setting
Lecture 3: Human Perceptions: Understanding People
Lecture 4: Types Of Soft Skills: Self-Management Skills
Lecture 5: Aiming For Excellence: Developing Potential And Self-Actualisation
Lecture 6: Need Achievement And Spiritual Intelligence

Week 2: Lecture 7: Conflict Resolution Skills: Seeking Win-Win Solution
Lecture 8: Inter-Personal Conflicts: Two Examples
Lecture 9: Inter-Personal Conflicts: Two Solutions
Lecture 10: Types Of Conflicts: Becoming A Conflict Resolution Expert
Lecture 11: Types Of Stress: Self-Awareness About Stress
Lecture 12: Regulating Stress: Making The Best Out Of Stress

Week 3: Lecture 13: Habits: Guiding Principles
Lecture 14: Habits: Identifying Good And Bad Habits
Lecture 15: Habits: Habit Cycle
Lecture 16: Breaking Bad Habits
Lecture 17: Using The Zeigarnik Effect For Productivity And Personal Growth
Lecture 18: Forming Habits Of Success

Week 4: Lecture 19: Communication: Significance Of Listening
Lecture 20:Communication: Active Listening
Lecture 21:Communication: Barriers To Active Listening
Lecture 22:Telephone Communication: Basic Telephone Skills
Lecture 23:Telephone Communication: Advanced Telephone Skills
Lecture 24: Telephone Communication: Essential Telephone Skills

Week 5: Lecture 25: Technology And Communication: Technological Personality
Lecture 26: Technology And Communication: Mobile Personality?
Lecture 27: Topic: Technology And Communication: E-Mail Principles
Lecture 28: Technology And Communication: How Not To Send E-Mails!
Lecture 29: Technology And Communication: Netiquette
Lecture 30: Technology And Communication: E-Mail Etiquette

Week 6: Lecture 31: Communication Skills: Effective Communication
Lecture 32: Barriers To Communication: Arising Out Of Sender/Receiver's Personality
Lecture 33: Barriers To Communication: Interpersonal Transactions

Lecture 34: Barriers To Communication: Miscommunication
Lecture 35: Non-Verbal Communication: Pre-Thinking Assessment-1
Lecture 36: Non-Verbal Communication: Pre-Thinking Assessment-2

Week 7: Lecture 37: Nonverbal Communication: Introduction And Importance
Lecture 38: Non-Verbal Communication: Issues And Types
Lecture 39: Non-Verbal Communication: Basics And Universals
Lecture 40: Non-Verbal Communication: Interpreting Non-Verbal Cues
Lecture 41: Body Language: For Interviews
Lecture 42: Body Language: For Group Discussions

Week 8: Lecture 43: Presentation Skills: Overcoming Fear
Lecture 44: Presentation Skills: Becoming A Professional
Lecture 45: Presentation Skills: The Role Of Body Language
Lecture 46: Presentation Skills: Using Visuals
Lecture 47: Reading Skills: Effective Reading
Lecture 48: Human Relations: Developing Trust And Integrity

Books and references

1. Dorch, Patricia. *What Are Soft Skills*? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. *Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders*. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. *The Hard Truth about Soft Skills*. London: HarperCollins E-books, 2007.
4. Petes S. J., Francis. *Soft Skills and Professional Communication*. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. *The EQ Edge: Emotional Intelligence and Your Success*. Canada: Wiley & Sons, 2006.

MOC 366 Python for Data Science (MOOCs-3)

Objective: The course aims at equipping participants to be able to use python programming for solving data science problems.

CO-1	Remember and understand the basic concepts/Principles of Python for Data Science
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1: BASICS OF PYTHON SPYDER (TOOL)
Introduction Spyder
Setting working Directory
Creating and saving a script file
File execution, clearing console, removing variables from environment, clearing environment
Commenting script files
Variable creation
Arithmetic and logical operators
Data types and associated operations

Week 2:
Data Structures
1. Lists
2. Tuples

3. Dictionary
4. Sets

Numpy

1. Array
2. Matrix and associated operations
3. Linear algebra and related operations

Week 3:

Pandas dataframe and dataframe related operations on Toyota Corolla dataset

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

Control structures using Toyota Corolla dataset

1. if-else family
2. for loop
3. for loop with if break
4. while loop

Functions

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income

Books and references

1. Introduction to linear algebra - by Gilbert Strang
2. Applied statistics and probability for engineers – by Douglas Montgomery 3. Mastering python for data science, Samir Madhavan

MOC 475 Software Testing (MOOCs-4)

Objective: This course will cover various techniques for test case design, as used for testing of software artifacts including requirements, design and code. We will discuss algorithms and techniques for test case design based on graphs, logic, syntax of programming languages and on inputs. Special techniques for testing object-oriented features and web applications will also be discussed. The course will end with symbolic testing techniques. These broadly will cover test cases for both white-box and black-box..

CO-1	Remember and understand the basic concepts/Principles of Software Testing
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1: Techniques and algorithms for test case design: Graphs based testing- structural coverage criteria.
Week 2: Graphs based testing: Data flow coverage criteria
Week 3: Graphs based testing: Data flow coverage criteria
Week 4: Graphs coverage for source code, design elements and requirements
Week 5: Techniques and algorithms for test case design: Logic based testing- Predicates, logic based coverage criteria
Week 6: Specification based logic coverage, logic coverage on finite state machines
Week 7: Input space partitioning: Input domain modeling, combination strategies criteria
Week 8: Syntax based testing: Coverage criteria based on syntax, mutation testing
Week 9: Test case design (as learnt above) applied to object-oriented applications
Week 10: Test case design (as learnt above) applied to web applications
Week 11: Symbolic testing
Week 12: Concolic testing, Conclusion

MC 530 Financial Accounting (MOOCs-1)

Objective: The basic objective behind this course is to provide a conceptual understanding of double-entry system accounting process to the target learners. This course will facilitate understanding of key concept associated with finance and accounting and will also help the learners to understand the double-entry accounting process. Simultaneously the course will also offer hands on to the learners through structured numerical problems, there by meeting the basic objective of a clear understanding of financing and double-entry accounting.

CO-1	Remember and understand the basic concepts/Principles of Financial Accounting
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Weeks Weekly Lecture Topics

Week 1
1. An Introduction to Financial Accounting Part – I
2. An Introduction to Financial Accounting Part - II
3. Double Entry System of Accounting : An Introduction

Week 2
4. Journalizing Part -I
5. Journalizing Part -II
6. Double Entry Accounting Process and Introduction to Journal

Week 3
7. Sub-Division Of Journal Part - I
8. Sub-Division Of Journal Part - II
9. Cash Book Part - 1

Week 4
10. Cash Book (Part - II) Three Column Cash Book
11. Cash Book (Part - III) Petty Cash Book
12. Double Entry Accounting Process(Stage - II) Ledger Posting Part-I

Week 5
13. Double Entry Accounting Process(Stage - II) Ledger Posting Part- II
14. Double Entry Accounting Process (Stage – III) - Summarizing
15. Bank Reconciliation Statement - I

Week 6 16. Bank Reconciliation Statement - II
17. Errors And Their Rectification Part - I
18. Errors And Their Rectification Part - II

Week 7 19. Errors And Their Rectification Part - III
20. Accounting Process Stage –4 Finalizing-I
21. Accounting Process Stage – 4 Finalizing - II

Week 8 22. Accounting Process Stage – 4 Finalizing - III
23. Adjustments In Final Accounts Part - I
24. Adjustments In Final Accounts Part - II
25. Adjustments In Final Accounts Part - III

Week 9 26. Adjustments In Final Accounts Part - VI
27. Adjustments In Final Accounts Part - V

Week 10 28. Preparation Of Final Accounts With Adjustments, Part - I
29. Preparation Of Final Accounts With Adjustments, Part - II
30. An Introduction To Depreciation Accounting

Week 11 31. Depreciation Accounting : Fixed Instalment Method
32. Depreciation Accounting : Fixed Instalment Method (Numerical Problem)
33. Depreciation Accounting : Written Down Value Method

Week 12 34. Depreciation Accounting : Written Down Value Method(Numerical Problem)

Books and references

- Maheshwari & Maheshwari (2008), Financial Accounting, Vikas Publishing House Pvt. Ltd., New Delhi
- Mukherjee & Hanif (2005), Financial Accounting, Tata McGraw Hill Publication Company, New Delhi
- Horngren et Al. (2005), Introduction toFinancial Accounting, Pearson Prentice Hall Publication

MC 562 MOOCs-3 (Decision Support Systems for Managers)

Objective: This course is designed with the purpose of making the participant an effective user as well as a builder of Decision Support systems (DSS). The course is application oriented and particularly focused towards solving semi-structured decision problems faced by managers in manufacturing and service organization

CO-1	Remember and understand the basic concepts/Principles of Decision Support Systems for Managers
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1: Introduction to Decision Support Systems (DSS) – Different types of Managerial Decision Problems and the Role of a DSS in solving them. Management Information System versus DSS, Range of Capabilities of a DSS, Components of a DSS, Examples of DSS, Basics of DSS Design Cycle.

Week 2: Models in Decision Support Systems – What is a Model? Classification of Models, Purpose of Modeling in DSS, Solution Techniques: Optimization, Heuristics, and Simulation, Traditional approach to modeling and its weaknesses, Desirable features for Models in DSS, Models and Managers: The Concept of a Decision Calculus'.

Week 3: Decision Support System for Evaluation of Investment Proposals
Week 4: Decision Support System for Materials Managers
Week 5: Decision Support System for Forecasting Demand for Independent Items – single and multi-period forecasting, forecasting for products with intermittent demand
Week 6: Decision Support System for Determination of Product Mix – product choice and bundling decisions, product mix decisions
Week 7: Decision Support System for Production Distribution Problem for a Multi-Product and a Multi-Unit Organization
Week 8: Decision Support System for Vehicle Scheduling
Week 9: Decision Support System for Customer Centric Value Driven Decisions – designing the service system
Week 10: Decision Support System for Human Resources Function
Week 11: Decision Support System for Distribution Network Design in a Supply Network
Week 12: Decision Support System for Pricing Decisions

Books and references

1.Peter G.W. Keen and Michael S. Scott Morton, 'Decision Support Systems: An Organizational Perspective' Addison-Wisely Publishing Company
2.Mc Cosh, Andrew M, and Michael S. Scott Morton., "Management Decision Support Systems', The Mac Millan Press Limited, 1978.
3.Sprague, Ralf H., Carlson, Eric D., "Building Effective Decision Support Systems". Prentice Hall Inc., 1982.

MC 563 MOOCs-3 (Data Science for Engineers)

Learning Objectives :

1. Introduce R as a programming language
2. Introduce the mathematical foundations required for data science
3. Introduce the first level data science algorithms
4. Introduce a data analytics problem solving framework
5. Introduce a practical capstone case study

Learning Outcomes:

1. Describe a flow process for data science problems (Remembering)
2. Classify data science problems into standard typology (Comprehension)
3. Develop R codes for data science solutions (Application)
4. Correlate results to the solution approach followed (Analysis)
5. Assess the solution approach (Evaluation)
6. Construct use cases to validate approach and identify modifications required (Creating)

Course layout

Week 1:
Course philosophy and introduction to R
Week 2:
Linear algebra for data science
1. Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse)
2. Geometric view - vectors, distance, projections, eigenvalue decomposition

Week 3:
Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)
Week 4:
Optimization
Week 5:
1. Optimization
2. Typology of data science problems and a solution framework
Week 6:
1. Simple linear regression and verifying assumptions used in linear regression
2. Multivariate linear regression, model assessment, assessing importance of different variables, subset selection
Week 7:
Classification using logistic regression
Week 8:
Classification using kNN and k-means clustering

Books and references

- INTRODUCTION TO LINEAR ALGEBRA - BY GILBERT STRANG
- APPLIED STATISTICS AND PROBABILITY FOR ENGINEERS – BY DOUGLAS MONTGOMERY

MOC 537 Big Data Computing (MOOCs-2)

Objective: The course is suitable for all UG/PG students and practicing engineers/ scientists from the diverse fields and interested in learning about the novel cutting edge techniques and applications of Big Data Computing.

CO-1	Remember and understand the basic concepts/Principles of Big Data Computing
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1 : Introduction to Big Data
Week 2 : Introduction to Enabling Technologies for Big Data
Week 3 : Introduction to Big Data Platforms
Week 4 : Introduction to Big Data Storage Platforms for Large Scale Data Storage
Week 5 : Introduction to Big Data Streaming Platforms for Fast Data
Week 6 : Introduction to Big Data Applications (Machine Learning)
Week 7 : Introduction of Big data Machine learning with Spark
Week 8 : Introduction to Big Data Applications (Graph Processing)

Books and references

Text Book:

Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014

MOC 617 Cloud Computing (MOOCs-2)

Objective: This course will introduce various aspects of cloud computing, including fundamentals, management issues, security challenges and future research trends. This will help students (both UG and PG levels) and researchers to use and explore the cloud computing platforms.

CO-1	Remember and understand the basic concepts/Principles of Cloud Computing
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1: Introduction to Cloud Computing
Week 2: Cloud Computing Architecture
Week 3: Service Management in Cloud Computing
Week 4: Data Management in Cloud Computing
Week 5: Resource Management in Cloud
Week 6: Cloud Security
Week 7: Open Source and Commercial Clouds, Cloud Simulator
Week 8: Research trend in Cloud Computing, Fog Computing

Books and references

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India,2010

MOC 632 Deep Learning (MOOCs-3)

Objective: In this course we will start with traditional Machine Learning approaches, e.g. Bayesian Classification, Multilayer Perceptron etc. and then move to modern Deep Learning architectures like Convolutional Neural Networks, Autoencoders etc. On completion of the course students will acquire the knowledge of applying Deep Learning techniques to solve various real life problems.

CO-1	Remember and understand the basic concepts/Principles of Deep Learning
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Course layout

Week 1: Introduction to Deep Learning, Bayesian Learning, Decision Surfaces
Week 2: Linear Classifiers, Linear Machines with Hinge Loss
Week 3: Optimization Techniques, Gradient Descent, Batch Optimization
Week 4: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning
Week 5: Unsupervised Learning with Deep Network, Autoencoders
Week 6: Convolutional Neural Network, Building blocks of CNN, Transfer Learning
Week 7: Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Week 8: Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization
Week 9: Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc.
Week 10: Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc.
Week 11: LSTM Networks
Week 12: Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Books and references

1.Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press
2.Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

EL543 COMPUTER VISION & IMAGE PROCESSING

Course Objective: This course introduces fundamental concepts and techniques for imageprocessing and computer vision. Topics to be covered include image formation, image filtering, edge detection and segmentation, morphological processing,registration, object recognition, object detection and tracking, 3D vision, etc.

Course Outcome:

CO1: Understand the major concepts and techniques in computer vision and image processing

CO2: Analyses to understand state of the art technology in research in the field's computer vision and image processing.

CO3: Computer vision and image processing knowledge by designing and implementing algorithms to solve practical problems.

CO4: Project to prepare for research in computer vision and image processing and assignments to develop algorithms.

UNIT -I (10 Hrs.):

What Is Digital Image Processing? Application of Digital Image Processing. Fundamental Steps in Digital Image Processing. Components of an Image Processing System. Human Visual System, Image Sensing and Acquisition, Digital Image Representation: Image Sampling, Quantization. Image size, Image Resolution, Some Basic Relationships between Pixels. Linear and Nonlinear Operations. Low level and High level Image Processing,

UNIT -II (10 Hrs.):

Image Enhancement in Spatial Domain: Some Basic Gray Level Transformations. Histogram Processing. Enhancement Using Arithmetic/Logic Operations. Basics of Spatial Filtering. Smoothing Spatial Filters. Sharpening Spatial Filters.
Image Enhancement in Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain. Smoothing Frequency- Domain Filters. Sharpening Frequency Domain Filters. Homomorphic Filtering.

UNIT -III (12 Hrs.):

Morphological Image Processing: Dilation and erosion, opening and closing, Hit-or-Miss transformations, basic morphological algorithms,
Image Segmentation: Application of image segmentation, Edge Based Segmentation, Threshold Based

Segmentation, Detection of discontinues, Edge linking and boundary detection, thresh holding, Region – based segmentation.

UNIT -IV (10 Hrs.):

Computer Vision: Camera Calibration, Patterns, Features Extraction, Statistical Methods for Classification, Clustering, Scene Matching and Analysis, Bidirectional Reflection Distribution Function, Optical Flow, Shape from Shading, Structure from Motion, Three Dimensional Structure Representation.

[TOTAL: 42 Hrs.]

Text Books:

1. Rafael C. Gonzales and Richard E. Woods, "Digital Image Processing", Pearson Education, Reprint 2004
2. Anil K. Jain, "Fundamental of Digital Image Processing", PHI, EEE, 3rd reprint 1997

References:

1. David A. Forsyth and Jean Ponce,"Computer Vision: A Modern Approach", Prentice - Hall,2004
2. J. R. Parker, "Algorithms for Image Processing and Computer Vision", Wiley ,1996
3. Robert M. Haralick and Linda G. Shapiro, "Computer and Robot Vision**",** Addison Wesley,1992

ECC245 Advance Electronic Circuit Circuit

Prerequisites: Basic Electronics Circuits, Analog Electronic Circuits

Objectives: To learn advance concepts of Analog Electronics Circuits

CO-1	Remember and understand the basic concepts/ Principles of Advance Electronic Circuit
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module 1 (12 Hours)

Review of Selected Topics in Electronic Circuits, Active Filters: First & Second order low pass/high pass, band pass, band reject, and all pass filters. Universal active filter design, Comparators, Sawtooth wave generator using OP Amps, Waveform Conversion, Instrumentation Amplifier. Wideband amplifiers: Frequency response, Transient response of transistor stage, shunt compensation of a transistor stage in cascade, Rise time of cascaded compensated stages, low frequency compensation. Tuned Amplifiers: Single tuned, Double tuned, Staggered tuned.

Module 2 (12 Hours)

Bistable Multivibrator: Stable States of a binary, Fixed Biased and Self-biased Transistor binary, Commutating Capacitors, Symmetrical and Unsymmetrical triggering, Direct connected binary, Schmitt trigger Circuit, Emitter coupled Binary. The Monostable Multivibrator: Collector coupled Monostable Multi, Waveforms, Emitter-coupled Monostable Multi, triggering of Monostable Multi. AstableMultivibrator: Emitter Coupled, Collector Coupled, Waveforms.

Module 3 (12 Hours)

Negative resistance devices and Negative Resistance Switching Circuits: Tunnel diode, UJT operation and characteristics, Application of UJT to generate Sawtooth waveform, Tunnel diode monostable, astable, bistable and comparator circuits.

Module 4 (12 Hours)

Analysis of Voltage time base generator, Current time base generator, Pulse Transformer and Blocking Oscillator, IC 555 Timer Circuit and Applications, Voltage Controlled Oscillator, Phase Locked Loop.

Text Book:

1. Pulse, Digital and Switching Waveforms – Jacob Millman, Herbert Taub, M. Prakash Rao, 2nd Ed, The McGraw-Hill Companies (Selected portions from Chapters 4, 5, 10, 11, 12, 13, 14 and 15).

2. Electronic Principles- A.Malvino, D.Bates, 7thEd, The McGraw-Hill Companies. (Selected Portions from Chapters 21, 22, 23 for Module 1 and 4 only)

Reference Book:

1. OP-Amps and Linear Integrated Circuits-Ramakant A .Gayakwad (PHI Learning Pvt. Ltd.)

2. Pulse, Switching and Digital Circuits-D.A. Bell (Oxford Publishing).

3. Pulse and Digital Circuits by A. Anand Kumar, PHI Learning Pvt. Ltd

Course Title: ARTIFICIAL INTELLIGENCE
Course Code: ESD6E15

- To know about basic concepts of NLP and Machine Learning
- To obtain a thorough knowledge of various knowledge representation schemes
- To have an overview of various AI applications
- To study about various heuristic and game search algorithms
- To know about various Expert System tools and applications

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of ARTIFICIAL INTELLIGENCE
CO2	Analyse the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT - I

General Issues and overview of AI: The AI problems; What is an AI technique; Characteristics of AI applications, Problem solving, search and control strategies: General problem solving; production systems; control strategies: forward and backward and backward chaining Exhaustive searches: Depth first Breadth first search

UNIT - II

Heuristic Search techniques: Hill climbing; Branch and Bound technique; Best first search and A* algorithm; AND/Or Graphs; problem reduction and AO* algorithm; constraint satisfaction problems, Game playing: Minimax search procedure; Alpha-Beta cutoffs; Additional Refinements

UNIT - III

Knowledge Representation: First order predicate calculus; Skolemization Resolution principle and unification; Inference Mechanisms; Horn's clauses; semantic Networks; frame systems and value inheritance. Scripts; conceptual dependency;

UNIT - IV

Natural language processing : Parsing technique; context—context- free grammar; Recursive Transition Nets (RTN); Augmented Transition Nets ((ATN); case and logic grammars; semantic analysis, Planning : Overview- An example Domain: The Blocks Word. Component of planning systems: Goal Stack Planning (linear planning); Non-linear planning using goal sets; probabilistic reasoning and Uncertainty; probability theory; Bayes Theorem and Bayesian networks; certainty factor.

Books Recommended:

1. Elaine Rich and Kevin knight, "Artificial Intelligence", Tata McGraw hill, 3rd Edition, 2012
2. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson, 1stEdition, 2015
3. Nills j. Nilson, "Principles of Artificial Intelligence", Springer, 1982 Edition
4. Clocksin& C.S. Melish, "Programming in PROLOG",Springer-Verlag, 5th Edition
5. M.sasikumar ,S.Ramani, "Rule based expert system (A practical Introduction)", narosa publishinghouse.

SOFTWARE DEFINED NETWORK								
Course Code	**CS 6E16**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Data Communication Networks							
Objectives:	• Explain the key benefits of SDN by the separation of data and control planes. • Apply techniques that enable applications to control the underlying network using SDN							

CO1	Remember and understand the basic concepts/Principles of software defined network.
CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT-I SDN BACKGROUND AND MOTIVATION (10 Hours)

Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.

UNIT-II SDN DATA PLANE AND OPENFLOW (12 Hours)

SDN data plane: Data plane Functions, Data plane protocols, Openflow logical network Device: Flow table**.** Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table- OpenFlow Protocol**.**

UNIT-III SDN CONTROL PLANE AND APPLICATION PLANE (14 Hours)

SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- Open Daylight-REST- Cooperation and Coordination Among Controllers.

SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface-Network Services. Abstraction Layer: Abstractions in SDN, Frenetic- Traffic Engineering Measurement and Monitoring**,** Security- Data Center Networking- Mobility and Wireless.

UNIT-IV NETWORK FUNCTIONS VIRTUALIZATION (10 Hours)

Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements- NFV Reference Architecture: NFV Management and Orchestration.

TEXT BOOKS

1. William Stallings, "Foundations of Modern Networking", Pearson Ltd.,2016.
2. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black,Morgan Kaufmann Publications, 2014
3. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013

REFERENCE BOOKS

1. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
2. Kreutz et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015), 14-76

STOCHASTIC PROCESS								
Course Code	**CS 6E28**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Fundamental of computer science and mathematics							
Objectives:	• To equip students with theoretical knowledge and practical skills • To analyze stochastic dynamical systems in economics, engineering and other fields. • To study various properties and characteristics of processes.							

CO1	Remember and understand the basic concepts/Principles of probability and stochastic process.

CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT – I:

Vector space, Inner product space, norm, Hilbert spaces. Projection theorem. SeparableHilbert spaces and orthonormal bases. Linear functionals. Riesz representation theorem.Probability spaces. Random variables and random vectors. Distributions and densities.

UNIT – II:

Statistical independence. Expectations, moments and characteristic functions.Infinite sequences of random variables. Convergence concepts. Laws of large numbers.Radon-Nikodym theorem. Conditional expectations given aσ-field and a random vector.Jensen's inequality.

UNIT – III:

Stochastic processes. Separability and measurability. Continuity concepts. GaussianProcesses and Wiener processes. Second order processes. Covariance functions and theirProperties. Linear operations and second order calculus, orthogonal expansions.Stationarity in the strict and wide senses.Ergodicity in the q.m.sense. Wide senseStationary processes

UNIT – IV:

Herglotz's and Bochner's theorems. Spectral representation. L2- stochastic integrals.Spectral decomposition theorem. Low-pass and band-pass processes. White noise andWhite-noise integrals

TEXT BOOKS:

1. Papoulis, S. U. Pillai, "Probability, Random variables and Stochastic processes" Tata-Mc Hill
2. R.B.Ash&C.Doleans-Dade, Probability and Measure Theory.

REFERENCE BOOKS:

1. E.Wong & B.Hajek, Stochastic Processes in Engineering systems, Springer, 1985
2. R.B.Ash & W.A.Gardner, Topics in stochastic processes, Academic Press, 1975.
3. Stakgold, I., Green's Functions and Boundary value Problems (e), Wiley, 1998.

TIME SERIES ANALYSIS								
Course Code	**CS 6E29**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Foundation of computer science and mathematics.							
Objective:	To understand the concepts of Time Series theory and methods of analysis.							

CO1	Remember and understand the basic concepts/Principles of time series analysis.

CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

(14 Hours)

UNIT-I

Stochastic process and its main characteristics Stochastic process. Time series as a discrete stochastic process. Stationarity. Main characteristics of stochastic processes (means, autocovariation and autocorrelation functions). Stationary stochastic processes. Stationarity as the main characteristic of stochastic component of time series. Wold decomposition. Lag operator. Autoregressive-movingaverage models ARMA(p,q) Moving average models MA(q). Condition of invertability. Autoregressive models AR(p). Yull-Worker equations. Stationarity conditions. Autoregressive- moving average models ARMA (p,q).

UNIT-II **(10 Hours)**

Coefficients estimation in autoregressive models. Coefficient estimation in ARMA (p) processes. Quality of adjustment of time series models. AIC information criterion. BIC information criterion. "Portmonto"-statistics. Box-Jenkins methodology to identification of stationary time series models.

UNIT-III **(12 Hours)**

Forecasting, trend and seasonality in Box-Jenkins model. Non-stationary time series. Time series withnon-stationary variance. Non-stationary mean. ARIMA (p,d,q) models. The use of Box-Jenkins methodology to determination of order of integration. Non-stationary time series, TSP or DSP:methodology of research. Segmented trends and structure changes.

UNIT-IV **(12 Hours)**

Time series co-integration. Co-integration regression. Testing of co-integration. Vector auto regression and co-integration. Co-integration and error correction model. Granger causality. Hypothesis testing on rational expectations. Hypothesis testing on market efficiency.

TEXT BOOKS

1. Enders W. Applied Econometric Time Series. John Wiley & Sons, Inc., 1995
2. Mills, T.C. The Econometric Modelling of Financial Time Series. Cambridge University Press, 1999
3. Andrew C. Harvey. Time Series Models. Harvester wheatsheaf, 1993.
4. Andrew C. Harvey. The Econometric Analysis of Time Series. Philip Allan, 1990.

REFERENCES

1. Banerjee, A., J.J. Dolado, and D.V. Hendry. Co-Integration, Error Correction, and Econometric Analysis of Non-Stationary Data. Oxford University Press, 1993.
2. Maddala, G.S. And Kim In-Moo. Unit Roots, Cointegration, and Structural Change. Cambridge University Press, 1998.

PYTHON AND R LAB (MC 517)

Course Code **MC 517** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **I**

Category: Laboratory Course

Prerequisite: Fundamentals of Computer and basics of Mathematics

Learning Objective: After having completed the course, the students should be knowledgeable in the principles of programming in R for the purpose of data management, visualization of data (plotting) and basic statistical calculations as well as programming in Python

Learning Outcome:

- Explain and use basic concepts in programming

- Construct and execute basic programs in Python
- Design and implement basic algorithms in Python
- Use external libraries with Python
- Construct and execute basic programs in R using elementary programming techniques, e.g. import/export of data from file or Internet, assign and manipulate data structures, create user-defined functions, loops, condition statements and debugging.
- Use R for statistical calculations
- Graphically visualize data and results of statistical calculations
- Use external R-packages in statistics and data mining.

Possible topics to be covered:

- The Python part of the course will give a general introduction to programming, and students will learn and practice introductory programming concepts using the Python programming language. Focus lies on how to think computationally and students will learn and practice to write small programs to tackle problems.
- In the R part of the course the tools needed for data analysis, in particular for large dataset will be taught.
    - The student will learn how to take a large dataset break up into manageable pieces and use a range of qualitative and quantitative tools to summarize it and learn what it has to tell.
    - The importance of how to communicate the findings will be an emphasis. Each section of the course is motivated by a particular dataset, and the student will gain experience working with a wide variety of data sources varying in size and quality.
    - The course covers practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, and organizing and commenting R code. Topics in statistical data analysis and optimization will provide working examples.

SUGGESTED READINGS:

Jake VanderPlas. 2016. Python Data Science Handbook: Essential Tools for Working with Data (1st ed.). O'Reilly Media, Inc.

Hadley Wickham and Garrett Grolemund. 2017. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data (1st ed.). O'Reilly Media, Inc..

CYBER SECURITY

Course Code **MC 543** **L-P-T-Cr.:** **4 0 0 4** **Semester:** **IV**

Category: Core Course

Prerequisite: **Computer Network**

Learning Objective:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.

- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.
- Describe the enhancements made to lPv4 by IPSec
- Understand Intrusions and intrusion detection
- Discuss the fundamental ideas of public-key cryptography.
- Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
- Discuss Web security and Firewalls

Learning Outcome:

- Student will be able to understand basic cryptographic algorithms, message and web authentication and security issues.
- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.

UNIT – I: **(10 hours)**

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

UNIT – II: **(14 hours)**

Symmetric key Ciphers: Block Cipher principles & Algorithms (DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Key distribution Asymmetric key Ciphers: Principles of public key cryptosystems1 Algorithms (RSA, Diffie-Hellman, ECC), Key Distribution.

UNIT – III: **(12 hours)**

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm Authentication Applications: Kerberos, X.509 Authentication Service, Public — Key Infrastructure, Biometric Authentication.

UNIT – IV: **(12 hours)**

E-Mail Security: Pretty Good Privacy, S/MIME

IP Security: lP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations, key management.

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction.

Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.

TEXT BOOKS:

1. Cryptography and Network Security: William Stallings, Pearson Education,4t" Edition.
2. Cryptography and Network Security: Atul Kahate, McGraw Hill, 2nd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1' Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, McGraw Hill, 2 Edition.
3. Information Security, Principles and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.

WEB TECHNOLOGY

Course Code **CS 534** **L-P-T-Cr.:** 4 0 0 3 **Semester:** **III**
Category: Core
Prerequisite: **Fundamentals of Programming and Networking**
Learning Objective:

- Describe the concepts of WWW including browser and HTTP protocol.
- List the various HTML tags and use them to develop the user-friendly web pages.
- Define the CSS with its types and use them to provide the styles to the web pages at various levels.
- Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
- Use the JavaScript to develop the dynamic web pages.
- Use server-side scripting with PHP to generate the web pages dynamically using the database connectivity.
- Develop the modern Web applications using the client and server-side technologies and the web design fundamentals.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Web Technology
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(8 hours)**

Introduction: Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of Web 2.0.

Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

UNIT – II: **(14 hours)**

HTML: Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Web site structure. Overview and features of HTML5.

Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

UNIT – III: **(14 hours)**

JavaScript: Client-side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML: Combining HTML, CSS and JavaScript, Events and buttons.

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT

UNIT – IV: **(13 hours)**

PHP: Introduction and basic syntax of PHP, decision and looping with examples, PHP and HTML, Arrays, Functions, Browser control and detection, string, Form processing, Files, Advance Features: Cookies and Sessions, Object Oriented Programming with PHP.

PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs.

TEXT BOOKS

1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India.
2. Web Technologies, Black Book, dreamtech Press
3. HTML 5, Black Book, dreamtech Press

REFERENCE BOOKS:

1. Web Design, Joel Sklar, Cengage Learning
2. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill

WEB TECHNOLOGY LAB

Course Code **CS 535** **L-P-T-Cr.:** 0 3 0 2 **Semester:** **III**
Category: Laboratory Course
Prerequisite: NA
Learning Objective:

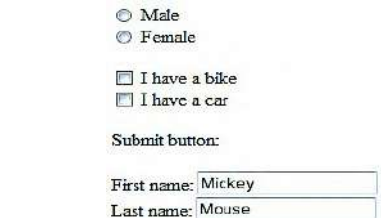
- HTML, the fundamentals of how the Internet and the Web function
- A basic understanding of graphic production with a specific stress on creating graphics for the Web
- A general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web publishing.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Web Technology Lab
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF TOPICS:

1. Design the following static web pages required for an online book store web site.
   1) HOME PAGE: The static home page must contain three **frames**.
   2) LOGIN PAGE
   3) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table.
   4) CART PAGE: The cart page contains the details about the books which are added to the cart.
   5) REGISTRATION PAGE
2. Write JavaScript to validate the fields of the above page. Write JavaScript to validate the fields of the Login page.
3. Design a web page using CSS which includes the following:
   1) Use different font, styles:
   2) Set a background image for both the page and single elements on the page.
   3) Control the repetition of the image with the background-repeat property.
   4) Define styles for links
   5) Working with layers
   6) Add a customized cursor
4. Write an XML file which will display the Book information. Write a Document Type Definition (DTD) to validate the above XML file. Display the XML file in a table. Use XML schemas XSL and CSS for the above purpose.
5. Create a simple visual bean with a area filled with a color. The shape of the area depends on the property shape. If it is set to true then the shape of the area is Square and it is Circle, if it is false. The color of the area should be changed dynamically for every mouse click. The color should also be changed if we change the color in the "property window".
6. Design the following Web page.



7. 1) Install TOMCAT web server and APACHE. 2) Access the above developed static web pages for books web site, using these servers by putting the web pages developed in week-1 and week-2 in the document root.
8. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Write a servlet for doing the following. 1. Create a Cookie and add these four user id's and passwords to this Cookie. 2. Read the user id and passwords entered in the Login form and authenticate with the values available in the cookies.
9. Install a database (Mysql). Create a table which should contain at least the following fields: name, password, email-id, phone number Write a PHP program to connect to that database and extract data from the tables and display them. Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration page.
10. Write a PHP which insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the user name and password from the database.

Course Code **CSE E28 ADVANCED DATABASE L-P-T-Cr.:4 0 0 3 Semester: VIII**

Category: Professional elective course

Prerequisite: DBMS, Computer Networks

Objective:

- To know advanced concepts of database in large scale analytics, derive data maintenance, change schema, database update and Benchmark Object Databases, deals with uncertainties in advanced concepts of database, and open issues in database technologies.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED DATABASE SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: PARALLEL AND DISTRIBUTED DATABASES (08 hours)

Inter and Intra Query Parallelism – Architecture – Query evaluation – Optimization – Distributed Architecture – Storage – Catalog Management – Query Processing - Transactions – Recovery - Large-scale Data Analytics in the Internet Context – Map Reduce Paradigm - run-time system for supporting scalable and fault-tolerant execution - paradigms: PigLatin and Hive and parallel databases versus Map Reduce

UNIT – II: ACTIVE DATABASES, TEMPORAL AND OBJECT DATABASES (10 hours)

Syntax and Sematics (Starburst, Oracle, DB2) – Taxonomy – Applications – Integrity Management – Workflw Management – Business Rules – Design Principles – Properties – Rule Modularization – Rule Debugging – IDEA methodology – Open Problems.
Overview – Data types – Associating Facts – Temporal Query Language – TSQL2 – Time Ontology – Language Constructs – Architecture – Temporal Support – Object Database and Change Management – Change of Schema – Implementing Database Updates in O2 – Benchmark Database Updates – Performance Evaluation.

UNIT – III: SPATIAL, TEXT AND MULTIMEDIA DATABASES (10 hours)

Traditional Indexing Methods (Secondary Keys, Spatial Access Methods) – Text Retrieval – Multimedia Indexing – 1D Time Series – 2d Color images – Sub pattern Matching – Open Issues – Uncertainties

UNIT – IV: COMPLEX QUERIES AND REASONING (10 hours)

Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Data log – Fix point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues.
Introduction to Big data analytics and No-SQL

TEXT / REFERENCE BOOKS:

1. Ramakrishnan, Gehrke, "Database Management System", Tata McGraw Hill Publications, Third Edition.
2. Carlo Zaniolo, Stefano Ceri "Advanced Database Systems", Morgan Kauffmann Publishers.
3. VLDB Journal.
4. Elmaski&Navathe -Fundamentals of Database Systems, 4th Edition, Pearson Education
5. Database Systems, Thomas Connolly, Carolyn Begg
6. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2002.

WEB REFERENCES

1. http://video.google.com
2. http://www.blinkvid.com/video
3. http://www.learnerstv.com/course.php?cat=Computers

http://www.crazyengineers.com/forum

THIRD SEMESTER
Course Title: DIGITAL IMAGE PROCESSING
Course Code: EL525A
No. of Credits - 4

- To learn the fundamental concepts of Digital Image Processing
- To study basic image processing operations
- To understand image analysis algorithms
- To expose students to current applications in the field of digital image processing

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DIGITAL IMAGE PROCESSING Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DIGITAL IMAGE PROCESSING
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

What is Digital Image Processing, Fundamental Steps in Digital Image Processing, Elements of Visual Perception, Image Sampling and Quantization, Some basic relationships between Pixels, Image Enhancement: Gray Level Transformation: Image Negatives, Log Transformations, Histogram Processing: Histogram Equalization, Basics of Spatial Filtering

UNIT-II

Image Transforms; Fourier Transform and their properties, Smoothing Frequency-Domain Filtering: Ideal, Butterworth, Gaussian Low pass Filters, Sharpening Frequency Domain Filtering: Ideal, Butterworth, Gaussian High pass Filters.

UNIT-III

Image Restoration: A model of the Image Degradation/Restoration Process, Noise Models. Restoration in the Presence of Noise Only-spatial Filtering. Estimating the Degradation Function. Inverse Filtering. Minimum Mean Square Error (Wiener) Filtering. Morphological Image Processing: Preliminaries. Dilation and Erosion. Opening and Closing. The Hit-or- Miss Transformation.

UNIT-IV

Some Basic Morphological Algorithms: Boundary Extraction, region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning. Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression: Variable length coding, LZW coding, Image Segmentation: Detection of Discontinuity, Edge linking and Boundary Detection, Region based Segmentation.

Books Recommended:

1. R.C.Gonzalez&R.E.Wood, "Digital Image Processing", Addison Wesley.
2. B.Channda&D.Dutta,"Digital Image Processing and Analysis", PHI, 2nd Edition, 2011
3. A.K.Jain, "Fundamentals of Digital Image Processing",Pearson Education, 1st Edition, 2015
4. George Baciu David Zhang Zhang Kamel, "Integrated Image and Graphics Technologies", Springer Us, 1st Edition, 2004

Flexible AC Transmission System (EEE482)

Prerequisite	**Power System Operation and Control**	
Course Objective	**The course provides application aspects of electrical energy in a wide range of areas**	
Course Outcome	CO-1	Remember and understand the basic concepts/principles of Flexible AC Transmission System
	CO-2	Analyze the various concepts to understand them through case studies
	CO-3	Apply knowledge in understanding practical problems
	CO-4	Execute/create the projects or field assignment as per knowledge gained in the course
Accompanied by Laboratory Course	**No**	
Course Credits	**3-0-0**	
Course Type	**Professional Elective-6**	

Module-I (10 Hours)

Introduction to FACTS, Transmission Interconnections, Flow of Power in an AC System, What limits the Loading Capability, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic Types of FACTS Controllers, Basic Description and Definitions of FACTS Controllers.

Module-II (10 Hours)

Static Series Compensators: Objective of Series Compensation (GCSC, TSSC, TCSC), Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators (SSSC) Static Voltage and Phase Angle Regulators: Objectives of Voltage and Phase Angle Regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle

Regulators (TCVRs and TCPARs). 169

Module-III (10 Hours)

Static Shunt Compensation: Objectives of Shunt Compensation, Methods of Controllable VAR Generation, Static VAR Compensators, SVC and STATCOM

Module-IV (10 Hours)

Combined Compensators: Introduction, Unified Power Flow Controller (UPFC), The Interline Power Flow Controller (IPFC), Generalized and Multifunctional FACTS Controllers.

Text Books

1. Narain G Hingorani, **Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems**, Standard Publishers
2. K S Padiyar, **FACTS controllers in power transmission and distribution**, New Age
3. Mohan Mathur R, Rajiv K Varma, **Thyristor based FACTS controller for electrical transmission system**, IEEE Press, Wiley

Reference Books

1. Enrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Perez, Cesar Angeles-Camacho, **FACTS: Modelling and Simulation in Power Networks**, Wiley
2. Y H Song, Allan T Johns, Flexible AC Transmission System, **Institution of Electrical Engineers Pre**

Electric and Hybrid Vehicles (EEE369)

Prerequisite	**Electrical Machine-I, Electrical Machine-II, Power Electronics**	
Course Objective	**The course aims to provide a detailed overview of electric and hybrid electric vehicles**	
Course Outcome	CO-1	Remember and understand the basic concepts/principles of Electrical and Hybrid Vehicles
	CO-2	Analyze the various concepts to understand them through case studies
	CO-3	Apply knowledge in understanding practical problems
	CO-4	Execute/create the projects or field assignment as per knowledge gained in the course
Accompanied by Laboratory Course	**No**	
Course Credits	**3-0-0**	
Course Type	**Professional Elective-3**	

Module-I (10 Hours)

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive- trains on energy supplies.

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis

Module-II (10 Hours)

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

Module-III (10 Hours)

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power

Module-IV (10 Hours)

Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies

Text Books

1. Iqbal Hussein, **Electric and Hybrid Vehicles: Design Fundamentals,** CRC Press, 2003

Reference Books

1. James Larminie, John Lowry, **Electric Vehicle Technology Explained**, Wiley, 2003
2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, **Hybrid**

Network Analysis and Synthesis (EEE201)

Prerequisite	**None**	
Course Objective	**The objective of the program is to provide knowledge about different network theorems and principles to undergraduate students of electrical and electronics engineering**	
Course Outcome	CO-1	Remember and understand the basic concepts/principles of Network Analysis and Synthesis
	CO-2	Analyze the various concepts to understand them through case studies
	CO-3	Apply knowledge in understanding practical problems
	CO-4	Execute/create the projects or field assignment as per knowledge gained in the course
Accompanied by Laboratory Course	**Yes**	
Course Credits	**3-0-0**	
Course Type	**CORE**	

Module-1(10 Hours)

DC Circuit Analysis and Network Topology: Ohm's law, Kirchhoff's law, mesh and nodal analysis, Super Mesh and Super Node Analysis **Network Reduction:** voltage & current division, source transformation, star-delta conversion.**Network Topology**: Graph of network, concept of tree, Tie-set & cut-set matrix.**DC Theorems**: Thevenin, Norton, Superposition, Maximum power transform, Reciprocity,compensation,millimann, Tellegen's Theorem.

Module-2(10 Hours)

AC Circuit Analysis: RLC Series and Parallel Circuits, Sinusoids and phasors, Sinusoidal steady state analysis and theorems, AC Power Analysis **Resonance& Coupled Circuit**: series & parallel resonance-their frequency response, Q-factor & bandwidth, self & mutual inductance, coefficient of coupling, Tuned circuit.**Transient Response**: Transient response of R-L, R-C and RLC circuits.

Module-3(10 Hours)

Two port Network function & Response: Z, Y, ABCD andh-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks, Network Functions, Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots. **Filter Design by co-efficient matching:** Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response.

Module-4 (10 Hours)

Network synthesis: Hurwitz polynomial, Properties of Hurwitz polynomial, Positive real functions and their properties, Concepts of network synthesis, Realization of simple R-L, R-C and L-C functions in Cauer-I, Cauer-II, Foster-I and Foster-II forms.

Text Books

1. Charles Alexander, Matthew N. O. Sadiku, **Fundamentals of Electric Circuits**, Tata McGraw Hills.
2. AbhijitChakrabarty, **Circuit Theory (Analysis and Synthesis)**, DhanpatRai and Co.
3. William H. Hayat, Jack Kemmerly, Steven M Durbin, **Engineering Circuit Analysis**, TataMcGraw Hill, New Delhi.
4. M.E Valkenburg, **Network Analysis and Synthesis**, Pearson Publication
5. John O'Malley, **Schaum's Outline of Basic Circuit Analysis**,McGraw Hill

Reference Books

1. M L Soni and J C Gupta, **A Course on Electrical Circuit and Analysis**, DhanpatRai
2. Kuo F. F., **Network Analysis and Synthesis**, Wiley India., 2008

ECC171 OPTICAL COMMUNICATION

CO-1	Remember and understand the basic concepts/ Principles Optical Communication
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: (12Hours)
Overview of Optical fiber Communication, Optical fibers Structures and Wave guiding, Signal degradation in optical fibers, Optical Sources, Photo detectors, Optical receiver Operations.

MODULE II: (12Hours)
Optical Networks: Network concepts, Topologies, SONET/SDH, High speed light wave links, Optical Add Drop Multiplexing.

MODULE III: (12Hours)
Digital Links. Wavelength Division Multiplexing: concepts and components. Design issues in WDM

Optical Network, Optical switching, WDM network examples.

MODULE IV: (12Hours)

Wavelength Routing Algorithms, Next generation Optical Internet Networks, IP over ATM, IP over SONET, Overlay and Integrated models for IP/WDM networks.

REFERENCE BOOKS:

1. Optical Fiber Communication by Gerd Keiser TMH, 4/e.
2. WDM Optical Networks: Concepts Design, and Algorithms by C. Siva Ram Murthy and Mohan Gurusamy, PHI, EEE.

ECL 176 OPTICAL COMMUNICATION LAB

CO-1	Remember and understand the basic concepts/ Principles of Optical Communication Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: (12Hours)

Overview of Optical fiber Communication, Optical fibers Structures and Wave guiding, Signal degradation in optical fibers, Optical Sources, Photo detectors, Optical receiver Operations.

MODULE II: (12Hours)

Optical Networks: Network concepts, Topologies, SONET/SDH, High speed light wave links, Optical Add Drop Multiplexing.

MODULE III: (12Hours)

Digital Links. Wavelength Division Multiplexing: concepts and components. Design issues in WDM Optical Network, Optical switching, WDM network examples.

MODULE IV: (12Hours)

Wavelength Routing Algorithms, Next generation Optical Internet Networks, IP over ATM, IP over SONET, Overlay and Integrated models for IP/WDM networks.

REFERENCE BOOKS:

1. Optical Fiber Communication by Gerd Keiser TMH, 4/e.
2. WDM Optical Networks: Concepts Design, and Algorithms by C. Siva Ram Murthy and Mohan Gurusamy, PHI, EEE.

CAD VLSI

Credit: 3 L-T-P:3-0-0 Course Code: ECE03

Prerequisite: Knowledge of IC design , Basics of VLSI ..

Objective: -To learn different types of VLSI Design methodologies ,VLSI design Automation tools, Design rules.

- To learn about different design steps to design a VLSI chip.

CO-1	Remember and understand the basic concepts/ Principles of CAD VLSI
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I VLSI Design Methodologies (12 lectures)

Introduction to VLSI Design methodologies, Review of Data structures and algorithms, Review of VLSI Design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, general purpose methods for combinatorial optimization.

MODULE II Design Rules(12 lectures)

Layout Compaction, Design rules, problem formulation, algorithms for constraint graph compaction, placement and partitioning, Circuit representation, Placement algorithms, partitioning

MODULE III Floor Planning and Simulation(12 lectures)

Floor planning concepts, shape functions and floor plan sizing, Types of local routing problems, Area routing, channel routing, global routing.

Simulation, Gate-level modelling and simulation, Switch-level modelling and simulation, Binary Decision Diagrams, Two Level Logic Synthesis.

MODULE IV Modelling And Synthesis(12lectures)

High level Synthesis, Hardware models, Internal representation, Allocation assignment and scheduling, Simple scheduling algorithm, Assignment problem, High level transformations.

Text Books

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons,2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002

VIRTUAL INSTRUMENTATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE08

CO-1	Remember and understand the basic concepts/ Principles of Virtual Instrumentation
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I:(12Hours)

Introduction to basic instrumentation system Overview of instrumentation system and internals, Origin of signals and the various types of signal acquiring devices such as sensors and transducers : Bending and stress Strain gauge Bridges Various types of sensors.

MODULE II:(12Hours)

The concepts of signal conditioning : Scaling, Offset, Filter, Control System basics: Feedback control concepts, Controller structure and parameters, Transfer Function System Stability.

MODULE III:(12Hours)

Introduction to Virtual Instrumentation System: Concepts ,Architecture , Distributed VI, Advantages, G' Language concepts: Introduction , LabVIEW basics, LabVIEW environment , What Advantages Does This Bring to the Developer? LabVIEW Component Oriented Design(LCOD): Components & Design , LCOD Implementation, LCOD Complementary Techniques: State Machines, Graphical User Interface (GUI) Design and Prototyping, Abstraction in the Code, Detail Outside the Code, Error Handling, Pre- and Post conditions: Check What Comes In and What Goes Out & Reuse.

MODULE IV:(12Hours)

Hardware aspects : Acquisition in LabVIEW, DAQ Hardware, DAQ components, Using DAQ assistant, Case Studies and Student seminars.

TEXT BOOKS:

1. LabVIEW based Advanced Instrumentation by S. Sumati& P. Surekha, Springer publishers.

REFERENCE BOOKS:

1. A Software Engineering Approach to LabVIEW™, Jon Conway, Steve Watts, Prentice Hall PTR.
2. LabVIEW for Everyone: Graphical Programming Made Easy and Fun, Third Edition, Jeffrey Travis, Jim Kring, Prentice Hall.
3. Learning with LabVIEW 7 Express by Robert H.Bishop.Pearson Prentice Hall. 2005

IC TECHNOLOGY

Credit: 3 L-T-P:3-0-0 Course Code: ECE09

Prerequisite: Knowledge of IC design , Basics of VLSI

Objective:-To learn about fabrication of ICs.

- To learn about different process involved to fabricate an IC.

CO-1	Remember and understand the basic concepts/ Principles of IC Technology
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE-I (12Hours)

Introduction: Introduction to IC Technology: Basic fabrication steps and their Importance. Environment of IC Technology: Concepts of Clean room and safety requirements,

MODULE-II(12Hours)

Processes used in fabrication of modern integrated circuits: Process steps for crystal growth, Concepts of Wafer cleaning processes and wet chemical etching techniques.

Impurity Incorporation: Solid State diffusion modelling and technology; Ion Implantation modelling, technology and damage annealing, characterization of Impurity profiles Oxidation: Kinetics of Silicon

dioxide growth both for thick, thin and ultra thin films, Oxidation technologies in VLSI and ULSI,

Characterization of oxide films, High k and low k dielectrics for ULSI.

MODULE-III (12Hours)

Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI, Mask generation. Chemical Vapour Deposition Techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon: modelling and technology.

MODULE-IV (12Hours)

Metal Film Deposition: Evaporation and sputtering techniques, Failure mechanisms in metal interconnects Multi-level metallization schemes. Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

TEXT BOOKS:

1. S.M.Sze (2nd Edition)"VLSI Technology", McGraw Hill Companies Inc,2003
2. C.Y. Chang and S.M. Sze, "ULSI Technology", McGraw Hill Companies Inc, 1996.

REFERENCES TEXT BOOKS:

1. Stephena, Campbell,"The Science and Engineering of Microelectronic Fabrication", Second Edition, Oxford University Press, 2005.

James D.Plummer, Michael D.Deal, "Silicon VLSI Technology" Pearson Education

Speech and audio processing

Credit: 3 L-T-P:3-0-0 Course Code: ECE10

CO-1	Remember and understand the basic concepts/ Principles of Speech and audio processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Speech Communication: Introduction, discrete-time speech signal processing, speech communication, review of signals and linear systems.Speech Production and acoustic phonetics: Anatomy and physiology of speech organs, speech sounds andclassification, International Phonetic Alphabet (IPA), Articulatory Phonetics: Manner of articulation and place ofarticulation, vowel triangle, Acoustic Phonetics: spectrograms, wide-band and narrow-band spectrograms, acoustic characteristics of speech sounds, coarticulation and prosody.

Module-II(12Hours)

Time-domain models for speech processing: Introduction to short-time speech analysis, windowing, short-time energy and average magnitude, short-time Zero-Crossing Rate (ZCR), speech vs. silence discrimination using energy and zero crossings, short-time autocorrelation function, short-time Average

Magnitude Difference Function(AMDF), Short-time Fourier analysis: Short-time Fouriertransform (STFT), spectral displays, time-frequency resolution tradeoffs, Linear filtering interpretation, short-time synthesis, filter bank summation method.

Module-III(12Hours)

Linear Predictive Analysis: Basic principles of Linear predictive analysis,autocorrelation method and covariance method, computation of gain for the model, prediction error signal, frequency domain interpretation of LP analysis, frequency domain interpretation of mean-squared prediction error, applications of LPC parameters.

Module-IV(12Hours)

Homomorphic Signal Processing: Concept of Homomorphic processing, Homomorphic systems for convolution, properties of complex cepstrum, Homomorphic filtering, complex cepstrum of voiced speech, complex cepstrum of unvoiced speech, Mel-scale cepstrum

Speech Coding: Fundamentals of coding, liner prediction and harmonic noise models in speech coding, modeling excitation for voiced and unvoiced speech, Code-Excited linear prediction coding

Reference Books:

1.Speech Communication: Human and machine, D.O'Shaughnessy, Uniiversity Press
2.Digital Processing of Speech Signals, L. Rabiner and R. Schafer, Pearson Education
3.Discrete-time Speech Signal Processing, T. Quatieri,
Pearson Education

ADAPTIVE SIGNAL PROCESSING

Credit: 3 L-T-P:3-0-0 Course Code: ECE11

Prerequisite: Basics of digital signal processing and statistics.

Objective: To help the students to understand and solve complex problems in power spectrum estimations and signal processing. Also how the adaptive filters are used to deal with random signal propagating through wireless medium.

CO-1	Remember and understand the basic concepts/ Principles of Adaptive Signal Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Multirate Digital Signal Processing:Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by rational factorI/D, Filter Design and Implementation for sampling-rate, Multistage implementation of sampling rate conversion, Sampling rate conversion of Band pass signal,

Application of multi rate signal processing: design of phase shifters, Implementation of narrowband lowpass filters. Implementation of Digital filter banks. Filter Bank and Sub-band Filters and its applications.

Module-II(12Hours)

Linear prediction and Optimum Linear Filters:Innovations Representation of a stationary randomprocess,

Forward and Backward Linear Prediction, Solution of the normal equations, Properties of the linear prediction-error filters, AR lattice and ARMA lattice- ladderfilters, Wiener filter for filtering and Prediction: FIR Wiener Filter, Orthogonality Principle in linear mean-square estimation.

Module-III(12Hours)

Power Spectrum Estimation:Estimation of spectra from finite-duration observation of signals, Non parametric method for power spectrum estimation: Bartlett method, Blackman and Turkey method, parametric method for power estimation: Yuke-Walker method, Burg method, MA model and ARMA model.

Module-IV(12 Hours)

Adaptive Signal Processing:Basics of Wiener filtering, Widrow-Hopf Equation, Least mean square algorithm, Recursive least square algorithm, variants of LMS algorithm: FX-LMS, Fast LMS, N-LMS, PN-LMS. Design of Adaptive FIR & IIR filters, Application of adaptive signal processing: Adaptive linear combiner, System identification, Channel equalization, adaptive noise cancellation, adaptive line enhancer.

Text Books:

1. Digital Signal Processing, Third Edition, J.G. Proakis and D.G. Manolakis, Prentice Hall.
2. Adaptive Signal Processing, B. Widrow and Stern,

Reference Books:

1. Digital Signal Processing, by Sanjit K Mitra, new edition, TMH.
2. Digital Signal Processing, by Salivahanan, new edition, TMH.

ANTENNAS AND PROPAGATION

Credit: 3 L-T-P:3-0-0 Course Code: ECE12

Pre-requisite

Electromagnetic field theory, Maxwell equations, Vector calculus, Coordinate transformations.

Objective

To teach the students about the concept of antenna and its characteristics.

CO-1	Remember and understand the basic concepts/ Principles of Antenna and Propagation
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I.(12 hours)

Introduction, basic antenna parameters,Radiation pattern, radiation power density,radiation intensity, directivity, beam efficiency,aperture concept, effective height, polarization,input impedance, gain ,radiation efficiency, beam width, bandwidth, beam efficiency, FRIIS, transmission equation, Basic concepts of Maxwell's equation, vector potential, wave equation, near

field and far fieldradiation, dual equations for electric andmagnetic current sources.

Module-II.(12 hours)

Linear wire antennas: Infinitesimal dipole its radiation field, radiation, resistance, radiation sphere, ear field, far fielddirectivity, small dipole, finite length dipole, halfwave length dipole, linear elements near or oninfinite perfect conductors, ground effects andtheir application, Folded dipole, sleeve dipoleand their applicationsLoop Antenna:Small loop comparison of small loop with shortdipole, radiation pattern its parameters and theirapplication.

Module-III.(12 hours)

Arrays:Linear arrays, planner arrays and circular arrays.Array of two isotropic point sources, nonisotropic sources, principle of patternmultiplication linear arrays of n elements,broadside, Endfire radiation pattern, directivity,Beamwidth and null directions, arrayfactor. Antenna analysis usingDolph-Tschebyscheff.Frequency Independent Antennas:Log periodic and Helical antennas.Microstrip antennas:Rectangular & circular patch applications andfeed network. Reflector antennas: Plane reflector, corner reflector, procedures,Radiation mechanisms Dielectric waveguide,dielectric resonator, dielectric horn antenna.

Module-IV.(12 hours)

Antenna Measurement: Antenna Ranges, Radiation Pattern, Gain anddirectivity, Polarization. Radio wave propagation Ground wave propagation, Ionospheric propagation, Propagation losses.

TEXT BOOKS:

1. Antenna Theory analysis and design,Costantine A. Balanis, John Wiley publication
2. Electromagnetic, Jordan Balmann, Prentice Hall of India publication

REFERENCE BOOKS:

1. Antennas-John D. Kraus, Tata McGraw Hill publication
2. Harish A. R., Antenna and wave propagation, Oxford University Press.

Telephone Switching And Networks

Credit: 3 L-T-P:3-0-0 Course Code: ECE14

Pre-requisite Basic telephone communication system and network topologies.
ObjectiveThe objective of the course is to provide a knowledge on digital telephone network, advanced technologies used in the telephone switching system and the network switching.

CO-1	Remember and understand the basic concepts/ Principles of Telephone Switching and Networks
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Introduction: Evolution, simple telephone communication, basics of switching systems, telecommunication networks. Electronic space division switching: Stored program control, centralized and distributed SPC, software architecture, application software, enhanced software, two and three

stage networks.

Module-II(12 Hours)

Time Division Switching: Basic time division space switching, basic time division time switching, time multiplexed space and time switching, combination switching, three-stage combination switching.

Module-III(12 Hours)

Traffic Engineering: Network traffic load and parameters, Grade of service, modeling switching systems, incoming traffic and Service Time Characterization. Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, signaling techniques.

Module-IV(12 Hours)

Computer and Data Networks: Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, LAN, MAN, an overview of data network standards. Integrated Service Digital Network: Motivation, new services, transmission channels, signaling, service characterization, broad band ISDN, voice data integration.

Text Books:

1. Telecommunication Switching Systems and Networks by Thiagarajan Viswanathan, PHI.

Reference Books:

1. Telecommunication Switching Systems and Networks by P.Gnanasivam,New age International.
2. W. Stallings, Data and Computer Communications, PHI, New Delhi, 2006

Mixed Signal Design

Credit: 3 L-T-P:3-0-0 Course Code: ECE15

CO-1	Remember and understand the basic concepts/ Principles of Mixed Signal Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Switched Capacitor filters: Introduction to Analog and Discrete Time signal processing, sampling theory, Nyqist and over sampling rates, Analog filters, analog amplifiers, lock in amplifiers, analog integrated and discrete time switched capacitor filters, non idealities in switched capacitor filters, architectures for switched capacitor filters and their applications and design. Switched capacitor amplifiers.

Module-II(12Hours)

Data converters: Basics of data converters, Types of data converters, types of ADCs, Successive approximation, dual slope, Flash type, pipelined ADCs, hybrid ADCs, high resolution ADCs, parallel path ADCs like time-interleaved and multi-channel converters.

Module-III(12Hours)

Types of DACs and their architectures, binary weighted DACs. Performance metrics of data converters, SNR, SFDR, SNDR. Background and foreground techniques to improve performance of data converters, Green data converters (low power design).

Module-IV(12Hours)

Frequency synthesizers and synchronization:Analog PLLs, Digital PLLs design and architectures, Delay locked loops design and architectures. Direct Digital Synthesis.

Reference Books:

1.CMOS mixed-signal circuit design by R. Jacob Baker Wiley India, IEEE press, reprint 2008
2.Switched-Current Signal Processing and A/D Conversion Circuits: Design and Implementation, R. Jacob Baker, Wiley India IEEE press 2008.
3.Mixed Signal Systems: a guide to CMOS circuit design, Andrzej Handkiewicz, IEEE computer Society Press.
4.Mixed Signal and DSP Design techniques, EngineeringAnalog Devices Inc, Engineering Analog Devices Inc, Walt Kester, Publisher Newnes.
5.Digital Frequency Synthesis Demystified, Bar-Giora Goldberg, Elsevier. Published by Newnes

IMAGE AND VIDEO PROCESSING

Credit: 3 L-T-P:3-0-0 Course Code: ECE19

Pre-requisite

A fundamental study on matrix convention, probability theory, statistical principles and basic digital processing techniques are needed to be learned.

Objective

The objective of the course is to comprehend the digital image and video processing techniques to incorporate the ideas into the visual analysis systems.

CO-1	Remember and understand the basic concepts/ Principles of Image and Video Processing
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I(12Hours)

Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image –Basic relationship between pixels Image Transforms: 2 –D Discrete FourierTransform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods:

Module-II(12Hours)

Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation
concepts, point, line and Edge detection, Thresholding, region based segmentation Image

Module-III(12Hours)

Compression Image compression fundamentals –coding Redundancy, spatial and temporal redundancy. Compression models: Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , waveletcoding.

Module_IV (12Hours)

JPEG standards Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations 2-D Motion Estimation:
Optical flow, general methodologies, pixel based motion estimation, Block
matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motionestimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXT BOOKS

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rdedition , Pearson
2. Yao wang, Joem Ostarmann and Ya –quin Zhang, "Video processing and communication ",1stedition , PHI

REFERENCE TEXT BOOK

1. M. Tekalp ,"Digital video Processing", Prentice Hall International

SIMULATION TEXT BOOKS

1. Relf, Christopher G.,"Image acquisition and processing with LabVIEW",CRC press
2. Aner ozdemi R,"Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms",John Wiley& Sons
3. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image ProcessingA Practical Approach with Examples in Matlab",John Wiley &Sons.

ESD611 Digital VLSI Design

Prerequisites: Digital Circuit and System, VLSI Engineering.Objective: To study the basics of Digital VLSI Design.

CO-1	Remember and understand the basic concepts/ Principles of Digital VLSI Design
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE –I 10 hours

Introduction to MOSFETs: MOS Inverter, Static and Switching Characteristics, Voltage Transfer characteristics, Noise Margin, Regenerative Property, Power and Energy Consumption, Stick/Layout Diagrams; Issues of Scaling.

MODULE –II 10 hours

Combinational MOS Logic Circuits: Pass Transistors, Transmission Gates, Primitive Logic Gates; Complex Logic Circuits, Sequential MOS Logic Circuits: Latches and Flip-flops, Dynamic Logic Circuits; Clocking Issues, Rules for Clocking, Performance Analysis, Logical effort.

MODULE –III 10 hour

CMOS Subsystem Design; Data Path and Array Subsystems: Addition, Subtraction, Comparators, Counters, Coding, Multiplication and Division.

MODULE –IV 10 hours

SRAM, DRAM, ROM, Serial Access Memory, Content Addressable Memory, Field ProgrammableGate Array.

Text Books

1. Rabey J.M, A. Chandrakasan, and B.Nicolic, Digital Integrated Circuits: A design Perspective,Second Edition, Pearson/PH, 2003 (Cheap Edition).
2.Hodges, David A, Analysis and Design Of Digital Integrated Circuits, In Deep SubmicronTechnology , Tata McGraw-Hill Education, 2005.

Reference Books

1. Kang, Sung-Mo, and Yusuf Leblebici. CMOS Digital Integrated Circuits, Tata McGraw-HillEducation, 2003.
2. J.P Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2001 3. R. L. Geiger, P.E. Allen and N.R. Strader, VLSI Techniques for Analog and Digital Circuits, McGraw-Hill, 1990
3. DebaprasadDas , VLSI Design, Oxford Publication.

Analog VLSI

Credit:4 L-T-P: 3-1-0 Course Code: ESD621

CO-1	Remember and understand the basic concepts/ Principles of Analog VLSI
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Module-I

Small Signal & large signal Models of MOS & BJT transistor. Analog MOS Process (Double Poly Process)**MOS & BJT Transistor Amplifiers:** Single transistor Amplifiers stages: Common Emitter, Common base, Common Collector, Common Drain, Common Gate & Common Source Amplifiers Multiple Transistor Amplifier stages: CC-CE, CC-CC, & Darlington configuration, Cascode configuration, Active Cascode. Differential Amplifiers: Differential pair & DC transfer characteristics.

Module-II Current

Mirrors, Active Loads & References

Current Mirrors: Simple current mirror, Cascode current mirrors Widlar current mirror,Wilson

Current mirror, etc. Active loads, Voltage & current references. Analysis of Differential Amplifier with active load, supply and temperature independent biasing techniques, Frequency Response

Module-III

Operational Amplifier:

Applications of operational Amplifier, theory and Design; Definition of Performance Characteristics; Design of two stage MOS Operational Amplifier, two stage MOS operational Amplifier with cascodes, MOS telescopic-cascode operational amplifiers, MOS Folded-cascode operational amplifiers, Bipolar operational amplifiers. Frequency response & compensation.

Module-IV

Nonlinear Analog Circuits:

Analysis of four quadrant and variable Tran conductance multiplier, Voltage controlled oscillator, Comparators, Analog Buffers, Source Follower and Other Structures. Phase Locked Techniques; Phase Locked Loops (PLL), closed loop analysis of PLL. Digital-to- Analog (D/A) and Analog-to-Digital (A/D) Converters.

Text:

1. Paul B Gray and Robert G Meyer, "Analysis and Design of Analog Integrated Circuits".
2. Behzad Razavi, "Principles of data conversion system design", S.Chand and company Ltd, 2000. John Wiley

References:

1. D. A. Johns and Martin, Analog Integrated Circuit Design, John Wiley, 1997.
2. R Gregorian and G C Temes, Analog MOS Integrated Circuits for Signal Processing, John Wiley, 1986.
3. R L Geiger, P E Allen and N R Strader, VLSI Design Techniques for Analog & Digital Circuits, McGraw Hill, 1990.
4. Gray and Meyer," Analysis and Design of Analog IC ", Wiley international,1996.
5. Gray, Wooley, Brodersen, "Analog MOS Integrated circuits", IEEE press, 1989.
6. Kenneth R. Laker, Willy M.C. Sensen, " Design of Analog Integrated circuits and systems", McGraw Hill, 1994.

Wireless channel modelling lab

Credit:2 L-T-P: 0-0-3 Course Code: CSY6EL06

CO-1	Remember and understand the basic concepts/ Principles of Wireless channel modelling lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

Experiment 1: Free space Propagation – Path Loss model to determine the free space loss and the power received using Matlab program.

Experiment 2: Introduction to the IEEE80211.a WLAN PHY Communication Toolbox in MATLAB a. What is IEEE 802.11a WLAN PHY? Briefly explain the functions of each blueblock in the model diagram. b. What type of shadowing is IEEE802.11 WLAN based on.

Experiment 3: Investigation on WLAN Multipath Channel c. Plot BER-SNR and Bit Rate- SNR graphs for different types of fading channel i. No Fading ii. Flat Fading iii. DispersiveFading

Experiment 4: Introduction to Simulink a. Familiarize with the block components of Simulink in MATLAB b. Setup a basic integrator for a square wave input and note the parameters like amplitude, frequency etc

Experiment 5: Implement a Direct Sequence Spread Spectrum with Matlab Simulink

Internet of Things Lab

Credit:2 L-T-P: 0-0-3 Course Code: CSY6EL11

CO-1	Remember and understand the basic concepts/ Principles of Internet of Things Lab
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems

CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

1.Define and Explain Eclipse IoT Project 2.List

and summarize few Eclipse IoT Projects.

3. Sketch the architecture of IoT Toolkit and explain each entity in brief.

4. Demonstrate a smart object API gateway service reference implementation in IoT toolkit.

5. Write and explain working of an HTTP-to-CoAP semantic mapping proxy in IoT toolkit.

6. Describe gateway-as-a-service deployment in IoT toolkit.

7. Explain application framework and embedded software agents for IoT toolkit.

8. Explain working of Raspberry Pi.

9. Connect Raspberry Pi with your existing system components.

10. Give overview of Zetta. Design based Problems (DP)/Open Ended Problem:

Major Equipment:

Raspberry pi, Arduino

PHYSICS LAB

Course Code **PHL118** **L-P-T-Cr.:** **0 3 0 2** **Semester: I**

Category: Laboratory Course

Prerequisite: Physics -I

Objective: This course provides basic information about mechanics involved in higher Physics, Lesser and Optical Fiber which are foundation of Information Technology.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of PHYSICS LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

LIST OF EXPERIMENTS

1. To determine acceleration due to gravity of earth using compound pendulum.
2. To determine moment of inertia of fly wheel.
3. To study power resonance in series and parallel LCR circuit.
4. To determine refractive index and dispersive power of material of prism.
5. To verify Faraday's electromagnetic induction law.
6. To determine slit width using laser diffraction.
7. To calculate horizontal component of earth magnetic field with the help of tangent galvanometer.
8. To determine wavelength of source light using Newton's ring experiment.

TEXT BOOKS:

1. Physics Practical book, *P.K. Verma*
2. Physics Practical book, *Agrawal, Jain & Sharma*

REFERENCE BOOKS:

DATA COMMUNICATIONS

Course Code	**ECC 212**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**III**

Category: Foundation Course

Prerequisite: Basic Computer Science.

Objective:

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DATA COMMUNICATIONS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Analog Communication: Block diagram of Electrical communication system, Types of Amplitude modulation, AM, DSB SC, SSB SC,VSB, Power and BW requirements, Diode detector, Product demodulation for DSB SC & SSB SC. Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

UNIT – II: **(12 hours)**

Pulse Modulations: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Divison Multiplexing, Frequency Divison Multiplexing, Asynchronous Multiplexing.

UNIT – III: **(12 hours)**

Digital Communication: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison.
Digital Modulation: ASK, FSK, PSK, and DPSK, QPSK demodulation, coherent and non-coherent reception, Comparison of binary and quaternary modulation schemes, M-ary modulation techniques.

UNIT – IV: **(12 hours)**

Protocol Architecture: Need for protocol architecture, TCP/IP protocol architecture, OSI model, TCP/IP Vs OSI model.
Information Theory and Coding: Discrete messages and information content, source coding, Shanon 's theorem, channel capacity, Block codes- coding and decoding, burst error correction(BRC),Convolutional coding, decoding convolutional code, comparison of error rates in coded and uncoded transmission, turbo codes.

TEXT BOOKS:

1. Communication Systems, Simon Haykin, John Wiley.
2. Principles of Communications – H. Taub and D. Schilling, Gouthamsaha, TMH.

REFERENCE BOOKS:

1. Communication Systems Analog and Digital – R.P. Singh and S D Sapre, TMH, 2nd Edition, 2008.
2. Digital and Analog Communication Systems – K Sam Shanmugam,WSE,2006.
3. Electronic &Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
4. Modern Digital and Analog communication Systems – B.P Lathi, Oxford 3rd edition.

COMPUTER ENGINEERING WORKSHOP CSL 218

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of COMPUTER ENGINEERING WORKSHOP
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

PC HARDWARE

Week 1 - Task 1 : Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a viva. Also students need to go through the video which
shows the process of assembling a PC. A video would be given as part of the course content.
Week 2 - Task 2 : Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a viva.
Week 3 - Task 3 : Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a viva
Week 4 - Task 4 : Several mini tasks would be that covers basic commands in linux and basic system administration in linux which includes: Basic linux commands in bash, create hard and symbolic links, text processing, using wildcards
Week 5 - Task 5 : Hardware Troubleshooting : Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to
working condition. The work done should be verified by the instructor and followed up with a Viva.
Week 6 - Task 6 : Software Troubleshooting : Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a viva.

INTERNET AND WORLD WIDE WEB

Week 7 - Task 1 : Orientation and Connectivity Boot Camp : Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should
22 demonstrate, to the instructor, how to access the websites and email. If
there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.
Week 8 - Task 2 : Web Browsers, Surfing the Web : Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
Week 9 - Task 3 : Search Engines and Netiquette : Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors.
Week 10 - Task 4 : Cyber Hygiene : Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to first install an anti virus software, configure their personal firewall and windows update on their computer. Then they need to

customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and MS/equivalent (FOSS) tool Power Point

Week 11 - Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes : PPT orientation, slide layouts, insertingtext, word art, formatting text, bullets and numbering, auto shapes, lines and arrows in both LaTeX and powerpoint.
Week 12 - Task 2 : Second week helps students in making their presentations interactive. Topic covered during this week includes : Hyperlinks, inserting images, clip art, audio, video, objects, tables and charts.
Week 13 - Task 3 : Concentrating on the in and out of Microsoft power point and presentations in LaTeX. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes :- Master Layouts (slide, template, and notes), types of views (basic, presentation, slide slotter, notes etc), Inserting: Background, textures, design templates, hidden slides. 23
Week 14 - Task 4 : Entire week concentrates on presentation part of LaTeX and power point. Topic covered during this week includes: Using auto content wizard, slide transition, custom animation, auto rehearsing publisher.
Week 15 : Help students in preparing their personal website using microsoft/ equivalent (FOSS) tool publisher. Topic covered during this week includes publisher orientation, using templates, layouts, inserting text objects, Editing text objects, inserting tables, working with menu objects, inserting pages, hyper linking, renaming, deleting, modifying pages, hosting website.

References

1. Vikas Gupta, Comdex Information Technology course tool kit, WILEY Dreamtech, 2009.
2. Cheryl A Schmidt, The Complete Computer upgrade and repair book, 3/e, WILEY Dreamtech, 2002.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2006.
4. Kate J. Chase, PC Hardware and A+Handbook, PHI (Microsoft), 2000.
5. Leslie Lamport, LaTeX Companion, PHI/Pearson, 1998.
6. All LaTeX and others related material is available at
(a) www.sssolutions.in
(b) www.sontisoftsolutions.org

Course Title: PROGRAMMING WITH JAVA
Course Code: CSC 223

No. of Credits - 4

- To understand basic syntax of JAVA programming language
- To able to differentiate between JAVA and C++
- To able to understand concepts of inheritance and polymorphism in java
- To understand use of exceptional handling in JAVA
- To get basics of graphics programming in java

Programme Education Objectives

PEO1	Understand the nature and basic concepts of PROGRAMMING WITH JAVA Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyze the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of PROGRAMMING WITH JAVA
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT-I

An overview of object oriented programming and Terminology: Abstraction variable and methods, encapsulation interfaces, message: object communicating with objects, modularity, classification, inheritance.

UNIT-II

Overview of JAVA Language, Java development environment, Language fundamental : how java differs from C AND C++: Programs structure and environment name space: packages, classes and members, Command line argument, no processor, Unicode and character escape, primitive data type, reference data type, objects, array, strings, operators, statement, exceptions and exception handling, multi-threading .

UNIT-III

Classes and objects in Java: introduction to class and objects, objects creation, class variables, class methods, object destruction, subclass and inheritance overriding methods, Data hiding and encapsulation, abstract class and interface, strings arrays and utility classes, standard system streams. IO streams, filtered stream.

UNIT-IV

Introduction to Applet, designing basics, drawing graphics, handling events, reading applet parameters, images and sounds, AWT overview, graphics, fonts, colors, images, Java controls, layout components.

Books Recommended:

1. Herbert Schildt, "JAVA- The Complete Reference", Mcgraw Higher Ed, 7th Edition, 2007
2. David Flanagan**, "**Java in Nutshell", O'Reilly, 6th Edition, 2015
3. E. Balaguruswami,**"**Programming with JAVA 5th Edition", Mcgraw Higher Ed, 5th Edition, 2014
4. P Radha Krishna, "Object oriented Programming through Java", Orient BlackSwan, 1st Edition, 2006

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of PROGRAMMING WITH JAVA LAB
CO2	Analyze the Various Concepts to understand them through case studies
CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

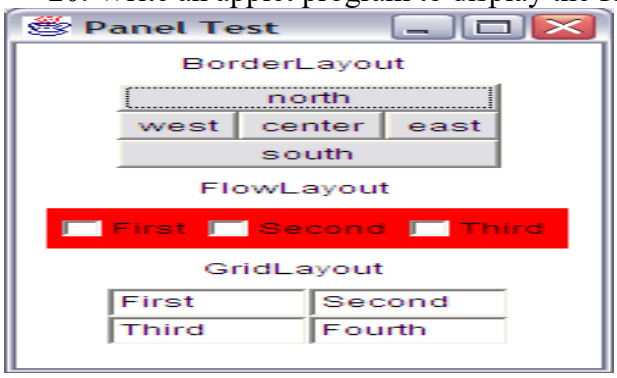
List of Programs

1. Write a java program to read three numeric values (integer) from user andfind the largest number among them.
2. Write a program to print the Fibonacci series up to a given number taken from user through command line.
3. Write a statistical computation program that to find out the maximum, minimum and mean value. Read input through command line.
4. WAP to create a class Rectangle (length, breadth), with zero argument constructor (default value is 5.0), one argument constructor(length = breadth), and two argument constructor, and define the methods area and perimeter of the rectangle. Create different objects with the help of three different constructorsand print the area (length x breadth) and perimeter (2 x (length + breadth)) of those objects.
5. Define a class called Room with the follwing attributes 1.length, 2.breadth, 3.height, 4.floor_area, 5.Wall_area, 6.No.of_fans, 7.No.of_windows, 8.no.of_doors. Define a suitable constructor and a method to display details of a room. Assume that 20% of the total wall area is occupied by doors and windows and calculate accordingly. All data must be taken from user.
6. Define a class point, inherit class line from point, rectangle from line, and cube from rectangle. Write no argument constructor in each class. Write a print statement in these constructors mentioning which class it is. Create an object of the cube class in the main method of a separate class called test and show the output.
7. WAP to create a Person class having name, age and gender as instance variables. Write three constructors for constructor overloading like,
   a) First with no-argument.
   b) Second with three arguments for passing name, age and gender.
   c) Third with object as parameter to create a new copy of an existing Person object.

   Display the properties of Person class object with suitable methods.
8. Create an abstract class Shape with methods calc_area and calc_volume. Derive four classes Sphere(radius) , Cone(radius, height) and Cylinder(radius, height), Box(length, breadth, height) from it. Calculate area and volume of all. (Use Method overriding).
9. Define an abstract class “Staff” with members name and address. Define two subclasses of this class – “FullTimeStaff” (department, salary) and “PartTimeStaff” (numberof- hours, rate-per-hour). Define appropriate constructors. Create n objects which could be of either FullTimeStaff or PartTimeStaff class by asking the user’s choice. Display details of all “FullTimeStaff” objects and all “PartTimeStaff” objects.
10. Define an interface “StackOperations” which declares methods for a static stack. Define a class “MyStack” which contains an array and top as data members and implements the above interface. Initialize the stack using a constructor. Write a menu driven program to perform operations on a stack object.
11. Define an interface “QueueOperations” which declares methods for a static queue. Define a class “MyQueue” which contains an array and front and rear as data members and implements the above

interface. Initialize the queue using a constructor. Write a menu driven program to perform operations on a queue object.

12. Write a java program to create n objects of the Student class. Assign roll numbers in the ascending order using static method. Accept name and percentage from the user for each object. Define a method "sort Student" which sorts the array on the basis of percentage
13. Write a program to enter the student's name, Rollno. Marks, in any no. of subjects as command line argument and find the percentage and grade of the student and thrown a NumberFormatException if required.
14. WAP having multiple catch and finally blocks where the catch blocks should handle the exceptions like, ArrayIndexOutOfBoundsException, NumberFormatException and ArithmeticException or any other exception.
15. Write a java program to creates ten threads, each of which do some work(search for the maximum value of a large matrix .Each thread searches one portion of the matrix.) It waits for them all to finish, then gathers the results.
16. Write a java program to show the use of synchronized method ().
17. Write a program to remove common characters from two strings.
18. Write a program to print all the palindrome words of a given string.
19. Input some strings through command line. Half of which will be stored in a *String* array and rest will be stored in a *StringBuffer* array. Write a program that will concatenate each element of this array of *String* objects with each element of *StringBuffer* objects. And the result will be stored in an array of *StringBuffer*.
20. Write an applet program to display the following by using different layouts.



Course Title: DISCRETE MATHEMATICS
Course Code: MAC 311
No. of Credits - 4

- To get familiar and understand the fundamental notions in discrete mathematics
- To understand and demonstrate the basic concept of an algorithm and its application in combinatorial mathematics
- To identify the basic properties of graphs and trees and model simple applications
- To understand the basic concept of group theory and its application
- To get familiar with some statistical measures

Programme Education Objectives

PEO1	Understand the nature and basic concepts of DISCRETE MATHEMATICS Relating to the M.Sc. Degree in Computer Sciences
PEO2	Analyse the relationships among different concepts
PEO3	Perform procedures as laid down in the areas of study
PEO4	Apply the Basic Concepts learned to execute them

Course Outcomes

CO1	Remember and understand the basic concepts/Principles of DISCRETE MATHEMATICS
CO2	Analyse the Various Concepts to understand them through case studies

CO3	Apply the knowledge in understanding practical problems
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT - I

Fundamentals of logic, Prepositional equivalences, Predicates and Quantifiers, Methods of Proof, Sequences and summations, Mathematical Induction. Sets, Set operations, Properties of binary relations, Equivalence relations and partitions, Partial ordering relations and lattices, Properties of lattices, Distributive and Complemented lattices, Boolean algebra,

UNIT - II

The basics of counting, Permutations and Combinations, Recurrence relations, Solving Recurrence relations, Generating functions, Inclusion-exclusion.

UNIT - III

Groups, Subgroups, Cosets and Lagrange's Theorem, Codes and Group codes, Homomorphism and Normal subgroups, Isomorphism, Ring, Integral Domains and Fields.

UNIT-IV

Introduction to graphs, Graph terminology, Representing graphs and Graph isomorphism, Euler and Hamilton paths, Introduction to trees, Applications of trees.

Frequency Distribution, Measures of Central Tendencies, Dispersion, Skewness, Kurtosis, Mathematical Expectation.

Books Recommended:

1. Kenneth H. Rosen, "Discrete Mathematics & Its Application", TMH, 7th Edition, 2011
2. C. L. Liu, "Elements of Discrete Mathematics", TMH, 2nd Edition, 2000
3. BernardiKolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structure", PHI, 6th Edition, 2008
4. S.P.Gupta,"Statistical Methods", S.Chand& Sons, 2011 Edition

OPEN SOURCE LAB

Course Code **CSL 317** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **III**

Category: Laboratory Course

Prerequisite: Basic concepts of Computer Science

Objective: To get clear understanding about LaTeX and shell scripting in LINUX.

Course Outcome :

CO-1	Remember and understand the basic concepts/Principles of Open source lab
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

Contents

A. Learning LaTeX

1. What is and why to learn LaTeX?
2. Writing your first piece of LaTeX
3. The preamble of a document
4. Adding a title, author and date and adding comments
5. Bold, italics and underlining
6. Adding images
7. Creating lists in LaTeX
8. Adding math to LaTeX
9. Basic Formatting
10. Creating tables and adding a Table of Contents
11. Preparing beamer slides

B. Shell Scripting in LINUX

Sno	**List ofprograms**
1	Write a Shell Script that accepts a file name, starting and ending line numbers as arguments and displays all lines between the given line numbers.
2	Write a shell script that deletes all lines containing the specified word in one or more files supplied as arguments to it.
3	Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.
4	Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly. whenever the argument is a file it reports no of lines present in it
5	Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.
6	Write a shell script to list all of the directory files in a directory
7	Write a shell script to find factorial of a given number.

SOFTWARE ENGINEERING LAB.

Course Code **CSL 325** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **VI**

Category: Program Core Course

Prerequisite: Knowledge on programming and data structure

Objective:

- The Software Engineering Lab has been developed by keeping in mind the following objectives:
- To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
- Present case studies to demonstrate practical applications of different concepts.
- Provide a scope to students where they can solve small, real life problems

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFTWARE ENGINEERING LAB.
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

List Of Experiments:

1. Develop requirements specification for a given problem (The requirements specification should include both functional and non-functional requirements. For a set of about 20 sample problems
2. Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required).
3. Develop Structured design for the DFD model developed.
4. Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)
5. Develop Sequence Diagrams
6. Develop Class diagrams.
7. Develop code for the developed class model using Java
8. Use testing tool such as Junit.
9. Use configuration management tool

Use any one project management tool such as Microsoft Project or Gantt

PERSONAL DEVELOPMENT

Course Code **OPE E05** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic knowledge about business communication and language.

Objective:

- A person's personality is defined by their characteristics, behaviors, thoughts, and feelings.
- These aspects start developing during childhood, and are strengthened and molded as the person grows.

Course outcome: This study nurtures the student and grooms their personality

CO-1	Remember and understand the basic concepts/Principles of PERSONAL DEVELOPMENT
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Self Awareness: Know yourself, have a snapshot of yourself, assess your personal traits, discover natural potential. Activities and Tasks: Class discussion, questionnaires, Johari Window, SWOC analysis (strengths, weaknesses, opportunities and challenges).

UNIT – II: **(10 hours)**

Self Discipline: Importance of self-discipline, characteristics of a self-disciplined achiever, self-discipline in personal life and career. Activities and Tasks: Viewing short videos followed by discussion and analysis, brainstorming in small groups, creating an action plan to realize academic and career goals.

UNIT – III: **(10 hours)**

Motivating Oneself: Self-motivation, confidence building, goal setting, decision making. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires, Handling emotions, time management, stress management, change management. Activities and Tasks: Discussion and analysis of case studies, completing self-assessment questionnaires.

UNIT – IV: **(10 hours)**

Interpersonal Behaviour: Attitude towards persons and situations, teamwork, leadership skills, problem solving skills, interpersonal adaptability, cultural adaptability. Importance of Corporate communication - Introduction to and definition of corporates – Communication, process, patterns and channels of communication- Barriers to communication and strategies to overcome them- Evolution of corporate culture- Role and contribution of individual group and organization - Role of psychology in communication.

TEXT BOOKS:

1. Personality Development and Soft Skills – Oxford University Press by Barun K. Mitra

REFERENCE BOOK:

1. Personality Development – Goodwill Publishing House by Harsh Kumar

E-COMMERCE

Course Code **HSE E07** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic Software Engineering.

Objective:

- To know Project Evaluation and Planning.
- To introduce the concept of Project Sequencing and Scheduling.
- To know Quality Management and People Management.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of E-COMMERCE
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems

CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Electronic Commerce: Frame work, anatomy of e-commerce applications, e-commerce consumer applications, e-commerce organization applications, consumer oriented electronic commerce, mercantile process models. Electronic payment systems: Digital token based, smart cards, credit cards, risks in electronic payment systems.
Inter Organizational Commerce: EDI, EDI implementation, value added networks.

UNIT – II: **(12 hours)**

Intra Organizational Commerce: Work flow, automation customization and internal commerce, supply chain management. Corporate Digital Library: Document library, digital document types, corporate data warehouses, advertising and marketing, information based marketing, advertising on internet, online marketing process, market research.

UNIT – III: **(08 hours)**

Consumer Search and Resource Discovery: Information search and retrieval, commerce catalogues, information filtering.

UNIT – IV: **(08 hours)**

Multimedia: Key multimedia concepts, digital video and electronic commerce, desktop video processing, desktop video conferencing.

TEXT BOOKS:

1. Ravi Kalakota and Andrew B. Whinston, Frontiers of electronic commerce, Pearson, 1996.

REFERENCE BOOKS:

1. Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, Ecommerce fundamentals andapplications, John Wiley, 2008.
2. S. Jaiswal, E-Commerce, Galgotia Publications, 2003.

HSE E09: HUMAN RESOURCE MANAGEMENT

Programme Education Objectives

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of HUMAN RESOURCE MANAGEMENT
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Course Contents

UNIT I Essentials of HRM: Nature of HRM, Scope, functions and importance of HRM, HRM vs.HRD, SHRM: Introduction, characteristics and scope of SHRM, SHRM vs. Conventional HRM, Barriers to strategic HRM, Linking HR strategy with business strategy, HRM linkage with TQM & productivity.

UNIT II Human Resource Planning and Employee Hiring : Nature of job Analysis, job design, Human Resource Planning, Demand forecasting for manpower planning, HR supply forecasting, factors influencing HRP, Employee hiring- Nature of Recruitment, Sources of recruitment, Employee selection, process of employee selection, recent trends in recruitment.

UNIT III Employee Training & Development: Nature and importance of Training, methods and types of training, career planning, promotion, transfer, demotion and separation, Performance Appraisal: Meaning and types of appraisal, Job Evaluation: Meaning and methods of job evaluation.

UNIT IV Compensation Management and Employee Relations: Introduction to compensation management, Components of employee and executive compensation, Factors affecting employee compensation, Employee incentive schemes, and recent trends in compensations management. Meaning and nature of employeerelation and industrial relations.

UNIT V Employee Safety/ Health and International Human Resource Management: Basics of ethics and fair treatment at work, measures and policies for employee safety at work, basic principles governing International Human Resource Management and the role of culture.

References Books:

1. V.S.P.Rao, Human Resource Management (Text and Cases) Himalaya Publications, Thirteenth Edition.
2. Durai Praveen, Human Resource Management Pearson Publication, 2nd Edition.
3. Gary Dessler and BijuVarkkeyHuman Resource Management, Person Publication, 2013, 14th Edition.
4. SeemaSanghi, Human Resource Management, VikasPubllications, 2014, 5th Edition.
5. K. Aswathappa, Human Resource Management, McGraw Hill Education, 2013, 7th Edition.

The list of cases and specific references including recent articles will be announced in the class at thetime of launching of the course.

SOCIETY AND SOCIAL ISSUES

Course Code: **HSE E10** **L-P-T-Cr.:** **3 0 0 3** **Semester:V**

Category: Open Elective Course

Prerequisite: Basic knowledge about Indian Society and Culture.

Learning Objective: Resolutions constitute an important opportunity for our students to analyze and opine on contemporary *social problems* that we believe the knowledge of social issues is of importance.

Learning Outcome: On the completion of the course, students will attain skills that will enable them to think critically and imaginatively about the society and social issues.

UNIT – I : **(8 Hours)**

Basic principles of management as per ancient Indian Wisdom and insight, Holistic approach, Kaushalam or Excellence at work quality, Quality of work-life and Work Ethics, Essential Features of Indian Ethos and Insight, Intuition in Management, Indian Wisdom and Modern Management, Managerial Effectiveness, Globalisation, High Technology, Ecology, New Marketing Concept, Managerial Effectiveness

UNIT – II: **(12 Hours)**

TQM: Quality, TQM, Quality Assurance, TQM and Human Values, Three Aspects of TQM, Internal Quality, Problem Solving Tools, Total Involvement of all Japanses Operating Management Ethos, HRD Interventions in TQM, Emphasis on Quality of Life, Focus on Quality of Work Life, TQM and Human Values System, TQM Environment, Value based Holism, Management as Change Agent, Cross functional Self-Managed Teams, , Mission, Vision, Values, Value based TQM of Western Company, Attributes of Support Team Managers, Quality Management, Kaizen Model

UNIT – III: **(10 Hours)**

Business Ethics and Stress Management: Need for managers, concept behind Business Ethics, what is ethical dilemma, need for ethical values in global change, Indian perspective, trans-cultural human values in management education Definition, types of stress, Causes of stress, positive and negative effect of stress, problem relating to stress in corporate management-Indian perspective, How to cope up with stress, Job burnout.

UNIT – IV: **(10 Hours)**

Corporate social responsibility Social responsibility of business, standard of living or life style, ethical policy and process, forces inducing, social responsibility, business and consumer, business and its environments

TEXT BOOKS

1. A study in Business Ethics :Rituparna Raj (Himalaya Publisher)
2. Ethics in Management :S.A.Sherlekar (Himalaya Publisher)

REFERENCE BOOKS

1. Foundation of Managerial Work :S.K.Chakrabory (Himalaya Publisher)
2. Managing in Turbulent Time: P.Drucker(Pan Book)
3. Managing Secularism in new Millennium :S.Kumar and Uberoi(Excel Books)

OPE E03 STATISTICAL METHODS

*The objective of the paper "**STATISTICAL METHODS & COMPUTER APPLICATION-II**" is to teach the students about testing of hypothesis and drawing of inferences from different sources of data using computer software. The paper also aims to enable the students to understand the index number and time series analysis.*

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **Statistical Method**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

I. **Estimation theory & Tests of hypotheses-I** , interval estimation, Tests of hypotheses,level of significance, large and small sample tests, Z-test, t-test, F-test and Chi-square test.

II. **Index numbers**: quantity and price index number, index number formulae, construction of index numbers, construction of cost of living index number, time reversal, factor reversal and circular test.

III. **Time series analysis**- decomposition- Fitting of secular Trend, Method of de-seasonalisation, Measurement of cyclical fluctuation and irregular variations.

IV. **Basic concept of sampling & Computer Applications**: random and non-random sampling ; Simple random, stratified random and PPS sampling;
Use of statistical packages (S.P.S.S. & E View) in frequency distribution, correlationand regression analysis, ANOVA, Time Series Tests.

Reading List:

1. Chiang A.C. (1986), Fundamental methods of Mathematical Economics, McGrawHill, New York.
2. Allen, R.G.D. (1974), Mathematical Analysis for Economists, Macmillan Press and ELBS London.
3. Yamane, Taro (1975), Mathematics for Economists, Prentice Hall of India, NewDelhi.
4. K. Sydsaeter and P. Hammond (2002), *Mathematics for Economic Analysis*, Pearson Educational Asia: Delhi.
5. Gupta, S. P. (1978), Statistical Methods, Sultan Chand and Sons.
6. Gupta, S. C. and V. K. Kapur (1970), Mathematical Statistics, Sultan Chand and Sons.
7. Murray R. Spiegel (1992), Theory and Problem of Statistics, Schaum's Outline Series, Metric edition
8. Gupta, S. C. (1981), Fundamentals of Statistics, Himalaya Publishing House

COMPUTER ORIENTED NUMERICAL METHODS

Course Code **OPE E05** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Interdisciplinary Elective Course

Objective:

- To Understand integration & differentiation .
- Understand the differential equation and root finding.
- Understand the solution of system of linear equation.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPUTER ORIENTED NUMERICAL METHODS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: ERROR (10 hours)

Calculation and handling of error in programming. Interpolation: Newton's. Lagrange's, Gauss. Stirling's and Bessel's interpolation formulae and their accuracy, Inverse interpolation. Interpolation with two independent variables (elementary idea only).

UNIT – II: INTEGRATION & DIFFERENTIATION (08 hours)

Trapezoidal, Simpson, Weddle's and Gaussian Quadrature methods and their accuracy. Numerical derivative (1st and 2nd order) based on Newton's Forward and Stirling's interpolation.

UNIT – III: DIFFERENTIAL EQUATION AND ROOT FINDING (12 hours)

Euler's method, Runge-Kutta Method (4th order algorithm), Finite difference method, J.C. Adam and Successive approximation method. Bisection, False Position, Newton-Raphson and Iteration Method. Simultaneous Equation for Several unknown: Newton-Raphson and Iteration Method.Solution for Multiple roots: Graeffe's Root Squaring method.
Least square fitting of a set of points: Line. Quadratic and Cubic Interpolation: Linear, Quadratic and Cubic Spline methods.

UNIT – IV: SOLUTION OF SYSTEM OF LINEAR EQUATION (10 hours)

Matrix inversion method, Gaussian elimination method, LU decomposition method, Pivoting. Eigen value and Eigenvector of Symmetric Matrix: Jacobi Transformations, Gaussian elimination method.

TEXT BOOKS:

1. J.B. Scarborough: Numerical Mathematical Analysis (Oxford and IBH)

REFERENCES:

1. E. Balgurusamy: Numerical Methods (TMH)
2. V. Rajaraman: Computer Oriented Numerical Methods
3. George W. Collins, II: Fundamental Numerical Methods and Data Analysis – Free Internet resource available at httP.7/ads.harvard.edu/books/1990fnmd.book

MIDDLEWARE TECHNOLOGIES

Course Code	**OPE E06**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**

Category: Open Elective Course

Prerequisite: Knowledge of Computer software.

Objective:

- To learn EJB application.To learn CORBA and COM

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MIDDLEWARE TECHNOLOGIES
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Client / Server concepts: client-server, file server, database server, group server, object server, web server, middleware, general middleware, service specific middleware, client / server building blocks, RPC, messaging, peerto- peer.

UNIT – II: **(10 hours)**

EJB Architecture: EJB, EJB architecture, overview of EJB software architecture, view of EJB, conversation, building and deploying EJBs, rolesin EJB.

UNIT – III: **(08 hours)**

EJB Applications: EJB APPLICATIONS: EJB session beans, EJB entity beans, EJB clients, EJB deployment, building an application with EJB

UNIT – IV: **(12 hours)**

CORBA: CORBA, distributed systems, purpose, exploring CORBA alternatives, architecture overview, CORBA and networking model, CORBA object model, IDL, ORB, building an application with CORBA

COM:COM, data types, interfaces, proxy and stub, marshalling, implementing server/client, interface pointers, object creation, invocation, destruction, comparison COM and CORBA .Introduction to .NET, overview of .NET architecture, marshalling, remoting.

TEXT BOOKS:

1. Robert Orfali, Dan Harkey and Jeri Edwards, The Essential Client /Server Survival Guide, Galgotia Publications, 2002.
2. Tom Valesky, Enterprise Java Beans, Pearson Education, 2002.

REFERENCE BOOKS:

1. Mowbray, Inside CORBA, Pearson Education, 2002.

2. Jeremy Rosenberger, Teach Yourself CORBA in 14 days, TEC Media, 2000.
3. Jason Pritchard, COM and CORBA Side by Side, Addison Wesley, 2000.
4. Jesse Liberty, Programming C#, 2/e, O'Reilly Press, 2002

OPE E08 VLSI ENGINEERING

Prerequisites: Knowledge of IC design , SPICE Modelling and digital basics .
Objective: To learn fundamentals of embedded system design.-To learn different types of VLSI Design methodologies ,VLSI design Styles and fabrication process of MOS transistors.
- To learn about MOS inverter, combinational and sequential logic circuits using MOS.

- To learn VHDL programming.

CO-1	Remember and understand the basic concepts/ Principles of VLSI Engineering
CO-2	Analyse the various concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute / Create the project or field assignment as per the knowledge gained in the course

MODULE I: INTRODUCTION TO VLSI(12 Hours)
Introduction, historical perspective, VLSI Design methodologies, VLSI Design flow, Design hierarchy, Design styles, CAD Technology. Fabrication of MOSFETS, Fabrication processes, NMOS Fabrication, CMOS n-well process, Layout Design rules, Full Custom Mask Layout Design, MOS Transistor, Review of structure and operation of MOSFET (n-MOS enhancement type), CMOS, MOSFET V-I characteristics, MOSFET scaling and small geometry effects, MOSFET capacitances, Modelling of MOS transistors using SPICE- Basic concept.
MODULE II: MOS INVERTERS(12 Hours)
Basic NMOS inverters, characteristics, inverters with resistive load and with n-type MOSFET LOAD, CMOS Inverter and characteristics. MOS Inverters: switching characteristics and interconnect effects : Delay time definitions and calculation, inverter design with delay constraints, estimation ofparasitic switching power dissipation of CMOS inverters.

MODULE III: COMBINATIONALAND SEQUENTIAL MOS LOGIC CIRCUITS(12 Hours)
Combinational MOS logic circuits: CMOS logic circuits, complex logic circuits, pass transistor logic. Sequential MOS logic circuits: introduction, SR latch, clocked latch & flip-flop circuits, CMOS D latch and edge triggered flip-flop. Dynamic logic circuits: Dynamic logic, basic principles, high performance dynamics CMOS circuits, Dynamic RAM, Static RAM, Flash memory.

MODULE IV:INTRODUCTION TO VHDL(12 Hours)
Introduction to VHDL, Behavioural modelling, sequential processing, Data types, IEEE std logic, VHDL operators, arrays, Modules, packages, libraries. VHDL description of combinational logic circuits, VHDL description of sequential logic circuits. Modelling of flip-flops, registers, and counters using VHDL. VHDL code for serial adder, and binary multiplier.

TEXT BOOKS:

1. CMOS Digital Integrated Circuits – Analysis & Design – Sung -Mo Kang &YussufLeblebici, TMH.
2. Basic VLSI Design by Douglas A Pucknell and Kamran Eshraghian, PHI, 3rd edition.
3. VHDL Programming by example – Perry TMH.

REFERENCE BOOKS:

1. Digital Integrated Circuits : A Design Perspective – Rabey et.al. Pearson Education.
VLSI Design Techniques for analog and digital circuits – Geiger et. Al. McGraw Hill

REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

Course Code **OPE E13** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Basic knowledge geography and computer science.

Objective:

- To Understand Geographic information system.
- Understand remote sensing.
- Understand natural resources management

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Fundamentals of Remote Sensing: Introduction, electromagnetic radiation, electromagnetic spectrum, energy interactions with earth's surface materials and atmosphere, sensors and platforms, false colour composite (FCC) image, image interpretation techniques, satellite remote sensing - Indian context.

UNIT – II: **(12 hours)**

Fundamentals of GIS: Introduction, elements of GIS, vectorization, rasterization, geo-referencing, map projections, digitization process, data base handling, types of data structures, overlay analysis, surface terrain models - digital elevation model (DEM), triangulated irregular network (TIN), and slope models.RS and GIS Techniques for Natural Resources Management: Land use/ land cover classification systems, forest cover, agriculture and wasteland management. water resources management.

UNIT – III: **(08 hours)**

RS and GIS Techniques for Infrastructure Planning and Management: Urban utilities, cadastral mapping and transport network. GPS Navigationsystem for various applications.

UNIT – IV: **(10 hours)**

RS and GIS Techniques for Natural Disasters Management: Earthquakes, landslides, cyclones and floods - hazard zonation, riskassessment, relief and rehabilitation measures.

TEXT BOOKS:

1. P.K. Guha, Remote Sensing for the Beginner, EWP Ltd., 2013.
2. M. Anjireddy, Text Book of Remote Sensing and Geographical Information Systems, BSP Publishers, 2012.

REFERENCE BOOKS:

2. T.M. Lillesand and Kiefer, Remote Sensing and Image Interpretation, R.W. John Wiley & Sons Publishers, 2008.

NETWORK MANAGEMENT

Course Code: **CSE E24** **L-P-T-Cr.:** **3 0 0 3** **Semester:VIII**

Category: Programme Elective Course

Prerequisite: Basic Computer Network..

Course Objective:
1 Fundamentals of Network monitoring
2 Fundamental of SNMP.
3 Remote Network Monitoring

Learning Outcome: This course enables us to understand the concepts of Network management.

UNIT I **(08 Hours)**

Introduction: Network management requirements, network management system. Network Monitoring: Network monitoring architecture, performance monitoring, fault monitoring, accounting monitoring.Network Control: Configuration control, security control.

UNIT II **(12 Hours)**

SNMP Network Management Concepts: Background, basic concepts. SNMP Management Information: Structure of management information, practical issues. Standard MIB: MIB-II, ethernet interface MIB. Simple Network Management Protocol: Basic concepts, protocolspecifications, transport level support, SNMP group.

UNIT III **(10 Hours)**

Remote Network Monitoring: Statistics collection, basic concepts, groups,statistics, history, host, hostTopN, matrix, token ring extensions to RMON.Remote Network Monitoring: Alarms and filters: Groups: alarm, filter,packet capture, event. RMON2: Overview, protocol directory group,protocol distribution group, address map group, RMON2 host groups,MON2 matrix groups, user history collection groups, probe configurationgroup, extensions to RMON1 for RMON2 devices.

UNIT IV **(10 Hours)**

SNMPv2: Management Information: Background, structure of managementinformation. SNMPv2: Protocol: Protocol operations, transport mappings, coexistence with SNMPv1. SNMPv2: MIBs and conformance: SNMPv2 management information base, conformance statements, evolution of the interfaces group of MIB-II.**SNMPv3:** Cryptographic Algorithms in SNMPv3: Conventional encryption with DES, the MD5 secure hash function, the SHA-1 secure hash function, message authentication with HMAC SNMPv3: Architecture and Applications: Background, SNMPv3 overview, SNMPv3 architecture, SNMPv3 applications, MIBs for SNMPv3 applications.

TEXT BOOK

1. William Stallings, SNMP, SNMPv2, SNMPv3, AND RMON1 and 2, 3/e,Pearson Education, 1998.

REFERENCE BOOKS

1 Mani Subramanian, Network Management Principles and Practice, Pearson Education, 2012.

SEMANTIC WEB

Course Code	CSE E03	L-P-T-Cr.:	4	0	0	3	Semester:	VI

Category: Professional Elective Course

Prerequisite: Basic Computer science

Objective:

- To identify Web Intelligence.
- To know Knowledge Representation for the Semantic Web.
- Understanding Semantic Web Applications, Services and Technology

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SEMANTIC WEB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

Web Intelligence: Thinking and intelligent web applications, theinformation age ,the world wide web, limitations of today's web, the next generation web, machine intelligence, artificial intelligence, ontology,inference engines, software agents, berners-lee www, semantic road map,logic on the semantic web. Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, ontologies languages for the semantic web -Resource Description Framework(RDF) / RDF schema, Ontology Web Language(OWL),UML,XML/XML schema.

UNIT – II: **(08 hours)**

Ontology Engineering: Ontology engineering, constructing ontology, ontology development tools, ontology methods, ontology sharing and merging, ontology libraries and ontology mapping, logic, rule and inference engines.

UNIT – III: **(10 hours)**

Semantic Web Applications, Services and Technology: Semantic web applications and services, semantic search, e-learning, semantic bioinformatics, knowledge base, XML based web services,creating an OWL-S ontology for web services, semantic search technology, web search agents and semantic methods.

UNIT – IV: **(10 hours)**

Social Network Analysis and semantic web: What is social networksanalysis? Development of the social networks analysis, electronic sources for network analysis, electronic discussion networks, blogs and online communities, web based networks, building semantic web applications with social network features.

TEXT BOOKS:

1. Berners Lee, Godel and Turing, Thinking on the Web, Wiley inter science, 2008.
2. Peter Mika, Social Networks and the Semantic Web, Springer, 2007.

REFERENCE BOOKS:

1. Davies, R.Studer, P.Warren, Semantic Web Technologies, Trends and Research in Ontology Based Systems, J John Wiley and Sons, 2007.
2. Liyang Lu Chapman and Hall, Semantic Web and Semantic Web Services,CRC Publishers , 2007.
3. Heiner Stuckenschmidt, Frank Van Harmelen, Information Sharing on thesemantic Web, Springer Publications, 2004.

CLOUD COMPUTING

Course Code **CSE E04** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VIII**

Category: Professional Elective Course

Prerequisite: Basic Computer Network

Objective:

- To develop the understanding of fundamentals and technological aspects of Cloud Computing. Management of cloud services.
- Virtualization along with various terminologies and the keywords used in Cloud Computing and virtualization. Storage network design and optimization

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of CLOUD COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: CLOUD COMPUTING FUNDAMENTALS **(10 hours)**

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.Cloud Computing definition, private,public and hybrid cloud.
Cloud types: IaaS,PaaS, SaaS. Benefits and challenges of cloud computing, public vs privateclouds, role of virtualization in enabling the cloud; Business Agility: Benefits andChallenges to Cloud architecture. Application availability, performance, securityand disaster recovery

UNIT – II: MANAGEMENT OF CLOUD SERVICES **(08 hours)**

Reliability, availability and security of services deployed from the cloud.Performance and scalability of services, tools and technologies used to managecloud services deployment; Cloud Economics: Cloud Computing infrastructuresavailable for implementing cloud based services.

UNIT – III: VIRTUALIZED DATA CENTER ARCHITECTURE & INFORMATION STORAGE SECURITY & DESIGN **(12 hours)**

Cloud infrastructures; public, private, hybrid. Service provider interfaces; Saas,Paas, Iaas. VDC environments; concept, planning and design, business continuity and disaster recovery principles. Managing VDC and cloud environments and infrastructures. Storage strategy and governance; security and regulations. Designing secure solutions; the considerations and implementations involved. Securing storage in virtualized and cloud environments.

UNIT – IV: STORAGE NETWORK DESIGN & OPTIMIZATION OF CLOUD STORAGE **(10 hours)**

Architecture of storage, analysis and planning. Storage network designconsiderations; NAS and FC SANs, hybrid storage networking technologies(iSCSI, FCIP, FCoE), design for storage virtualization in cloud computing, hostsystem design considerations.Global storage management locations, scalability, operational efficiency. Globalstorage distribution; terabytes to petabytes and greater

TEXT BOOKS:

1. Greg Schulz, “Cloud and Virtual Data Storage Networking”, AuerbachPublications [ISBN:978-1439851739], 2011.
2. GautamShroff, “Enterprise Cloud Computing Technology ArchitectureApplications”,

Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

REFERENCE BOOKS:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A PracticalApproach" McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.
2. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 edition[ISBN: 1439834539],2010.
3. EMC, "Information Storage and Management" Wiley; 2 edition [ISBN: 9780470294215],2012.

Human Computer Interaction

Course Code **CSE E05** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional elective course

Prerequisite: Basics of Computer, Programming, WEB

Objective:

- Software process and Design rules.Implementation and user support.Differentmodels for cognition and collaboration.Introduction to Ubiquitous computing

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Human Computer
InteractionCO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (08 hours)

The Human – Input-output channels – Human Memory – Thinking – emotions – Psychology & design of interactive systems; Computer – Text entry devices- Positioning, Pointing & drawing – Display devices for Virtual reality, 3D; Interaction – models – Frameworks & HCI, Ergonomics – Interaction styles – WIMP Interfaces – context; paradigms for Interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories

UNIT – II: SOFTWARE PROCESS & DESIGN RULES,IMPLEMENTATION & USER SUPPORT (12 hours)

Interaction design basics – user focus – scenarios – navigation – screen design & layout; HCI in software process – life cycle – Usability engineering – Interactive design & prototyping ; Design rules – Principles for usability – standards – guidelines – golden rules – HCI patterns
Implementation support – Windowing system elements – using tool kits – user interface management ; Evaluation techniques – goals – expert analysis – choosing a method; universal design principles – multimodal interaction; user support – requirements – Approaches – adaptive help systems – designing user support systems.

UNIT – III: COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS (10 hours)

Cognitive models – Goal & task hierarchies – Linguistic models – Physical & device models – architectures ; communication & collaboration models – Face-to-face communication – conversation – text based – group working; Task analysis – difference between other techniques – task decomposition – Knowledge based analysis – ER based techniques –uses

UNIT – IV: UBIQUITOUS COMPUTING, HYPERTEXT, WWW (10 hours)

Ubiquitous computing application research – virtual & augmented reality – information & data visualization ; understanding hypertext – finding things – Web Technology & issues – Static Web content – Dynamic Web content; Groupware systems – Computer mediated communication – DSS – Frameworks for groupware.

TEXT BOOKS:

1. Human Computer Interaction by Alan Dix, Janet Finlay , ISBN :9788131717035, Pearson Education (2004)
2. Designing the User Interface - Strategies for Effective Human Computer Interaction", by Ben ShneidermanISBN : 9788131732557, Pearson Education (2010).

REFERENCE BOOKS:

1. Usability Engineering: Scenario-Based Development of Human-Computer Interaction , by Rosson, M. and Carroll, J. (2002)
2. The Essentials of Interaction Design, by Cooper, et al. , Wiley Publishing(2007)
3. Usability Engineering, by Nielsen, J. Morgan Kaufmann, San Francisco, 1993. ISBN 0-12-518406-9
4. The Resonant Interface: HCI Foundations for Interaction Design , by Heim, S. , Addison-Wesley. (2007)
5. Usability engineering: scenario-based development of human-computer interaction, By Rosson, **M.A** & Carroll, J.M. , Morgan Kaufman.(2002)
6. Human Computer Interaction in the New Millenium, John M.Carrol, Pearson Education, 2002

ADVANCED DATA STRUCTURES

Course Code	**CSE E06**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**V**

Category: Programme Elective Course

Prerequisite: Data Structure Basic

Objective:
Design and analyze programming problem statements.
Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
Understand the necessary mathematical abstraction to solve problems.
Come up with analysis of efficiency and proofs of correctness
Comprehend and select algorithm design approaches in a problem specific manner.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED DATA STRUCTURES
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (10 hours)

Review of Data Prilinary Structures: Stack, Queue, Linked lists, binary tree and graph.
Time complexity, Asymtotic analysis: complexity-notations, Omega notation and Theta notation, Big O notation, Divide and conquer: Binary search, Quick sort, Merge sort. Master method for recurrence relation, Hashing, B and B + tree, AVL tree.

UNIT – II: GREEDY METHOD AND DYNAMIC PROGRAMMING (10 hours)

Greedy method: Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest path problem.
Dynamic Programming: General method, applications-Strassen's Matrix chain multiplication, sum of subsets problem.

UNIT – III: BRANCH & BOUND AND ONLINE ALGORITHM (10 hours)

Branch and Bound: General method (Backtracking), N-queen problem, graph coloring, travelling salesman problem. Online Algorithm: Competitive Analysis, Deterministic Algorithms, Randomized Algorithms, Optimum Offline Algorithms, Case Studies – Ski Rental Problem, List Update Problem.

UNIT – IV: APPROXIMATION ALGORITHM AND NP CLASS PROBLEM (10 hours)

Approximation Algorithms: Basic Concepts, Bounds, Polynomial Time Approximation.
Schemes, Bin Packing Problem. NP-Hard and NP-Complete classes, Cook's theorem. Introduction to Beyond NP-Class.

TEXT BOOKS:

Introduction to Algorithms, 2nd Edition,T.H.Cormen,C.E.Leiserson,R.L.Rivest,andC.Stein,PHIPvt.Ltd.Pearson Education.

REFERENCE BOOKS:

(g) Design and Analysis of algorithms, Aho,UllmanandHopcroft, Pearson Education.
(h) Computer Algorithms, E.Horowitz, S.Sahani and S.Rajasekharan, Galgotia Publishers pvt.Limited.

6. Algorithms, Robert Sedgewick, Addison- Wesley

7. Data structure using Java, Sahani
8. Online Computation and Competitive Analysis - A. Borodin and R. El-Yaniv, Cambridge Univ. Press,1998.
9. Approximation Algorithms - Vijay V. Vazirani, Springer Verlag, 2003.

OBJECT ORIENTED ANALYSIS AND DESIGN

Course Code **CSE E07** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VIII**

Category: Professional elective course

Prerequisite: Software Engineering

Objective:

- To train students on object modeling.
- To apply unified process phases.
- To apply unified modeling language for software design of any applications.
- To study case studies for OOAD

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OBJECT ORIENTED ANALYSIS AND DESIGN
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction to UML: Importance of modeling, principles of modeling, Object oriented modeling, Conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT – II: **(10 hours)**

Basic BehavioralModeling: Interactions, Use cases, Use case Diagrams, Interaction diagrams, Activity Diagrams

UNIT – III: **(08 hours)**

Basic Structural Modeling: Classes, Relationships, Common Mechanisms, Diagrams., Class diagrams

UNIT – IV: **(12 hours)**

Advanced Behavioral Modeling: Events and signals, State machines, Processes and Threads, Time and space, State chart diagrams. Advanced Structural Modeling Advanced classes, Advanced Relationships, Interfaces,Types and Roles, Packages,Instances Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Case Study: The Unified Library application.

TEXT BOOKS:

1. The Unified Modeling Language User Guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.
2. UML 2 ToolkitHans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, WILEY-Dreamtech India Pvt. Ltd.

REFERENCE BOOKS:

1. Fundamentals of Object Oriented Design in UML Meilir Page-Jones,Pearson Education.
2. Modeling Software Systems Using UML2, Pascal Roques:, Wiley- Dreamtech India Pvt. Ltd.
3. Object Oriented Analysis &Design,AtulKahate:, The McGraw Hill Companies.

4. Practical Object-Oriented Design with UML Mark Priestley:,TATA McGraw Hill.
5. Appling UML and Patterns: An introduction to Object–Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

DISTRIBUTED DATABASE SYSTEMS

Course Code	**CSE E08**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**

Category: Professional elective course

Prerequisite: A course on "Database Management Systems"

Objective:

- To acquire knowledge on parallel and distributed databases and itsapplications.
- To study the usage and applications of Object Oriented databases.To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and its applications.Equip students with principles and knowledge of parallel and object oriented databases.
- Topics include distributed DBMS architecture and design; query processing and optimization; distributed transaction management and reliability; parallel and object database management systems.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DISTRIBUTED DATABASE SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(08 hours)**

Features of Distributed versus Centralized Databases, Principles of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design

UNIT – II: **(12 hours)**

Translation of Global Queries to Fragment Queries, Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General QueriesThe Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT – III: **(08 hours)**

Reliability, Basic Concepts, Nonblocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency,Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management inDistributed Databases, Authorization and Protection

UNIT – IV: **(12 hours)**

Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed ObjectStorage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues,Query Execution, Transaction Management, Transaction Management in Object DBMSs,Transactions as ObjectsDatabase Integration, Scheme Translation, Scheme Integration, Query Processing Query ProcessingLayers in Distributed Multi-DBMSs, Query Optimization Issues Transaction Management Transactionand Computation Model, Multidatabase Concurrency Control, Multidatabase Recovery, ObjectOrientation and Interoperability, Object Management Architecture CORBA and Databaseinteroperability, Distributed Component Object Model, COM/OLE and Database Interoperability,PUSH-Based Technologies

TEXT BOOKS:

1. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, TMH.
2. Principles of Distributed Database Systems, M. Tamer Ozsu, Patrick Valduriez ,Pearson Education, 2nd Edition.

REFERENCE BOOKS:

1. Distributed Database Systems, Chanda Ray, Pearson.
2. Distributed Database Management Systems, S. K. Rahimi and Frank. S. Haug, Wiley

COMPUTER GRAPHICS

Course Code **CSE E11** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **V**

Category: Programme Elective Course

Prerequisite: Knowledge on C programming and mathematics

Objective:

- To identify and understand the core concepts of computer graphics
- To apply graphics programming techniques to design and create computer graphics scenes.
- To learn about the 2D and 3D transformations including translation,scaling,rotation and reflection .
- To understand principle of clipping,basic line-clipping algorithms
- To learn about application of curves in computer graphics

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPUTER GRAPHICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Graphics Hardware: Display devices, input devices, Raster Graphics.
Line and Circle drawing algorithms: DDA, Bresenham's line drawing algorithm, midpoint circledrawing algorithm.

UNIT – II: **(14 hours)**

Windowing and Clipping: Viewing and Window coordinate System, Viewport, Window, Zoom-inZoom-out, Cohen Sutherland, Cyrus beck line clipping algorithms
2D and 3D Geometrical Transformations: Homogeneous Coordinate system, Basic transformations: Translation, Scaling, Rotation and Reflection.

UNIT – III: **(12 hours)**

Viewing Transformation: Parallel Projection: Orthographic, Axonometric, Cavalier and Cabinet. **Perspective Projection:** one point, two point, three point perspective projection, vanishing point.

UNIT – IV: **(12 hours)**

Curve and Surfaces: Properties of curves, Blending functions: Cubic Bezier and B-Spline curves.
Parametric Surfaces: Surface of revolution Sweep surfaces, Fractal curves and surfaces,
Hidden line/surface removal: Object space and Image space methods, Inside- outside test, Back
Face detection: Z-buffer, A-Buffer Methods.Introduction to computer animation.

TEXT BOOKS:

1. Hearn D. and P. Baker, Computer Graphics C version, Prentice-Hall. (Major Reading)

REFERENCE BOOKS:

1. David F. Rozers, Procedural Elements for Computer Grapihics, TMH.
2. David F. Rozers, Mathematical Elements for Computer graphics, TMH.
3. Foley, J.D. A. Van Dam, Computer Graphics: Principles and Practice, Addison- Wesley.

Other References: (Web)

HIGH PERFORMANCE COMPUTING

Course Code **CSE E12** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Computer Architecture, Advanced Computer Architeture, OS

Objective:

- The course highlights different features of High-Performance Computing, and how they can be implemented through the hardware (architecturalfeatures) and system software (operating systems, run-time systems).

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of HIGH PERFORMANCE COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: BASICS OF HIGH PERFORMANCE COMPUTING **(10 hours)**

RISC processors, Characteristics of RISC processors, RISC vs. CISC, Classification of instruction set architectures, Review of performance measurements, Basic parallel processing techniques: instruction level, thread level and process level.Need of high speed computing – increase the speed of computers – history of parallel computers and recent parallel computers; solving problems in parallel – temporal parallelism – data parallelism – comparison of temporal and data parallel processing – data parallel processing with specialized processors – inter-task dependency. The need for parallel computers - models of computation - analyzing algorithms – expressing algorithms.

UNIT – II: PIPELINING CONCEPTS (10 hours)

Principles of pipelining and vector processing - Linear pipelining - Classification of pipeline processors - General pipelines - Instruction and Arithmetic pipelines –Design of Pipelined instruction unit-Principles of Designing Pipeline Processors- Instruction prefetch and branch handling- Data Buffering and Busing Structure-Internal forwarding and register tagging, Hazard detection and Resolution, Dynamic pipelines and Reconfigurability

UNIT – III: INTRODUCTION TO DATAFLOW AND MULTI-PROCESSOR SYSTEMS (10 hours)

Dataflow computers - Data driven computing and Languages, Data flow computers architectures - Static data flow computer, Dynamic data flow computer, Data flow design alternatives.Multi-Processors: Centralized vs. distributed shared memory, Interconnection topologies, Multiprocessor architecture, Symmetric multiprocessors, Cache coherence problem, memory consistency, Multicore architecture

UNIT – IV: CONCEPTS OF MEMORIES AND PROCESS MANAGEMENT (14 hours)

Virtual memory: Use of memory by programs, Address translation, Paging, Cache memory: Organization, impact on programming.Operating systems: Processes and system calls, Process management, Program profiling, File systems: Disk management, Name management, Protection, Parallel architecture: Inter-process communication, Synchronization, Mutual exclusion, Basics of parallel architecture, Parallel programming with message passing using MPI.

TEXT BOOKS:

1. Hennessey and Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufman.2004.

REFERENCE BOOKS:

1. K. Hwang, F. A. Briggs, "Computer architecture and parallel processing", McGraw-Hill.

GRID COMPUTING

Course Code	**CSE E16**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**
Category:	Professional Elective Course								
Prerequisite:	Operating Systems, Data Structures, and Distributed Computing, Design and Analysis of Algorithms								

Objective:

- The objective is to learn emerging techniques in Cluster and Grid computing and its applications, fault tolerance and security in Grids.
- Learn different Resource Allocation Schemes, Task scheduling algorithms, High-Throughput Computing, and knowledge about GridSim, Gridlet, and Grid Secuirty.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of GRID COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: BASICS OF DISTRIBUTED SYSTEMS (10 hours)

Introduction-Different form of computing,Strengths and Weakness of distributed computing, operating system concepts, Relevant to distributed computing, The architecture of distributed Applications, paradigm for distributed applications, choosing a paradigm for an application(Trade-Off).

UNIT – II: PARALLEL AND CLUSTER COMPUTING (10 hours)

Parallel computing overview, Parallel Programming Models andParadigms.Introduction to Cluster Computing, Scalable Parallel Computer Architectures, Cluster Computer and its Architecture, Classifications, Components for Clusters, Cluster Middleware and Single System Image.

UNIT – III: INTRODUCTION TO GRID COMPUTING (10 hours)

Introduction to Grid Computing, Grid computing anatomy- Architecture, Applications of Grid Computing, Types of grids: Computational, Data, Desktop, Enterprise and Utility Grids, relationship to other distributed technologies, grid computing roadmap.

UNIT – IV: GRID SERVICE ARCHITECTURE (10 hours)

Merging Grid service architecture with the web service architecture. Open grid service architecture: Introduction Atchitecture and goal, Simple use cases: Commercial data centers, National Fusion collaboratory, online media and entertainment, OGSA Platform components, infrastructure.

TEXT BOOKS:

1. Distrbuted Computing, principles and applications, M.L.Liu,Pearson Education, 2004.
2. (Edited By) I. Foster and C. Kesselman, The Grid: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, Elsevier, 2004.
3. Raj KumarBuyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education, 2008.
4. Grid Computing, Joshy,Joseph and Craig fellenstein, Pearson Education 2004.

REFERENCE BOOKS:

1. Chakrabarti, Grid Computing Security, Springer, 2007.
2. Wilkinson, Grid Computing: Techniques and Applications, CRC Press, 2009.
3. S. R. Prabhu, Grid and Cluster Computing, PHI, 2008.

BIG DATA ANALYTICS

Course Code **CSE E17** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VIII**

Category: Professional elective course

Prerequisite: Basic Computer Network, Cloud Computing and Database system.

Objective:

- Fundamentals of Big data. Fundamental of Mapreduce. Information Management and Data Privacy and Ethics

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of BIG DATA ANALYTICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(08 hours)**

Introduction: Big data and its importance, a flood of mythic "start up"proportions, big data is more than merely big why now? aconvergenceof key trends, a wider variety of data, the expanding universe of unstructureddata, industry examples of big data: Digital marketing and the online world,the right approach, cross channel lifecycle marketing.

UNIT – II: **(12 hours)**

Big Data Technology: The elephant in the room: Hadoop's parallel world, old vs. new approaches. Data discovery: Work the way people's minds work, open source technology for big data analytics, the cloud and big data, predictive analytics moves into the limelight, a brief history of hadoop, apache hadoop and the hadoop ecosystem.
MapReduce: Analyzing the data with hadoop, map and reduce, java mapreduce, scaling out, data flow, combiner functions, running a distributedmapreduce job, hadoop streaming, the hadoop distributed file system, thedesign of HDFS, HDFS concepts, blocks, name nodes and data nodes, HDFS federation, HDFS high, availability, the command, line interface, basic file system operations, hadoop file systems

UNIT – III: **(12 hours)**

Information Management: The big data foundation, big data computingplatforms, big data computation, more on big data storage, big datacomputational limitations, big data emerging technologies.
Business analytics : The last mile in data analysis, geospatial intelligence will make your life better, consumption of analytics, from creation to consumption.
Visualizing: How to make it consumable? organizations are using data visualization as a way to take immediate action.

UNIT – IV: **(10 hours)**

Data Privacy and Ethics : The privacy landscape, the great data grabisn't new, preferencess, personalization, and relationships, rights andresponsibility, playing in a global sandbox , conscientious and conscious responsibility, privacy may be the wrong focus can data be anonymized?balancing for counter intelligence.

TEXT BOOKS:

1. MichaelMinelli, Michele Chambers, Big Data,Big Analytics, Wiley Publications, 2013
2. Tom White, Hadoop: The Definitive Guide, 3/e, O'Reilly Publications, 2012.

REFERENCE BOOKS:

1. Bill Franks Taming, The Big Data Tidal Wave, 1/e, Wiley, 2012.
2. Frank J. Ohlhorst, Big Data Analytics, 1/e, Wiley, 2012

INTRODUCTION TO BIOINFORMATICS

Course Code **CSE E19** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Basics of Algorithm, Biology

Objective:

- To understand basic concepts of molecular biology and genetics, the concepts of computer science that relate to problems in biological sciences, computer as a tool for biomedical research, and important functional relationships from gene data.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of INTRODUCTION TO BIOINFORMATICS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION **(08 hours)**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Roleof Structural bioinformatics - Biological Data Integration System.

UNIT – II: DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS **(08 hours)**

Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics

UNIT – III: MODELING FOR BIOINFORMATICSAND PATTERN MATCHING **(14 hours)**

Hidden markov modeling for biological data analysis – Sequence identifiation –Sequence classifiation – multiple alignment generation – Comparative modeling –Protein modelling –genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks Molecular modeling – Computer programs for molecular modeling.Gene regulation – motif recognition – motif detection – strategies for motif detection –Visualization – Fractal analysis – DNA walk models – one dimension – two dimension –higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

UNIT – IV: MICROARRAY ANALYSIS **(10 hours)**

Microarray technology for genome expression study – image analysis for data extraction –preprocessing – segmentation – gridding – spot extraction – normalization, fitering – cluster analysis – gene network analysis – Compared Evaluation of Scientifi Data Management Systems – Cost Matrix – Evaluation model - Benchmark – Tradeoffs.

TEXT BOOKS:

1. Yi-Ping Phoebe Chen (Ed), “BioInformatics Technologies”, First Indian Reprint, Springer Verlag, 2007.
2. Zoe lacroix and Terence Critchlow, “BioInformatics – Managing Scientifi data”, First Indian Reprint, Elsevier, 2004

REFERENCE BOOKS:

1. Zoe Lacroix and Terence Critchlow, "Bioinformatics – Managing Scientifi Data", First Edition, Elsevier, 2004
2. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005

INTERNET OF THINGS

Course Code	**OPE E20**	**L-P-T-Cr.:**	**3**	**0**	**0**	**3**	**Semester:**	**VII**

Category: Open Elective Course

Prerequisite: Basic Computer Network

Objective:

- To Understand the Architectural Overview of IoT.
- Understand the vision of IoT from a global context.
- Understand the application of IoT.Determine the Market perspective of IoT.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of INTERNET OF THINGS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (10 hours)

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT – II: IOT ARCHITECTURE (10 hours)

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoTarchitecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT – III: IOT LAYERS PROTOCOLS (10 hours)

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART,Z-Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

UNIT – IV: INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE (10 hours)

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

TEXT BOOKS:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1stEdition, Academic Press, 2014
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014

REFERENCE BOOKS:

1. Peter Waher, "Learning Internet of Things", PACKT publishing,BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet ofThings", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2,Springer

Management Information Systems

Course Code	**OPE E21**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**

Category: Open Elective Course

Prerequisite: Basic Software Engineering.

Objective:

- The objective of the course is to develop the basic understanding of the decision support system of the artificialintelligence for business organization.Implication of emerging trends in technology.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of Management Information Systems
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Management Information system: Introduction, objective, definition, benefits, characteristics of MIS, , information system level, types of information system, resistance to MIS, implementing MIS,features of MIS, components of MIS.

UNIT – II: **(10 hours)**

Managerial decision making: Decision making process, problem solving techniques, how decisions are being supported – decisions styles group, Simon Model of decision making, features of various CBIS. Decision support system overview - relevance, scope, characteristic and capabilities, components and classification of DSS Decision support System: Introduction, architecture, components, limitation, development.

UNIT – III: **(08 hours)**

Database management system: Objective, characteristics, components and use of DBMS, types of database, Role of DBA. Model base management system: types of models, certainty, uncertainty, risk

UNIT – IV: **(12 Hours)**

Information Security challenges in E-enterprise : Introduction, Security Threats and Vulnerability, Controlling Security Threat and Vulnerability, Management Security Threat in E-business, Disaster Management, MIS and Security Challenges,Software security: threats, method of safety, cryptography, digital signature.Introduction to Emerging trends technology, Expert System, knowledge management, A.I., data mining,data warehousing,

TEXT BOOKS

1. Keen, peter G.W.: Decision Support System an Organisational Perspective Addison-Wesley Pub.
2. Theierauff, Robert J. Decision Support System for effective planning – Prentice Hall – 1982.

REFERENCE BOOKS

1. Kroger, Donald W., and Hugh J. Watson Computer Based Information System New York, 1984.
2. Davis, Michael W. A management Approach – Macmillan Publishing company, Prentice Hall, New Jersey,1988.

MACHINE LEARNING

Course Code **OPE E22** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VIII**

Category: Open Elective Course

Prerequisite: Fundamental of computer science and mathematics

Objective:

- To introduce concepts of learning.
- To know decision tree learning and various learning methods.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MACHINE LEARNING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(12 hours)**

General Introduction: Learning Problems, Choosing Training experience/Target Function, Representation of the target function, issues in machine learning.

Concept Learning: Concept learning task-Inductive Learning, Concept Learning as search, FIND-S algorithm, version spaces, The List then Eliminate algorithm, Representation of version spaces, The Candidate Elimination algorithm, Inductive bias.

UNIT – II: **(12 hours)**

Decision Tree Learning: Decision tree representation, ID3 Learning algorithm, Entropy, Information gain, over fitting, reduced error pruning, Rule-post pruning.

Bayesian Learning: Bayes' Theorem and concept Learning, Bayes optimal classifier, Bayesian Belief Network.

UNIT – III: **(12 hours)**

Instance based Learning: Introduction, k-Nearest Neighbour Learning algorithm, distance weighted nearest neighbour learning algorithm, case based reasoning, lazy learner and eager learner.
Learning Set of Rules: Sequential covering algorithm, First Order Inductive Learning (FOIL), Induction as inverted deduction, Inverting resolution (First order resolution), Generalisation, theta-subsumption and entailment, PROGOL.

UNIT – IV: **(12 hours)**

Analytical Learning: Inductive vs Analytical Learning, Prolog-EBG, Combining inductive and analytical learning.

TEXT BOOKS

1. Tom M. Mitchell, Machine Learning, Mac Graw Hill

REFERENCE BOOKS:

1. Christopher M. Bishop, Machine Learning and Pattern Recognition, Springer

ADVANCED SOFTWARE ENGINEERING

Course Code **CSE E23** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Professional Elective Course

Prerequisite: Software Engineering,

Objective:

- To learn unified software development process.
- To learn Architecture Description Languages and UML

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ADVANCED SOFTWARE ENGINEERING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Embedded software and systems engineering: overview, examples and industrial realities Project Management - Project Planning and Scheduling Standards, e.g. PSS-05; Case studies

UNIT – II: **(10 hours)**

Unified Software Development Process Software Process Improvement Software Economics Software QualitySoftware Metrics - Measurement, Estimation and Prediction Requirements Management Configuration Management Risk Management Testing and Inspection

UNIT – III: **(10 hours)**

Architecture Description Languages Pattern-Oriented Software Architecture Component-based Development Distributed Software Architectures using Middleware Enterprise Application Integration Architectures for Mobile and Pervasive Systems Model Driven Architecture

UNIT – IV: **(10 hours)**

UML Extension Mechanisms Object Constraint Language Model Checking

TEXT BOOKS:

1. Jacobson, J. Rumbaugh, G. Booch: The Unified Software Development Process. Addison Wesley. 1999
2. F. Buschmann, R. Meunier, H. Rohnert, P. Sommerlad, M. Stal: Pattern-Oriented Software Architecture. John Wiley. 1996
3. G. Booch, I. Jacobson, J. Rumbaugh: The Unified Modeling Language User Guide. Addison Wesley. 1999

REFERENCE BOOKS:

1. H.B. Warmer, A. G. Kleppe: The Object Constraint Language: Precise Modeling With UML Addison Wesley. 1997
2. E. M. Clarke, O. Grumberg, D. Peled: Model Checking. MIT Press. 2000
3. A. Finkelstein (ed): The Future of Software Engineering. ACM Press. 2000
4. W. Emmerich: Distributed Component Technologies and their Software Engineering Implications. Proc. of the 24th Int. Conference on Software Engineering, Orlando,nFlorida. pp. 537-546.ACMPress.2002.Alsoavailablefrom http://www.cs.ucl.ac.uk/staff/w.emmerich/publications/ICSE2002/SOA/
5. R. Hubert, D.A. Taylor: Convergent Architecture: Building Model Driven J2EE Systems with UML. Wiley 2002.
6. W. A. Ruh, F. X. Maginnis, W. J. Brown: Enterprise Application Integration. Wiley 2000
7. C. Mascolo, L. Capra and W. Emmerich: Middleware for Mobile Computing. In E. Gregori, G. Anastasi, S. Basagni (eds): Networking 2002 Tutorial Papers. Lecture Notes in Computer Science 2497. Springer Verlag 2002.
8. http://www.cs.ucl.ac.uk/staff/w.emmerich/publications/Networking2002 W. Emmerich, E. Ellmer and H. Fieglein: TIGRA: An Architectural Style for Enterprise Application Integration. Proc. of 23rd Int. Conference on

DISTRIBUTED SYSTEMS

Course Code	**CSE E25**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VII**

Category: Professional Elective Course

Prerequisite: Basic operating system

Objective:

- The main objective of studying this course is to understand concept distributed systems; clock synchronization issues, mutual exclusion, deadlock, resource management, system failure and fault tolerance, system protection model in distributed system.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of DISTRIBUTED SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO•-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION, THEORITICAL FOUNDATION **(10 hours)**

Overview: Concepts, architecture, issues in distributed OS, communication model: message passing, RPC, Theoretical Foundations: Physical clocks, Logical clock, vector clock, happened before relation, major property of the clocks. Applications of clock synchronization: causal ordering of messages(Birman-Schiper-Stephenson, and Schiper-Eggli-Sandoz protocols) **Global state:** consistent global state,(chandy-lamport's global state recording algorithm), Cuts in distributed computation, Huang's termination detection algorithm.

UNIT – II: MUTUAL EXCLUSION, DEAD LOCK, AND AGREEMENT PROTOCOLS **(10 hours)**

Distributed Mutual Exclusion: What is it? Mutual Exclusion in uniprocess system/shared memory systemvs Distributed systems.System Model, requirements, performance metrics. Algorithms: Lamport's algorithm,Ricart-Agrawala algorithm,Maekawa's Quorum based algorithm, Suzuki-Kasami Broadcast Algorithm,Raymond's Tree-Based Algorithm, Singhal's heuristic algorithm.

Distributed Deadlock Detection: Preliminaries, handling strategies, control organizations, Algorithms : Centralized control (Completely centralized control, Ho-Ramamurthy algorithms), Distributed deadlock detection (Path pushing, Edge-chasing algorithms, diffusion computation based algorithms), Hierarchal deadlock detection (Ho-Ramamurthy algorithms).

Agreement Protocols : Introduction, System model, classifications (Byzantine, consensus, and interactive agreement protocols), Lamport's algorithm, Dolev et alia Algorithm. Applications of agreement protocols.

UNIT – III: DISTRIBUTED RESOURCE MANAGEMENT **(10 hours)**

Distributed File Systems: Architecture, Mechanism for building Distributes file system, Design issues, Case studies (SUN NFS, SPRITE).

Distributed Shared Memory: Architecture, advantages, Algorithms : Central server approach, Migration algorithm, Read replication algorithm, Full replication algorithms, Memory coherence (Introduction only).

Distributed Scheduling: Introduction, motivation, Issues in load distribution, components of load distribution, Load distributing algorithms (Sender-initiated, Receiver-initiated algorithm), Task Migration, issues in task migration

UNIT – IV: FAILURE RECOVERY, FAULT TOLERENCE, AND RESOURCE SECURITY AND PROTECTION **(10 hours)**

Failure Recovery: Types of failure, Backward and forward error recovery, Recovery in concurrent systems (Orphan message and the Domino effect, Lost messages, Livelocks). Checkpoints : consistent, and strongly consistent state of checkpoints. Fault Tolerance : Introduction, issues, two-phase commit protocols, non-blocking commit protocols, Voting protocols.Access and Flow Control: Introduction, The access matrix model, Safety in the access matrix model, Lattice model and information flow.

TEXT BOOKS:

1. Singhal, Mukesh& N.G. Shivaratri, Advanced Concepts in Operating Systems, TMH.

REFERENCE BOOKS:

1. P. K. Sinha, "Distributed Operating Systems" PHI, 1998.
2. A.S. Tanenbaum, Modern Operating Systems, PHI
3. G. Coluris, Distributed Systems-Concepts and Design.
4. Chow, Johnson, Distributed Operating Systems, Addison-Wesley

SOFTWARE DESIGN AND VALIDATION

Course Code **CSE E26** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: Software Engineering

Objective:

- Understand the concepts and theory of advanced software design.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of SOFTWARE DESIGN AND VALIDATION
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: CONCEPTS OF MODELS (10 hours)

System, Process and Product Engineering Hierarchies Requirement Engineering and its phases, Building the Analysis Models: Concepts, Data Flow Model, Control Flow Model, State Charts and Transition Models, Quality Function Deployment, Language and Tools, Requirements Validation Metrics.

UNIT – II: SOFTWARE DESIGN CONCEPTS (10 hours)

Software Design Concepts and Principles, Data Design, Software Architectural Styles, Analysis of Architectural Designs, Architectural Design Metrics, Design Structure Quality Index Estimation, User interface design models and process Interface Design Activities, Component Level Design and Notations, Component Level Design Metrics.

UNIT – III: CONCEPT OF SOFTWARE ARCHITECTURE AND OBJECT-ORIENTED DESIGN (10 hours)

Design quality, Design Concepts, The Design Model, Introduction to Pattern Based Software Design, Architecture styles: Main program with sub program style, Abstract data type style, Repository, Layered. Architectural Design: Software Architecture, Data Design and Architectural Design, User Interface Design: Rules, User Interface Analysis and Steps in Interface Design, Design Evaluation Design of Objects, Design and Factoring , Design of Software Objects ,Features and Methods, Cohesion of Objects , Coupling between Objects , Coupling and Visibility, Inheritance, Establishing The Object Model, Refining classes and associations, Analysis model vs. design model classes,

UNIT – IV: INTRODUCTION TO SOFTWARE VERIFICATION AND VALIDATION (10 hours)

An Introduction to Software Verification and Validation/Basic Concepts, Software Quality/Maturity Model/Project presentation, Verification &Validation Planning and Scoping, Requirements for Verification &Validation, Architecture and Design Verification & Validation, Testing of Verification & Validation

TEXTBOOKS:

1. Roger Pressman. S., Software Engineering : A Practitioner s Approach, (4th Edition), McGraw Hill, 1997.
2. Sommerville, Software Engineering, V Edition: Adison Wesley, 1996.
3. Pfleeger, Software Engineering, Prentice Hall, 1999.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli Fundamentals of Software Engineering, Prentice Hall of India, 1991

REFERENCE BOOKS:

1. GradyBooch, James Rambaugh, Ivar Jacobson, "Unified Modeling Language User Guide", 2nd Edition, Addison- Wesley, ISBN – 0321267974.
2. JimArlow, IlaNeustadt, "UML 2 and Unified Process: Practical Object Oriented Analysis and Design.", 2nd Edition, Addison- Wesley, ISBN – 0321321278

ETHICAL HACKING

Course Code **CSE E28** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VII**

Category: Professional Elective Course

Prerequisite: A course on "Operating Systems".A course on "Computer Networks".A course on "Network Security and Cryptography.

Objective:

- The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
- The course includes-Impacts of Hacking; Types of Hackers; Information Security Models; Information Security Program; Business Perspective; Planning a Controlled Attack;Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of ETHICAL HACKING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction: Hacking Impacts, The HackerFramework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, IntegrationInformation Security Models: Computer Security, Network Security, Service Security, Application Security, Security ArchitectureInformation Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking

UNIT – II: **(10 hours)**

The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

UNIT – III: **(08 hours)**

Preparing for a Hack: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance.

UNIT – IV: **(12 hours)**

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern Deliverable: The Deliverable, The Document, Overal Structure, Aligning Findings, Presentation Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion.

TEXT BOOKS:

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press

REFERENCE BOOKS:

1. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning
2. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning

GAME PROGRAMMING

Course Code	CSE E30	L-P-T-Cr.:	4	0	0	3	Semester:	VII

Category: Professional Elective Course

Prerequisite: Basic Computer science

Objective:

- To provide fundamentals knowledge of game programming.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of GAME PROGRAMMING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(08 hours)**

Introduction to game programming, suitable languages for developing games and reasons, animation framework, worms in windows and applets, full screen worms.

UNIT – II: **(12 hours)**

Introduction to java imaging, image loading, visual effects and animation. Loading and playing sounds, audio effects and synthesis, and sprites. Side scroller, isometric tile game, 3-D check board and checkers 3-D, loading and managing external models, lathe to make shapes, 3D- sprites

UNIT – III: **(10 hours)**

Networking basics, network chat, networked two-person game, networked virtual environment

UNIT – IV: **(10 hours)**

Game production and project management, game industry roles and economics, the publisher developer relationship, marketing, intellectual property content, law and practice, content regulation.

TEXT BOOKS:

1. Andrew Davison, Killer Game programming in Java, O'Reilly Publishers, 2005.
2. Steve Rabin, Introduction to Game Development, CENGAGE Technology, 2009.

REFERENCE BOOKS:

1. David Brackeen, Developing Games in Java, 2004.
2. David M Bourg & Glenn Seemann, AI for Game Developers, O'Reilly Publishers, 2004.

WEB RESOURCE:

1. http://www3.ntu.edu.sg/home/ehchua/programming/java/J8d_Game_Framework.html.

REAL TIME SYSTEMS

Course Code	CSE E30	L-P-T-Cr.:	4	0	0	3	Semester:	V

Category: Programme Elective Course

Prerequisite: Data Structure and Algorithm, Linear Algebra, Basics of Web programming

Objective:

- Basics of Real time systems
- Real time memory and design considerations
- Integration of Hardware and software in real time applications

Course outcome:	
CO-1	Remember and understand the basic concepts/Principles of REAL TIME SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (8 hours)

Basic real time concepts - Introduction, Real-time Versus Conventional Software, Computer Hardware for Monitoring and Control, Software Engineering Issues.

UNIT – II: DESIGN TECHNIQUES AND MEMORY MANAGEMENT (10 hours)

Real time specification and design techniques – structure of an RTOS - real time kernels – inter task communication and synchronization.Real time memory management. System performance analysis and optimization.

UNIT – III: QUEUING MODELS AND FAULT TOLERANT ARCHITECTURES (9 hours)

Queuing models – Reliability,testing and fault tolerance, HW/SW faults, diagnosis, functional testing . Faulttolerant architectures: TMR systems - multiprocessing systems.

UNIT – IV: REAL-TIME DATABASES AND COMMUNICATION, APPLICATIONS (13 hours)

Introduction – Main Memory Databases – Transaction Priorities – Concurrency Control Issues – DiskScheduling Algorithms – Databases for Hard Real-Time Systems – Fault-Tolerant Routing Hardware/Software integration, real time applications- case studies.

TEXT BOOKS:

1. LaplantePhilip.A, “Real-time systems design and analysis: An engineer’s handbook”,2ndEdition,
2. PHI.,1994.C.M.Krishna, Kang G.Shin, “Real-time systems” – McGraw Hill, 1997.

REFERENCE BOOKS:

1. Alan C. Shaw , “Real – Time Systems and software “,John Wiley & Sons Inc,2001
2. Buhr R J and Bailey D L, “An Introduction to Real-Time Systems”, Prentice-Hall 1999.
3. Burns, A and Wellings, A, “Real Time Systems and Programming Languages: Ada 95, Real-Time Java and Real-Time C/POSIX”, Addison-Wesley. ISBN.,2001
4. Levi S.T. and Agarwal A.K., “Real time System Design”, McGraw Hill International Edition,1990. Rajibmall “Realtime systems, Theory & Practice “ , Pearson Education 2007.

WEB REFERENCES

1. www.eventhelix.com/realtimemantra/basics
2. www.unix.ecs.umass.edu/~krishna
3. http://infoweb.vub.ac.be/infoef/ulbarch/
4. www.augustana.ab.ca/~mohrj/courses/2005.winter/cs380/slides.7e

COMPILER DESIGN

Course Code	**CS 534**	**L-P-T-Cr.:**	**3**	**0**	**0**	**3**	**Semester:**	**VII**

Category: Programme Core Course

Prerequisite: Theory of Computation / Automata theory

Objective:

- To learn various stages of compilation, design phases of a compiler construction process.
- This course will also introduce open source tool Lex and Yaac.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of COMPILER DESIGN
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION (8 hours)

Overview of Compilation: Phases of Compilation – Lexical Analysis, Regular Grammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

UNIT – II: PARSING (12 hours)

Syntax Analysis: Role of a parser, context free grammars and context free languages, parse trees and derivations, ambiguous grammar.
Top Down Parsing: Recursive descent parsing, LL (1) grammars, non-recursive predictive parsing, error reporting and recovery.
Bottom Up Parsing: Handle pruning and shift reduces parsing, SLR parsers and construction of SLR parsing tables, LR(1) parsers and construction of LR(1) parsing tables, LALR parsers and construction of efficient LALR parsing tables, parsing using ambiguous grammars, error reporting and recovery, parser generator

UNIT – III: SDT,SYMBOL TABLE AND INTERMEDIATE CODE GENERATION (10 hours)

Syntax Directed Translation: Syntax directed definitions (SDD), inherited and synthesized attributes, dependency graphs, evaluation orders for SDD, semantic rules, application of syntax directed translation.
Symbol Table: Structure and features of symbol tables, symbol attributes and scopes.
Intermediate Code Generation: Introduction, benefits and types of intermediate code generation, three address codes - quadruples and triples, DAG for expressions, types and declarations, translation of expressions, translation of Boolean expressions and control flow statements, back patching, intermediate code generation for procedures.

UNIT – IV: REAL-TIME DATABASES AND COMMUNICATION, APPLICATIONS (10 hours)

Run Time Environment: storage organizations, static and dynamic storage allocations, stack allocation, Activation of the procedure and the activation record.
Code Generations: Introduction, Major Issues of Code generation, registers allocation, simple code generation using basic blocks.

Elements of Code Optimization: Objective, peephole optimization, redundant and un-reachable codes, concepts of elimination of local common sub-expressions, basics of flow of control optimization.

TEXT BOOKS:

1. Principles of Compiler Design, A.V. Aho .J.D.Ullman; Pearson Education.
2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.

REFERENCE BOOKS:

1. Lex&Yacc, John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Modern Compiler Design, Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.
3. Engineering a Compiler, Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson

WEB REFERENCES

1http://nptel.ac.in/courses/106108113/

UML LAB

Course Code **CS 536** **L-P-T-Cr.:** **0 2 0 2** **Semester:** **II**

Category: Foundation Course

Prerequisite: Object Oriented Analysis and Design concepts of Software Engineering.

Objective:

- Understand the importance and basic concepts and of object oriented modeling,
- Specify, analyze and design the use case driven requirements for a particular system.
- Model the different usecase diagrams, class diagrams, sequence diagrams etc

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of UML LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

List Of Experiments:

1. Develop Class diagram for a given scenario
2. Develop Sequence diagram for a given scenario
3. Develop Collaboration diagram for a given scenario
4. Develop Usecase diagram for a given scenario
5. Develop Component diagram for a given scenario
6. Develop Deployment diagram for a given scenario
7. Develop Activity diagram for a given scenario

WIRELESS SENSOR NETWORKS

Course Code	**CS 54E2**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VII**

Category: Professional Elective Course
Prerequisite: Basic Computer Network

Objective:

- The purpose of this course is to introduce students to Obtain a broad understanding about the network architecture of wireless sensor network.
- Understand all basic characteristics of wireless sensor networks and sensor nodes.
- The principles of data transmission, clustering algorithm and routing protocols. Design and development of new network architecture and MAC protocols.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of WIRELESS SENSOR NETWORKS	
CO-2	Analyze the Various Concepts to understand them through case studies	
CO-3	Apply the knowledge in understanding practical problems	
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course	

UNIT – I: INTRODUCTION (10 hours)

Networked wireless sensor devices, Applications: Habitat Monitoring, Smart Transportation, Key design challenges. **Network deployment:** Structured versus randomized deployment, Network topology, Connectivity. Introduction to cloud system,Sensor Cloud Systems, Challenges in Sensor Cloud Systems.

UNIT – II: LOCALIZATION AND WIRELESS CHARACTERISTICS (10 hours)

Localization: issues & approaches, Coarse-grained & Fine-grained node localization, Network-wide localization. Wireless characteristics: Basics, Wireless link quality, Radio energy considerations, SINR capture model for interference.

UNIT – III: MEDIUM-ACCESS AND SLEEP SCHEDULING (10 hours)

Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques.Classification of Energy Management SchemesSleep-based topology control: Constructing topologies for connectivity, constructing topologies for coverage.

UNIT – IV: ROUTING AND INTEGRATION OF SENSOR & CLOUD SYSTEM (10 hours)

Routing: Metric-based approaches, Routing with diversity, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing. Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, The database perspective on sensor networks.

TEXT BOOKS:

1. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati , Wiley Inter Science.
2. Networking Wireless Sensors: BhaskarKrismachari, Cambridge University Press

REFERENCE BOOKS:

1. Wireless Sensor Networks: Architectures and Protocols: Edgar H. Callaway, Jr. Auerbach Publications, CRC Press.
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati , Springer.
3. Distributed Sensor Networks: A Multiagent Perspective, Victor Lesser, Charles L. Ortiz, and MilindTambe , Kluwer Publications.

INTRODUCTION TO BIG DATA ANALYTICS

Course Code **CS 54E5** **L-P-T-Cr.:** 4 0 0 4 **Semester:** **IV**
Category: Program Elective Course
Prerequisite: **Basic Computer Network, Cloud Computing and Database system.Learning Objective:**

- Fundamentals of Big data
- Fundamental of MapReduce
- Information Management and Data Privacy and Ethics

CO-1	Remember and understand the basic concepts/Principles of Big data and Analytics
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Introduction: Big data and its importance, a flood of mythic "startup" proportions, big data is more than merely big why now? a convergence of key trends, a wider variety of data, the expanding universe of unstructured data, **Industry examples of big data:** Digital marketing and the online world, the right approach, cross channel lifecycle marketing.

UNIT – II: **(14 hours)**

Big Data Technology: The elephant in the room: Hadoop's parallel world, old vs. new approaches. Data discovery: Work the way people's minds work, open-source technology for big data analytics, the cloud and big data, predictive analytics moves into the limelight, a brief history of Hadoop, apache Hadoop and the Hadoop ecosystem.

MapReduce: Analyzing the data with Hadoop, map and reduce, java MapReduce, scaling out, data flow, combiner functions, running a distributed MapReduce job, Hadoop streaming, the Hadoop distributed file system, the design of HDFS, HDFS concepts, blocks, name nodes and data nodes, HDFS federation, HDFS high, availability, the command, line interface, basic file system operations, Hadoop file systems.

UNIT – III: **(12 hours)**

Information Management: The big data foundation, big data computing platforms, big data computation, more on big data storage, big data computational limitations, big data emerging technologies.

Business analytics: The last mile in data analysis, geospatial intelligence will make your life better, consumption of analytics, from creation to consumption.

Visualizing: How to make it consumable? organizations are using data visualization as a way to take immediate action.

UNIT – IV: **(12 hours)**

Data Privacy and Ethics: The privacy landscape, the great data grab isn't new, preferences, personalization, and relationships, rights and responsibility, playing in a global sandbox, conscientious and conscious responsibility, privacy may be the wrong focus can data be anonymized? Balancing for counter intelligence.

TEXT BOOKS:

1. Michael Minelli, Michele Chambers, Big Data,Big Analytics, Wiley Publications, 2013
2. 2. Tom White, Hadoop: The Definitive Guide, 3/e, O'Reilly Publications, 2012.

REFERENCE BOOKS:

1. Bill Franks Taming, The Big Data Tidal Wave, 1/e, Wiley, 2012.
2. Frank J. Ohlhorst, Big Data Analytics, 1/e, Wiley, 2012

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OBJECT ORIENTED PROGRAMMING LAB

Course Code **MC 526** **L-P-T-Cr.:** **0 3 0 2** **Semester:** **III**

Category: Laboratory Course

Prerequisite: A course on "Computer Programming & Data Structures".

Objective:

- To introduce Java compiler and eclipse platform. To make the student learn an object oriented way of solving problems using java.
- To make the students to write programs using multithreading concepts and handle exceptions.
- To make the students to write programs that connects to a database and be able to perform various operations.
- To make the students to create the Graphical User Interface using Applets, AWT Components & Swing Components.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of OBJECT ORIENTED PROGRAMMING LAB
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

1. Data types & variables.
2. Decision control structures: if, nested if etc.
3. Program with loop control structures: do, while, for etc.
4. Inheritance, polymorphism, packages, generics.
5. Program with modern features of java.
6. Interfaces and Inner classes
7. Implementing wrapper classes
8. Implementing generics.
9. Working with files.

MC 553: INFORMATION SECURITY

Course Outcomes

CO-1	Remember and understand the basic concepts/Principles of **INFORMATION SECURITY**
CO-2	Analyse the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/create the Project or field assignment as per the knowledge gained in the course

Course contents

Unit-I: Introduction: need for security, security approaches, principle of security, risk to introduction system. Security: physical security, logical security, threats to security.

Unit-II: Cryptographic technique: plain text and Cipre text, substitution technique, transportation technique encryption and decryption, symmetric and assenter key, stegonography, key range and key size, possible type attack.

Unit-III: Computer based Symantec key cryptographic algorithms: Introduction algorithm types and model overview of symmetric key cryptography, data encryption standard, IDEA, RCS, blowfish, AES.

Unit-IV: Computer based asymmetric key cryptographic algorithms: Introduction, RSA algorithm, digital signature, knapsack algorithm.

Unit-V: Public key infrastructure, digital certificate, private key management, PKCS, XML, PKI and security.

Suggested Readings

1. Cryptography and network security, Atil Khate, TMH.
2. PC and LAN Security by Stephen Cobb.
3. Enterprise Disaster Recovery Planning by Miora.
4. Computer Security for dummies.

The list of cases and specific references including recent articles will be announced in the class at the time of launching of the course.

MOBILE COMPUTING

Course Code **MC 55E3** **L-P-T-Cr.:** **3 0 0 3** **Semester:** **VII**

Category: Open Elective Course

Prerequisite: Data communication and Computer Networks

Objective:

- The objective is to learn emerging techniques in GSM, wireless MAC.Learn mobile network and transport layer.
- Learn mobile database, data disseminationand MANAT protocols

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of MOBILE COMPUTING
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION, GSM, WIRELESS MAC (10 hours)

Introduction to Mobile Communications and Computing: Mobile Computing (MC):Introduction to MC, novel applications, limitations, and architecture.

GSM: Mobile services, System architecture, Radio interface, Protocols, Localization andcalling, Handover, Security, and New data services.

Wireless Medium Access Control : Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

UNIT – II: MOBILE NETWORK AND TRANSPORT LAYER (10 hours)

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packetdelivery, agent advertisement and discovery, registration, tunneling and encapsulation, Optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT – III: MOBILE DATABASE AND DATA DISSEMINATION (10 hours)

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

UNIT – IV: MANAT, PROTOCOLS (10 hours)

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Protocols and Tools: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

TEXT BOOKS :

1. Jochen Schiller,"Mobile Communications",Addison-Wesley.
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing"

REFERENCES:

2. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applicationswith UML and XML", ISBN: 0521817331, Cambridge University Press.
3. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional.
4. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer.
5. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech.

ADVANCED COMPUTING NETWORKING								
Course Code	**CS 61E4**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Basic of Computer network and Cryptography							
Objectives:	• Internet Architecture: Advanced concepts of TCP/IP protocols • Wireless Networks, Cellular networks • Advanced concepts of networks							

CO1	Remember and understand the basic concepts/Principles of advanced computing networking.
CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT –I: (08 Hours)

The internet architecture, Access Networks, The network Core, Peer-to-Peer Networks, ContentDistribution Networks, Delay Tolerant Networks, Circuit Switching vs. Packet switching, Packetswitching Delays and congestion, Client/Server and Peer-to-Peer Architectures, MAC and LLC,Virtual LAN, Asynchronous Transfer Mode (ATM)

UNIT –II: (12 Hours)

Network Address Translator, Internet Control Message Protocol, SNMP, CIDR, IPv6, Routing Protocol Basics in advanced networks, Routing Information Protocol (RIP), Interior Gateway Routing Protocol (IGRP), Switching Services, Spanning Tree Protocol (STP), Standard Network Management Protocol.

TCP and Mobile TCP, TCP Tahoe and TCP Reno, High speed TCP, Coexistence of UDP and TCP flows, HTTP and HTTPS, FTP and SFTP, Domain Name Service, TCP and UDP sockets

UNIT –III: (10 Hours)

Introduction to traffic Engineering, Requirement Definition for Traffic Engineering, Traffic Sizing, Traffic Characteristics, Delay Analysis, Connectivity and Availability, Introduction to Multimedia Services, Explaining Transmission of Multimedia over the Internet. Introduction, Wireless Links and Network Characteristics, CDMA, WiFi: 802.11, Wireless LANs, The 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame, Mobility in the Same IP Subnet, Advanced Features in 802.11, Personal Area Networks: Bluetooth and Zigbee, Cellular Internet Access, An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular Subscribers, On to 4G: LTE, Mobility Management: Principles, Addressing, Routing to a Mobile Node, Mobile IP ,Managing Mobility in Cellular Networks, Routing Calls to a Mobile User, Handoffs in GSM, Wireless and Mobility: Impact on Higher-Layer Protocols

UNIT –IV: (10 Hours)

Explaining IP Multicasting, VOIP, Unified Communication, Virtual Networking, Data center Networking, Introduction to Optical Networking, SONET /SDH Standard, Next generation cellular networks, Secure Socket Layer, IP Sec, TLS, Kerberos, Domain name system Protection.

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach, 6/e, James F. Kurose and Keith W. Ross, Pearson Education, 2012.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A systems approach, Morgan Kaufman, 5th Edition, 2012
3. Data Communications and Networking, *Behrouz A. Forouzan*, Fourth Edition, Tata McGraw Hill
4. High Speed Networks and Internets – Performance and Quality of Service, *William Stallings,* Second Edition, Pearson Education.
5. Top-Down Network Design, *Priscilla Oppenheimer,* Second Edition, Pearson Education (CISCO Press)

REFERENCE BOOKS:

1. Advance Computer Network, By DayanandAmbawade, Dr. Deven shah, Prof. MahendraMehra, Wiley India
2. CCNA Intro – Study Guide – Todd Lammle, Sybex
3. Computer Networks by Mayank Dave, Cengage.
4. Guide to Networking Essentials, Greg Tomsho, Ed Tittel, David Johnson, Fifth Edition, Thomson.
5. Computer Networks, Andrew S. Tanenbaum, Fourth Edition, Prentice Hall.
6. An Engineering Approach to Computer Networking, S. Keshav, Pearson Education.
7. Campus Network Design Fundamentals, Diane Teare, Catherine Paquet, Pearson Education (CISCO Press
8. Computer Communications Networks, Mir, Pearson Education.
9. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to computer networks and Cyber Security, CRC press, Taylor & Francis Group, 2014
10. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Pearson, 5th Edition, 2014
11. G. Wright and W. Stevens, TCP/IP Illustrated, Volume 1 and Volume 2, Addison-Wesley, 1996

WEB REFERENCES

1. http://nptel.ac.in/courses/106105081/1

2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Computer%20networks/New_index1.html

INTELLECTUAL PROPERTY RIGHTS AND CYBER LAWS								
Course Code	**CS 61E9**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	None							
Objective:	Both Indian and International intellectual property, cyber laws							

CO1	Remember and understand the basic concepts/Principles of intellectual property rights and cyber laws.
CO2	Analyse the Various Concepts to understand them through case studies.
CO3	the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT –I: INTRODUCTON AND CONCEPTUAL FRAMEWORK (10 Hours)

Origin and evolution of IPRs – Conceptual framework of IPRs – Patents, Trade Marks, Copyright, The rational for their protection. The international conventions: the Berne convention, Universal copyright convention, the Paris convention, WIPO, TRIPS, UNESCO

UNIT –II: INTERNATIONAL CONVENTIONS AND TREATIES (10 Hours)

International instruments relating to patents; patent cooperation treaty, Budapest treaty, Eurasian Patent convention Trademarks – Madrid convention, Lisbon agreement. Copyrights and neighboring rights – Berne convention, universal copyright convention, Rome convention, Universal copyright convention WIPO TRIPs

UNIT –III: THE LEGAL REGIME OF IPR'S IN INDIA (10 Hours)

The Patent (Amendment) Act 2005, The Trade Marks Act 1999, The Copyright Act 1957, Comparative Study of Legal Frame Work in U.S & Japan.

UNIT –IV: IPRs EMERGING AREAS AND CYBER LAWS (10 Hours)

Geographical Indications, Protection of plant varieties – Indian Perspective, Public Health Issues, Traditional Knowledge, Biological diversity – Convention on Bio – diversity, Case study, Patent Protection for pharmaceutical and Agricultural Chemical Products. Monsanto VsSchmeiser, Basumathi, Turmeric, Overview of cyber Law- Regulation of cyber space Cybercrimes. IT Act 2000. It (Amendment) Act 2008

TEXT BOOKS:

1. Intellectual Property Law, B.L Wadhera.
2. Intellectual Property Rights and the Law, G.B Reddy.

REFERENCE BOOKS

1. Intellectual property Right -A premiere, Prof.R.AnitaRao&Prof.V.BhanojiRao, EBC Publications

WEB REFERENCES

1. http://nptel.ac.in/courses/109103024/40
2. http://nptel.ac.in/courses/109105112/

STORAGE AREA NETWORKS

Course Code **CS 62E3** **L-P-T-Cr.:** **4 0 0 3** **Semester:** **VI**

Category: Programme Elective Course

Prerequisite: Knowledge of Computer Networks and DBMS

Objective:

- To learn H/W and S/W architecture, various features of Storage area Network (SAN) as well as its applications

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of STORAGE AREA NETWORKS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: INTRODUCTION AND INTELLIGENT DISK SUBSYSTEMS (10 hours)

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks .The Data Storage and Data Access problem; The Battle for size and Access

Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O

Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems

UNIT – II: I/O TECHNIQUES, NETWORK ATTACHED STORAGE AND FILE SYSTEM AND NAS **(10 hours)**

I/O Techniques : The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage
Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.
File System and NAS: File System and NAS:Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

UNIT – III: STORAGE VIRTUALIZATION AND SAN ARCHITECTURE & HARDWARE DEVICES **(10 hours)**

Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric Storage virtualization in the Network SAN Architecture and Hardware devices : Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective

UNIT – IV: SOFTWARE COMPONENTS OF SAN AND MANAGEMENT **(10 hours)**

Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.
Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations

TEXT BOOKS:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks, Wiley India, 2007
Robert Spalding: Storage Networks The Complete Reference, Tata McGraw-Hill, 2003.

REFERENCE BOOKS:

1. Richard Barker and Paul Massiglia: Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs, John Wiley India, 2002

GAME THEORY								
Course Code	**CS 62E4**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Foundation of Mathematics, Artificial Intelligence							
Objectives:	• To introduce a basic level combinatorial and cooperative games. • To analyze conflicting situations using game theory.							

CO1	Remember and understand the basic concepts/Principles of game theory.
CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.

CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT –I: (10 Hours)

Introduction: Game Theory, Games and Solutions Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation

Nash Equilibrium- Strategic Games, Nash Equilibrium Examples Existence of a Nash Equilibrium, Strictly Competitive Games, Bayesian Games: Strategic Games with Imperfect Information

Mixed, Correlated, and Evolutionary Equilibrium -Mixed Strategy Nash Equilibrium Interpretations of Mixed Strategy Nash Equilibrium Correlated Equilibrium Evolutionary Equilibrium

UNIT –II: (10 Hours)

Rationalizability and Iterated Elimination of Dominated Actions-Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions.

Knowledge and Equilibrium -A Model of Knowledge Common Knowledge, Can People Agree to Disagree? , Knowledge and Solution Concepts, The Electronic Mail Game

UNIT –III: (10 Hours)

Extensive Games with Perfect Information -Extensive Games with Perfect Information Subgame Perfect Equilibrium Two Extensions of the Definition of a Game The Interpretation of a Strategy ,Two Notable Finite Horizon Games , Iterated Elimination of Weakly Dominated Strategies Bargaining Games -Bargaining and Game Theory , A Bargaining Game of Alternating Offers Subgame Perfect Equilibrium Variations and Extensions

UNIT –IV: SOFTWARE COMPONENTS OF SAN AND MANAGEMENT (10 Hours)

Repeated Games - The Basic Idea Infinitely Repeated Games vs.\ Finitely Repeated Games Infinitely Repeated Games: Definitions Strategies as Machines Trigger Strategies: Nash Folk Theorems Punishing for a Limited Length of Time: A Perfect Folk Theorem for the Limit of Means Criterion Punishing the Punisher: A Perfect Folk Theorem for the Overtaking Criterion Rewarding Players Who Punish: A Perfect Folk Theorem for the Discounting Criterion The Structure of SubgamePerfect Equilibria Under the Discounting Criterion Finitely Repeated Game

TEXT BOOKS:

1. M. J. Osborne and A. Rubinstein, A course in Game Theory, MIT Press
2. Roger Myerson, Game Theory, Harvard University Press
3. D. Fudenberg and J. Tirole, Game Theory, MIT Press

REFERENCE BOOKS:

1. J. von Neumann and O. Morgenstern, Theory of Games and Economic Behavior, New York: John Wiley and Sons.
2. R.D. Luce and H. Raiffa, Games and Decisions, New York: John Wiley and Sons.,
3. G. Owen, Game Theory, (Second Edition), New York: Academic Press,

WEB REFERENCES

1. http://nptel.ac.in/courses/112106131/33
2. https://onlinecourses.nptel.ac.in/noc16_mg01/preview

EMBEDDED SYSTEMS

Course Code	**CS 62E10**	**L-P-T-Cr.:**	**4**	**0**	**0**	**3**	**Semester:**	**VI**

Category: Open Elective Course

Prerequisite: Digital Electronics, Microprocessor and Microcontroller and Basic Computer Network

Objective:

- **A**bility to understand the design concept of embedded systems, real time interfacing of sensors, actuators to microcontrollers.

Course outcome:

CO-1	Remember and understand the basic concepts/Principles of EMBEDDED SYSTEMS
CO-2	Analyze the Various Concepts to understand them through case studies
CO-3	Apply the knowledge in understanding practical problems
CO●-4	Execute/Create the Project or field assignment as per the knowledge gained in the course

UNIT – I: **(10 hours)**

Overview of Embedded Systems: Embedded System, Categories and Requirements of Embedded Systems, Challenges and Issues in Embedded System Development, Applications of Embedded Systems in various domains.

UNIT – II: **(10 hours)**

Embedded Design cycle:Embedded Hardware & Software Design & Development Process & Environment: Hardware Architecture, Interfacing Processor, Memories, I/O and Communication Interface Standards, Embedded Operating systems, Types of Embedded Operating systems.

UNIT – III: **(10 hours)**

Microcontroller: 8/16/32 Bit (8051/ AVR/PIC/ARM/MSP 430) Microcontrollers and an overview of their Architecture, Instruction set, Interface & Applications. Programming Concepts and Embedded Programming in C for Device Drivers for interfacing LCD, ADC, sensors, stepper motor, key board, DAC, memory.Embedded System-on Programmable Chip (SOPC): FPGA based soft & hard processor, Embedded Software development on FPGA

UNIT – IV: **(10 hours)**

Embedded real time operating systems: Typical real time applications, Hard Vs Soft real-time systems, A reference model of Real Time Systems: Inter-process Communication and Synchronization of Processes, Tasks and Threads- Multiple Process in an Application, Problem of Sharing data by multiple tasks & routines, Scheduling, Commonly used Approaches to Real Time Scheduling Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective release time and Deadlines, Offline Vs Online Scheduling.Embedded systems case studies.

TEXT BOOKS:

1. Embedded Systems Architecture, Programming and Design, Second Edition, Raj Kamal, Tata Mc-Graw Hill
2. The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi, McKinlay, Second Edition, Pearson Education.
3. PIC Microcontroller and Embedded Systems using assembly and C for PIC18, Mazidi, MCKINLAY, CAUSEY, Pearson Education.
4. ARM Systems Developers Guides- Design & Optimizing System Software - Andrew N.

SEMANTIC WEB AND SOCIAL NETWORKING								
Course Code	**CS 62E12**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Web technology, Machine intelligence							
Objectives:	• To learn Web Intelligence • To learn Knowledge Representation for the Semantic Web • To learn Ontology Engineering • To learn Semantic Web Applications, Services and Technology • To learn Social Network Analysis and semantic web							

CO1	Remember and understand the basic concepts/Principles of semantic web and social networking.
CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT – I: **08 hours**

Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web. Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web

UNIT – II: **14 hours**

Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web —Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML,XML/XML Schema. Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping.
Logic, Rule and Inference Engines. Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base.

UNIT – III: **10 hours**

XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods, What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis — Electronic Discussion networks.

UNIT – IV: **08 hours**

Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

TEXT BOOKS

1. Thinking on the Web – Berners Lee, Godel and Turing, Wiley interscience, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, Audi Studer, Paul Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group)
3. Information Sharing on the semantic Web – HeinerStuckenschmidt; Frank Van Harmelen, Springer Publications.
4. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'ReiIIy, SPD.

SOFTWARE PROJECT MANAGEMENT								
Course Code	**CS 62E14**	**L-P-T-Cr.:**	**3**	**0**	**1**	**3**	**Semester:**	
Category:	Programme Elective Course							
Prerequisite:	Basic of Software Engineering.							
Objectives:	• To know Project Evaluation and Planning. • To introduce the concept of Project Sequencing and Scheduling. • To know Quality Management and People Management.							

CO1	Remember and understand the basic concepts/Principles of software project management.
CO2	Analyse the Various Concepts to understand them through case studies.
CO3	Apply the knowledge in understanding practical problems.
CO4	Execute/Create the Project or field assignment as per the knowledge gained in the course.

UNIT – I: Project Evaluation and Planning **10 hours**

Activities in Software Project Management, Overview Of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb.

UNIT – II: Project Sequencing and Scheduling **12 hours**

Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

UNIT – III: Monitoring And Control **08 hours**

Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts, Stages in Contract Placement, Typical Terms of a Contract, Contract Management and Acceptance.

UNIT – IV: Quality Management and People Management **10 hours**

Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model, Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety. ISO and CMMI models, Testing, and Software reliability, test automation, Overview of project management tools.

REFERENCE BOOKS:

1. Royce, "Software Project Management", Pearson Education, 1999.

Robert K. Wysocki, Effective Software Project Management, Wiley, 2009.

Other References: (Web)

- https://cs.uwaterloo.ca/~dberry/COURSES/software.engr/lectures.pdf/projman.pdf
- http://nptel.ac.in/courses/106101061/29

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