

15AVP201 /	AMRITA VALUES PROGRAMME I/	1 0 0 1
15AVP211	AMRITA VALUES PROGRAMME II	1 0 0 1

Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Courses offered under the framework of Amrita Values Programmes I and II

Message from Amma's Life for the Modern World

Amma's messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

Lessons from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The

Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

Message of the Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji's life.

Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahansa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Kerala Mural Art and Painting

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this

form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

Course on Organic Farming and Sustainability

Organic farming is emerging as an important segment of human sustainability and healthy life. 'Haritamritam' is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. In Amma's words "it is a big step in restoring the lost harmony of nature".

Benefits of Indian Medicinal Systems

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Unity in Diversity' and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

Science of Worship in India

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

15CHY100

CHEMISTRY

3 0 0 3

Unit 1

Chemical Bonding

Review of orbital concept and electronic configuration, electrovalency and ionic

bond formation, ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan's rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - coordinate covalent compounds and their characteristics, molecular orbital theory for H₂, N₂, O₂ and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

Unit 2

Thermodynamic Parameters

Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations - Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity – Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff' relation (integrated form) - bond enthalpy and bond order - Problems based on the above.

Kinetics

Review of molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions) - complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its significance, Michaelis Menden kinetics-enzyme catalysis.

Unit 3

Electrochemistry

Electrolytes - strong and weak, dilution law, Debye-Huckel theory, faraday's laws, origin of potential, single electrode potential, electrochemical series, electrochemical cells, Nernst equation and its application, reference electrodes- SHE, Ag/AgCl, Calomel.

Photochemistry

Photochemistry, laws of photochemistry - Stark-Einstein law, Beer-Lamberts law, quantum efficiency-determination, photochemical processes - Jablonsky diagram, internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo sensitization, photo polymerization.

REFERENCE BOOKS

Physical chemistry, Puri and Sharma

Inorganic chemistry, Puri and Sharma

15CHY181**CHEMISTRY LAB.****0 0 2 1**

1. Acid base titration (double titration)
2. Complexometric titration (double titration)
3. Redox (permanganometry) titration (double titration)
4. Conductometric titration
5. Potentiometric titration
6. Ester hydrolysis

15CHY231**ADVANCED POLYMER CHEMISTRY****3 0 0 3****Unit 1**

Newer Polymers and Polymerizations: Polymeric Liquid Crystals - Inorganic and Organometallic polymers - Synthesis and reactions of Phosphorus - Nitrogen polymers - Boron - Silicone polymers. Cyclisation versus Linear Polymerization - Molecular weight control in linear polymerization - Molecular weight distribution in linear polymerization - Molecular weight distributions in nonlinear polymerization - Multichain Polymerization - Metallocene Polymerization.

Unit 2

Solid-state irradiation polymerization - Atom transfer radical polymerization - Plasma Polymerization - Zwitterionic Polymerization - Isomerization polymerization - Polymer supported solid phase reactions - Merrifield method.

Polymer degradation and stabilization: Mechanism of different types of degradation - Commonly used antidegradants and the mechanism of their stabilization.

Unit 3

Polymer solutions: Criteria for solubility - Heat of Dissolution and Solubility parameters - Conformation of polymer chains in solutions - Nature of polymer molecules in solution - Size and shape of macromolecules in solution - Thermodynamics of polymer solutions - Phase equilibria - Entropy and heats of mixing of polymer solutions - Effect of molecular weight on solubility - Solubility of crystalline and amorphous polymers - Flory Huggins theory of polymer solution, Equation of state theory, Flory Krigbaum theory and cluster type theory - Viscosity of dilute polymer solutions.

TEXTBOOKS:

1. George Odian, "Principles of Polymerization", John Wiley & Sons Inc., New York, (1991).
2. Malcolm P. Stevens, "Polymer Chemistry", Oxford University Press, New York, (1999).

REFERENCES:

1. Harry R Allcock and Frederick W Lampe, "Contemporary Polymer Chemistry", 2nd edition, Prentice Hall, Inc., New Jersey, (1990).
2. Charles E Carraher, Jr., "Polymer Chemistry", 5th edition, Marcel Dekker Inc., New York, (2000).
3. Jayadev Sreedhar and Govariker, "Polymer Chemistry".

15CHY232**BIOMATERIALS SCIENCE****3 0 0 3****Unit 1**

Introduction: Bulk properties, Surface properties and characterization - polymers, silicone biomaterials, medical fibres and biotextiles - Smart polymers - bioresorbable and bioerodible materials - natural materials, metals and ceramics - physicochemical surface modification.

Biocompatibility concepts: Introduction to biocompatibility - cell material interaction - types of materials - toxic, inert, bioactive - long term effects of materials within the body - cell response.

Unit 2

Chemical and biochemical degradation of polymers - degradation of metals and ceramics - calcification of biomaterials.

Host reactions and their evaluation: Inflammation and foreign body response - adaptive immunity - systemic toxicity and hypersensitivity - blood coagulation and blood materials interactions - device related infections.

Unit 3

Biological testing of biomaterials: Invitro and invivo assessment of tissue compatibility - evaluation of blood materials interaction - microscopy in biomaterials.

Practical aspects of biomaterials: Bioelectrodes, biomedical sensors and biosensors - sterilization of implants - implant failure - implant retrieval and evaluation - legal aspects, ethical issues and regulation aspects.

TEXTBOOK:

Buddy D Ratner, Allan S Hoffman, "Biomaterials Science - An introduction to materials in Medicine", Elsevier academic press, (2004).

REFERENCES:

1. Jonathan Black, "Biological Performance of Materials: Fundamentals of Biocompatibility", 4th edition, CRC Press, (2006).
2. John D. Enderle, Susan M. Blanchard, Joseph D. Bronzino, "Introduction to Biomedical Engineering", 2nd edition, Elsevier Academic Press, 2005.

15CHY233**CATALYTIC CHEMISTRY****3 0 0 3****Unit 1**

Catalysis: Introduction, Industrial applications. Rates of reactions - equilibrium, energy of activation and the catalyst's role, Elementary reactions in catalytic transformations homogeneous and heterogeneous catalysis.

Catalysis in solutions: Acid-base catalysis - catalysis in the gas phase, catalysis in dilute aqueous solution, catalysis in concentrated strong acid solutions, catalysis by bases, catalysis by metal ions, catalysis by electron transfer, organometallic catalysis, catalysis in Ziegler Natta/Metallocene/Metathesis polymerization.

Unit 2

Catalysis by macromolecules, Phase transfer catalysis.

Catalysis by Enzymes: Introduction - kinetics of enzyme catalyzed reaction, catalysis through enzyme, organic catalysis, metalloenzyme catalysis, supported enzymes. Industrial applications of enzyme catalyst.

Catalysis by Polymers: Attachment of catalytic groups to polymer supports, Adsorption and the Kinetics of polymer-catalyzed reactions.

Unit 3

Catalysis in polymer gels, bifunctional and multifunctional catalysis, porous polymers, Applications of polymer catalysis.

Catalysis in Molecular scale cavities: Structures of crystalline solids, structure of Zeolites, catalysis by Zeolites, catalysis by Zeolites containing metal complexes and clusters. Catalysis on surfaces – surface catalysis, catalysis on metal surfaces.

TEXTBOOKS:

1. Bruce C Gates, "Catalytic Chemistry", John Wiley & Sons, Inc. USA, (1992).
2. Viswanathan B, Sivasankar S, Ramaswamy A V, "Catalysis, Principles and Applications", CRC Press, (2006).

REFERENCES:

1. James E House, "Principles of Chemical Kinetics", Academic Press, (2007).
2. Kuriacose J C, "Catalysis", Macmillan India Limited, New Delhi, (1991).

15CHY234**CHEMISTRY OF ADVANCED MATERIALS****3 0 0 3****Unit 1**

Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, polycarbonates, epoxy resins - polyamides - Nylon and Kevlar.

Chemistry of Carbon nanotubes: Introduction, carbon nanotubes - fabrication, structure, electrical properties – vibrational properties – mechanical properties – applications of carbon nanotubes.

Unit 2

Electron transfer studies in salt based conductors and magnets: Introduction - definitions and units - ferromagnets and ferrimagnets. One-dimensional conductors - quasi one and two-dimensional super conductor. Fullerides - paramagnetic conductors and superconductors. Electron transfer salt based ferromagnets: nitroxide, metallocene and ferric magnet-based ferromagnets - weak ferro magnets. Nanopore containment of magnetic particles - nanocarbon ferromagnets.

Unit 3

Functional electro active polymers: Conjugated polymers - synthesis, processing and doping of conjugated polymers: polyacetylene, polyaniline, polythiophene, poly (p-phenylenevinylene) - ionically conducting polymers - applications of conjugated polymers. Semi-conducting, poly ferrocene - photo resist optical fibers and sensors, photo chromic & thermo chromic materials.

Photochemistry in Electronics: Laws of absorption - quantum efficiency and quantum yield - fluorescence and phosphorescence – photosensitization.

High energy materials: Preparation, properties and application of ammonium nitrate (AN), NH₄NO₃, ammonium perchlorate (AP), NH₄ClO₄, ammonium dinitramide (AND), NH₄N(NO₂)₂, hydrazinium nitroformate (HNF), N₂H₅C(NO₂)₃ etc.

TEXTBOOKS:

1. Van Vlack, Lawrence H, "Elements of Material Science and Engineering", 6th edition, New York Addison, Wesley, (1989).
2. Chawla S, "A Textbook of Engineering Chemistry", Dhanpat Rai & Co, Delhi, (2001).

REFERENCES:

1. Mark Ratner and Daniel Ratner, 'Nano technology - A gently introduction to the next big idea', Pearson Education, (2003).
2. Interrante L. V. and Hampden Smith M.J, 'Chemistry of Advanced Materials', Wiley-VCH, (1988).

15CHY235**CHEMISTRY OF ENGINEERING MATERIALS****3 0 0 3****Unit 1**

Chemical materials in Electronics and Electrical Engineering: Structural correlation to behavior of conducting polymers, Semi-conducting polymers - properties of organic polymers containing metal groups such as poly ferrocene - optical fibers - definition, principle and structure - characteristics of optical fibre - photo resist

optical fibre - advantages of optical fibre - liquid crystalline - piezo and pyroelectric polymers - magnetic materials, hard and soft magnets – sensors (voltametric).

Nanomaterials: Nanotubes and Nanowires, Carbon nanotubes, single walled and multiwalled, aligned carbon nanotubes, doping with boron – applications - Nanostructured polymers.

Unit 2

Chemical aspects in biotechnology - Enzymes and bio reactors - Biotechnological processes – Bio-sensors - glucose biosensors, bio-filters and bio-membranes – Bio-fertilizers, Bio-surfactants.

Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, Polycarbonates, Epoxy resins - Polyamides - Nylon and Kevlar.

Photochemistry in Electronics: Photochemical reactions - laws of absorption (Grothters-Draper law - Stark-Einstein's law) - Quantum efficiency - photochemical decomposition of HI and HBr - and Quantum yield.

Unit 3

Florescence and Phosphorescence - chemiluminescence - photo sensitization.

Chemistry of Toxic Materials and Toxicology: Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H₂S - PH₃ - CO₂ - SO_x - NO_x - Heavy metals - lead, arsenic, mercury, antimony, barium, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

TEXTBOOK:

Kuriacose J C, Rajaram, "Chemistry in Engineering and Technology, Systematic Organic and Inorganic Chemistry and Chemistry of Materials (Vol 1 & 2)", Tata McGraw Hill Publishing Company Limited, 1999.

REFERENCE:

Van Vlack, Lawrence H, "Elements of Material Science and Engineering" (6th edition), New York Addison-Wesley, 1989.

15CHY236

CHEMISTRY OF NANOMATERIALS

3 0 0 3

Unit 1

Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nano structures - SEM, AFM - TEM and STM - Raman spectroscopy.

Synthesis of Nanomaterials: Synthetic approaches: Colloidal Self-Assembly (Self-assembled monolayers - SAMs) and electrostatic self-assembly, electrochemical methods, sol-gel deposition.

Unit 2

Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.

Carbon nanostructures: Carbon Clusters: Fullerenes, structure, synthesis, alkali doped C₆₀ - superconductivity in C₆₀, applications of fullerenes. Carbon nanotubes: Classification, properties, synthesis, characterization, and potential applications, growth mechanism of carbon nanotubes.

Other Nanostructures: Quantum Dots: Preparation, properties and applications of Au, CdS and CdSe quantum dots,

Unit 3

Fabrication and applications of conducting polymer nanotubes, TiO₂ and metallic nanotubes.

Molecular Electronics and Machines: Molecular electronics: Working of Molecular and supramolecular switches, transistors and wires. Molecular machines: Working of Molecular motors, rotors, cars, elevators and valves.

TEXTBOOKS:

1. Charles P Poole Jr, Frank J Ovens, "Introduction to Nanotechnology", Wiley Interscience, (2003).
2. Alexei Nabok, "Organic and Inorganic Nanostructure", Artech House, Inc. (2005).
3. Peter J F Harris, "Carbon Nanotube Science: Synthesis, Properties and Applications", Cambridge University Press, (2009).
4. Balzani V, Credi A, Venturi M, "Molecular devices and machines - A journey in to the Nanoworld", Wiley VCH, (2003).

REFERENCES:

1. Rao C N R, Muller A, Cheetham A K (Eds.), "The Chemistry of Nanomaterials: Synthesis, Properties and Applications", WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, (2004).
2. Zhong Lin Wang, "Characterization of nanophase materials", Wiley VCH, (2000).
3. Massimiliano Di Ventra, Stephane Evoy, James R Heflin, "Introduction to nanoscale science and technology", Kluwer Academic Publishers, (2004).
4. William A Goddard, III, Donald W Brenner, Sergey Edward Lyshevski and Gerald J. Lafrate, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, (2003).
5. Balzani V, Credi A, Venturi M, "Molecular devices and machines- A journey in to the Nanoworld" Wiley VCH (2003).
6. Bharat Bhushan, "Hand book of Nanotechnology", Springer, (2004).

15CHY237

CHEMISTRY OF TOXICOLOGY

3 0 0 3

Unit 1

Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury - medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants – solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

Unit 2

Exposure Classes, Toxicants in Air, Water, Soil, Domestic and Settings: Occupational Air, water and soil as primary media for human exposure to various classes of chemical toxicants in environmental, domestic, and occupational settings - historic and present status of air pollution and air quality - introduction to the major classes of soil and water pollutants - sources, exposure routes and potential adverse health effects - Classes of occupational toxicants - route of exposure and permissible levels - specific examples of concern.

Unit 3

Toxicant Analysis and Quality Assurance Principles: Introduction to procedures, principles and operation of analytical laboratories in toxicology. Summary of the general policies - analytical laboratory operation, analytical measurement systems, quality assurance (QA) - quality control (QC) procedures.

Environmental Risk Assessment: Environmental risk assessment procedures - particular environmental risk problem - appropriate endpoints - development of conceptual models, analyzing exposure – effects, information - characterizing exposure - ecological effects - management of risks.

Future Considerations for Environmental and Human Health: Changes in toxicology - evaluation of future risk assessment - more fundamental aspects of toxicology - in vivo and in vitro toxicity - biochemical toxicology - molecular toxicology - development of selective toxicants.

TEXTBOOK:

Ernest Hodgson, "Modern Toxicology", John Wiley & Sons, Inc., (2004).

REFERENCES:

1. John Wright, "Environmental Chemistry", Routledge, (2003).
2. A K DE, "Environmental Chemistry", New Age International, (2003).
3. Fritz Helmet, "Environmental Chemistry", Sarup and sons (Delhi), (2003).

15CHY238

COLLOIDAL AND INTERFACIAL CHEMISTRY

3 0 0 3

Unit 1

Introduction to surfaces, interfaces and colloids: Molecular origin, Surface phenomena and structure of interfaces, Surfactants structure, colloids in action - shapes and size distribution, Types of interaction forces - Physical and Chemical interaction, Classification of physical forces - Vander Waals force, electrostatic forces.

The Adsorption Phenomena - Structure and Properties of Adsorption Layers at the Liquid-Gas Interface, Principles of adsorption thermodynamics, The Gibbs equation, Structure and properties of the adsorption layers at the air-water interface.

Unit 2

Interfaces between Condensed Phases - Wetting, The interfaces between condensed phases in two-component systems, Adsorption at interfaces between condensed phases.

Thermodynamics - Adsorption, energy consideration of physical adsorption vs chemisorptions, Gibbs adsorption equation, Langmuir isotherm, BET isotherm, adsorption at solid-liquid interfaces. Emulsions - formation and stability, HLB number, PIT (Phase Inversion Temperature) foams, aerosols, Microemulsions, vesicles, micelles and membranes - applications of various colloidal systems.

Unit 3

Characterization of Colloids, Rheological properties - Classification, Interfacial rheology, Interfacial tension, Electrochemistry of interfaces - Electric double layer.

Stability of charge stabilized colloids, DLVO theory, Hamaker constant, Boltzmann distribution, Debye length, specific ion adsorption, stern layer, electrostatic, steric and electrosteric stabilization, zeta potential, surface tension, wetting and spreading, contact angle - Young's modulus, practical application - solid surfaces - surface mobility, characteristics and formation.

TEXTBOOKS:

1. D. Myers, "Surfaces, Interfaces and Colloids: Principles and Applications", 2nd Edition, Wiley-VCH, 1999.
2. T. Cosgrove, "Colloid Science: Principles, Methods and Applications", 2nd Edition, Wiley-Blackwell, 2010.

REFERENCES:

1. P. C. Hiemenz and R. Rajagopalan (Editors), "Principles of Colloid and Surface Chemistry", 3rd Edition, Academic Press, New York, 1997.

2. J. W. Goodwin, "Colloids and Interfaces with Surfactants and Polymers", John-Wiley and Sons Ltd, 2004
3. William Harde, "Colloids and Interfaces in Life Sciences", Marshall Dekker Inc. 2003

15CHY239 COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING 3 0 0 3

Unit 1

Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.

Molecular mechanics: Basic theory - Harmonic oscillator – Parameterization - Energy equations - Principle of coupling - Matrix formalism for two masses - Hessian matrix - enthalpy of formation - enthalpy of reactions.

Introduction to Quantum mechanics - Schrodinger equation - Position and momentum - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2

Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel's MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel's theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel's coefficient matrix - Wheeland's method - Hoffmann's EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3

Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman's theorem - Isodesmic reactions, DFT for larger molecules -

Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes - Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

TEXTBOOKS:

1. K. I. Ramachandran, G Deepa and K Namboori, "Computational Chemistry and Molecular Modeling - Principles and Applications", Springer-Verlag, Berlin, Heidelberg, 2008, ISBN-13 978-3-540-77302-3.
2. Donald W Rogers, "Computational Chemistry Using PC", Wiley, (2003).
3. Alan Hinchliffe, "Chemical Modeling from atoms to liquids", Wiley, (2005).

REFERENCES:

1. James B Foresman and Aeleen Frisch-Gaussian, "Exploring Chemistry with Electronic Structure Method", Inc., Pittsburgh, PA, 2nd edition, (2006).
2. A C Philips, "Introduction to Quantum mechanics", Wiley, (2003).
3. Wolfram Koch, Max C. Holthausen, "A Chemist's guide to Density Functional Theory", Wiley, VCH, 2nd edition, (2001).

15CHY241 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES 3 0 0 3

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Reserve batteries and Fuel cells: Reserve batteries - water activated, electrolyte activated and thermally activated batteries - remote activation - pyrotechnic materials. Fuel Cells: Principle, chemistry and functioning - carbon, hydrogen-oxygen, proton exchange membrane (PEM), direct methanol (DMFC), molten carbonate electrolyte (MCFC) fuel cells and outline of biochemical fuel cells.

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

TEXTBOOKS:

1. Derek Pletcher and Frank C. Walsh, "Industrial Electrochemistry", Blackie Academic and Professional, (1993).
2. Dell, Ronald M Rand, David A J, "Understanding Batteries", Royal Society of Chemistry, (2001).

REFERENCES:

1. Christopher M A, Brett, "Electrochemistry – Principles, Methods and Applications", Oxford University, (2004).
2. Watanabe T, "Nano-plating: microstructure control theory of plated film and data base of plated film microstructure", Elsevier, Oxford, UK (2004).
3. Kanani N, "Electroplating and electroless plating of copper and its alloy", ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).
4. Lindon David, "Handbook of Batteries", McGraw Hill, (2002).
5. Curtis, "Electroforming", London, (2004).
6. Rumyantsev E and Davydov A, "Electrochemical machining of metals", Mir, Moscow, (1989).

15CHY242

ENVIRONMENTAL CHEMISTRY

3 0 0 3

Unit 1

Air and air pollution (earth's atmosphere): Regions - ozone - CFC and other chemicals - catalytic decomposition of ozone - 'ozone hole' formation - Air pollution due to gas emission from industries - Atmospheric aerosols – dust, combustion products, aerosol concentration and lifetimes - Automobile exhausts, smog and effects - Acid rain - chemistry of acid rain, roll of meteorology, greenhouse gases and global warming - air pollution due to jet engines.

Water and water pollution (hydrosphere): Physical and chemical properties of water - microbiological processes - carbon, nitrogen cycles - Water pollution - polluting agents - indices of pollution, heavy metal pollution and toxicity - BOD and COD determination - suspended solids - determination of other ions by photometric methods - Chemistry of anaerobic process, use of Effective Microorganisms.

Unit 2

Aerobic processes - wastewater treatment systems (brief description only) - anaerobic and aerobic - sewage treatment, primary, secondary and tertiary processes - water reuse and recycle. Eutrophication of lakes, nitrogen and phosphorus in effluents - Drinking water standards - sources - fluoride and arsenic in water, purification, sterilization - chemistry of chlorination - water purification for domestic use - reverse osmosis - nano filters and membranes.

Industrial Pollution and its control: Industrial pollution and waste waters from various types of industries - environmental pollution due to paper mills, textile mills etc., and its control. Solid waste disposal - methods - solid waste from mining and

metal production and its disposal - Electrochemical treatment of pollution control, electro-coagulation and flocculation - Green chemical processes and green solvents - reaction conditions to control industrial pollution.

Unit 3

Other types of pollution: Soil pollution - agricultural pollution - use of chemical fertilizers - Organic chemicals and environment, dioxins and furans - chemistry of some of the pesticides, insecticides and herbicides, ill effects due to uncontrolled use - Bulk storage of hazardous chemicals and disasters, Radioactive pollution, radiation units, sources - exposure and damage - safety standards - radioactive wastes and their disposal - Toxicological substances, testing of toxic substance, enzyme inhibition and biochemical effects of toxic chemicals on humans.

Sampling and Measurements of Pollutants: Sampling and analysis techniques of air pollutants (brief outline only) - analysis of particulate matter and lead - Sampling and measurements of water pollutants - organic loadings, phosphates and nitrogen compounds - monitoring of water quality - water test kits, various analytical methods (brief outline only).

TEXTBOOKS:

1. Gary W. Van Loon and Stephen J. Duffy, "Environmental Chemistry", Oxford University Press, (2000).
2. Ajay Kumar Bhagi and G. R. Chatwal, "Environmental Chemistry", Himalaya Publishing House, (2003).

REFERENCES:

1. John Wright, "Environmental Chemistry", Routledge, (2003).
2. A K De, "Environmental Chemistry", New Age International, (2003).
3. Fritz Helmet, "Environmental Chemistry", Sarup and sons (Delhi), (2003).
4. Clair N Sawyer, Perry L McCarty and Gene F Parkin, "Chemistry for Environmental Engineering", McGraw Hill, (1994).
5. Jack Barrett, "Chemistry in your Environment", Albion Publishing Ltd., (1994).
6. Thomas G Spiro and William M Stigliani, "Chemistry of the Environment", Prentice Hall, (2002).
7. Kudisia V P and Ritu, "Environmental Chemistry", Pragati Prakashan, Meerut, (2000).

15CHY243**FUELS AND COMBUSTION****3 0 0 3****Unit 1**

Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.

Secondary liquid fuels - Gasoline, diesel, kerosene and lubricating oils. Liquid fuels - refining, cracking, fractional distillation, polymerization. Modified and synthetic liquid fuels. ASTM methods of testing the fuels.

Unit 2

Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Combustion: Stoichiometry, thermodynamics. Nature and types of combustion processes - Mechanism - ignition temperature, explosion range, flash and fire points, calorific value, calorific intensity, theoretical flame temperature. Combustion calculations, theoretical air requirements, flue gas analysis, combustion kinetics – hydrogen - oxygen reaction and hydrocarbon - oxygen reactions.

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:

Fuels and Combustion, Samir Sarkar, Orient Longman Pvt. Ltd, 3rd edition, 2009.

REFERENCE:

1. Fuels - Solids, liquids and gases - Their analysis and valuation, H. Joshua Philips, Biobliflife Publisher, 2008.
2. An introduction to combustion: Concept and applications - Stephen R Turns, Tata Mc. Graw Hill, 3rd edition, 2012.
3. Fundamentals of Combustion, D P Mishra, 1st edition, University Press, 2010
4. Engineering Chemistry - R. Mukhopadhyay and Sriparna Datta, Newage International Pvt. Ltd, 2007.

15CHY244**GREEN CHEMISTRY AND TECHNOLOGY****3 0 0 3****Unit 1**

Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2

Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behaviour and solvent attributes of supercritical CO₂, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO₂ fixation, green plastics, green oxidations, etc.

Unit 3

Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:

1. *Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.*
2. *Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press Inc., New York, 1998.*
3. *Matlack, A. S. Introduction to Green Chemistry Marcel Dekker: New York, NY, 2001.*

15CHY245 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3**Unit 1**

Error Analysis and Sampling: Accuracy - Precision - Classification of Errors - Minimization of errors - Standard deviation - Coefficient of variance - F-test - t-test - Significant figures. Sampling - Basis of sampling, Sampling and physical state - Safety measures of sampling.

Separation Techniques: Brief out line of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2

Gas chromatography - principle and applications – gel chromatography.

Electroanalytical techniques: Potentiometry - Potentiometric titration - determination of equivalence point - acid base, complexometric, redox and precipitation titrations - merits and demerits. Voltammetry - Cyclic voltammetry - basic principle and application - Polarography - introduction - theoretical principles - migration current - residual current - half wave potential - instrumentation - analytical applications.

Unit 3

Spectro-chemical techniques: UV-VIS spectrophotometry - principle - Beer's Law application - photometric titration - single and double beam spectrophotometer - instrumentation of IR - sample handling - IR applications - H - NMR - Instrumentation and applications - principle - instrumentation - applications of atomic absorption spectroscopy.

Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

TEXTBOOKS:

1. Willard H W, Merritt J R, "Instrumental Methods of Analysis", 6th edition, Prentice Hall, (1986).
2. Skoog Douglas A, West Donald, "Fundamentals of Analytical Chemistry", 7th edition, New York Addison, Wesley, (2001).

REFERENCES:

1. "Vogel's Textbook of Quantitative Chemical Analysis", 5th edition, ELBS, (1989).
2. Kaur. H, "Instrumental Methods of Chemical Analysis", Goel Publisher, (2001).

15CHY246 MEDICINAL ORGANIC CHEMISTRY 3 0 0 3**Unit 1**

Medicinal Chemistry: Introduction, drugs - classification of drugs - mechanism of drug action. Drug-receptor complex nomenclature - agonist, antagonist.

Physicochemical properties in relation to biological action: solubility, partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity, bioisosterism - Stereo chemical aspects of drug action - stereo isomerism - optical isomerism.

Unit 2

Enzymes and hormones: Enzymes - nomenclature, classification and characteristics of enzymes - mechanism of enzyme action, factors affecting enzyme action, cofactors and co-enzymes, enzyme inhibition, enzymes in organic synthesis. Hormones and vitamins - representative cases.

Medicinal agents from natural products: Natural products as therapeutic agents, medicinal plants, animal products as medicine, isolation methods of alkaloids, terpenes, anti-oxidants.

Unit 3

Medicinal agents: Medicinal agents belonging to steroids, polypeptides, modified nucleic acid bases, sulphonamide and sulpha drugs, antibiotics, antifungal, antiseptics and disinfectants, anaesthetics, antihypertensive drugs, analgesics, histamine and anti-histamine agents.

TEXTBOOKS:

1. Rama Rao Nadendla, "Principles of Organic Medicinal Chemistry", 1st edition, New age international (P) limited, (2005).
2. Thomas Nogrady and Donald F. Weaver, "Medicinal chemistry: A Molecular and Biochemical Approach", 3rd edition, Oxford university press, (2005).

REFERENCES:

1. Wilson C O, Gisvold O and Deorge R F, "Text book of organic, medicinal and Pharmaceutical chemistry", 7th edition, J.B.Lippincott company, Philadelphia, (1977).
2. Burger A, "Medicinal Chemistry", 3rd edition, Wiley Interscience, Newyork, (1970).
3. Graham L P, "An Introduction to Medicinal Chemistry", 3rd edition, Oxford university Press, (2005).

15CHY247 MODERN POLYMER COMPOSITES 3 0 0 3**Unit 1**

General introduction to composite materials: Concept and definition, classification of composites (CMC, MMC, PMC). Functional roles of reinforcement and matrix and importance of interface. Polymer matrix composites (PMCs): Fiber reinforced and particulate filled polymer composites. Reinforcements (glass, carbon/graphite, Kevlar), Matrices - Thermoset matrices - polyesters, epoxides, phenolics, vinyl esters, polyimides, cyanate esters - Thermoplastic matrices. Choice of reinforcements and matrices for different application needs.

Unit 2

Fiber reinforced polymer composites (FRPs): Basic rule of mixtures, stress-strain relationships. Tailoring of structural properties through laminar-sequencing and choice of fiber fractions/fiber orientations, to meet design requirements. Mechanical behavior of FRP composites: Fiber controlled and matrix dependent properties. Fibre volume fraction, tensile, shear, compressive, flexural, thermo elastic and off – axis responses of lamina and laminates - notched strength – fracture toughness - nondestructive testing. Effect of environmental conditions on properties.

Unit 3

Composite precursors: SMCs, DMCs, BMCs prepreg materials and their choice in specific applications. Fabrication processes for FRP Composites: hand layup, spray up, vacuum bag moulding, compression moulding, filament winding, braiding, pultrusion, RTM, RIM, RRIM, RFI, autoclave moulding, injection moulding etc. Room temperature and hot curing of composites, Nanocomposites: Introduction; Nanoscale Fillers – Clay, POSS, CNT, nanoparticle fillers; Processing into nanocomposites; Modification of interfaces; Properties. Applications. Joining composite elements and repairs, Recycling of polymer composites.

TEXTBOOKS:

1. B. Astrom, "Manufacturing of Polymer Composites", CRC Press, 1997.
2. P K Mallick, "Fiber-Reinforced Composites: Materials, Manufacturing, and Design", CRC Press, 2007.

REFERENCES

1. F. C. Campbell (Ed), *Manufacturing processes for advanced composites*, Elsevier, 2004.
2. S T Peters (Ed.), "Handbook of Composites", Springer, 1998.

15CHY248**ORGANIC REACTION MECHANISMS****3 0 0 3****Unit 1**

Introduction to organic chemistry: Lewis structure and formal charges of organic compounds - electro negativities and dipoles, resonances, aromaticity and anti aromaticity - equilibrium, tautomerism and hyper conjugation - acidity and basicity - pKa, nucleophiles and electrophiles - hydrogen bonding - different types of organic reaction - addition, substitution, elimination and rearrangement - oxidations and reductions - general principles of writing organic reaction mechanism - reactive intermediates.

Reaction of nucleophiles and bases: Nucleophilic substitution - SN1 and SN2 reactions, nucleophilic substitution at aliphatic sp² carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organo lithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.

Unit 2

Michael and 1,4-addition reaction - Favorskii rearrangement - benzilic acid rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

Reaction involving acids and other electrophiles: Carbocations - formation and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carbonyl compounds - hydrolysis of carbocyclic acid derivatives - electrophilic aromatic substitution - carbenes and benzynes - Baeyer-Villiger reactions - Dienone-phenol rearrangement - pinacol rearrangement.

Unit 3

Radical and radical ions: Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - SRN 1 reaction - radical ions - Birch reduction - Hofmann-Löffler-Freytag reaction - Barton reaction - McMurry reaction.

Pericyclic reaction: Representative of molecular orbitals of ethylene, butadiene and hexatriene molecules - Woodward - Hofmann rules of symmetry - electrocyclic reaction, cycloadditions - diels-Alder reaction - other thermal cycloadditions - photochemical [2+2] cycloaddition - 1,3-dipolar cycloadditions - Sigmatropic reactions, notations and directions of [3,3] sigmatropic rearrangements - Cope and oxy-Cope rearrangement [2,3] sigmatropic reaction - ene reaction.

TEXTBOOK:

Jerry March, "Advanced Organic Chemistry", 4th edition, John Wiley & Sons, (1992).

REFERENCES:

1. Carey F and Sundberg R, "Advanced Organic Chemistry - Part A & B", Kluwer, (2000).
2. Peter Sykes, "Organic reaction mechanism", 6th edition, Pearson education (Singapore) Pte. Ltd., (2005).
3. Michael B.Smith, "Organic Synthesis", 2nd edition, McGraw Hill, (2004).

15CHY249 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3**Unit 1**

Nomenclature of Organic compounds: Polyenes, Alkynes with and without functional groups by IUPAC nomenclature. Aromatic and Heteroaromatic systems - nomenclature of heterocycles having not more than two hetero atoms such as oxygen, sulphur, nitrogen.

Stereochemistry: Tacticity, R/S system of nomenclature of central and axial molecules.

Unit 2

Atropisomerism - isomerism of biphenyls - allenes and spiranes - ansa compounds - Geometrical isomerism, E, Z Isomerism. Asymmetric synthesis.

Conformational Analysis: Optical activity and chirality - Conformational Analysis of cyclic and acyclic system - Conformational effects on reactivity of acyclic systems only.

Unit 3

Asymmetric synthesis: Stereo selective - Stereo specific - Regioselective and Regiospecific reactions. Principle of protection of alcohol, amine, carboxyl and carbonyl groups - Functional group inter conversions - Disconnection approach - Reversal of polarity - reagents in synthesis.

TEXTBOOKS:

1. E. L. Eliel, "Stereochemistry of Carbon Compounds", McGraw Hill Book Co, (2000).
2. Jerry March, "Advanced Organic Chemistry", 4th edition, John Wiley & Sons, (1992).

REFERENCES:

1. S. Warren, "Designing Organic Synthesis", Wiley & Sons, (1998).
2. Finar I. L., "Organic Chemistry: Stereochemistry and the Chemistry of Natural Products", 5th edition, ELBS, (2000).

15CHY250 POLYMER MATERIALS AND PROPERTIES 3 0 0 3

Unit 1

Structure of polymers – thermoplastic, thermoset, rubber - Linear, branched, crosslinked, and network polymers – polymerization types – addition, condensation, mechanism, methods – bulk, solution, suspension and emulsion - crystalline, amorphous, orientation – molecular weight – intermolecular forces, solubility parameter- glass transition temperature.

Unit 2

Manufacturing, mechanical, thermal, electrical and chemical properties and applications of commodity plastics - PE, PP, PVC, PS, Engineering plastics - ABS, PC, PMMA, polyamide, polyacetal, PET, PBT, PTFE, High performance polymer - PES, PEI, PEEK, conducting polymer.

Unit 3

Thermoset materials - PF, UF, MF, epoxy and unsaturated polyester resin, Rubber - natural rubber, synthetic rubber - SBR, PB, nitrile, chloroprene, butyl, silicone - compounding and additives.

TEXTBOOKS:

1. J. A. Brydson, "Plastics Materials" Butterworth-Heinemann – Oxford, 7th Ed., London, 1999
2. Maurice Morton, "Rubber Technology", 3rd Ed, Kluwer Academic Pub, Dordrecht, Netherlands, 1999
3. ManasChanda and Salil K. Roy, "Plastics Technology Handbook", CRC Press, Atlanta, 2007

REFERENCE BOOKS:

1. D. W. Van Krevelena and P.J. Hoftyzen, "Properties of Polymer", 3rd Edition Elsevier Scientific Publishing Company Amsterdam – Oxford – Newyork. 1990.
2. Jozef Bicerano, "Prediction of Polymer Properties", Second Edition, Marcel Dekker Inc. New York, 1995.

15CHY251 POLYMERS FOR ELECTRONICS 3 0 0 3

Unit 1

Conducting polymers: Conducting mechanisms - Electron transport and bipolar polymers - electrodepositable resists, resins. Applications - Organic light emitting diodes, Sensors, EMI shielding, printed Circuit Boards, Artificial nerves, Rechargeable Batteries, Electromechanical Actuators and switches.

Unit 2

Photoconductive polymers: Charge carriers, charge injectors, charge transport, charge trapping. Polymers for optical data storage - principles of optical storage, polymers in recording layer.

Nonlinear optics: NLO properties and NLO effects, wave guide devices, polymer optical fibers - through plane modulators.

Unit 3

Thermosensitive polymers: Applications - Mechanical actuators and switches - Tissue culture, Drug delivery, Photo resists - Types - Chemically amplified photoresists - Applications. Magnetic polymers - structure and Applications.

Liquid crystalline polymers: Fundamentals and process, liquid crystalline displays - Applications.

TEXTBOOK:

Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, "Functional Monomers and Polymers", CRC Press, (1997).

REFERENCES:

1. A B Kaiser, "Electronic properties of conjugated polymers - basics, models and applications", Springer Verlag, (1987).
2. J. A. Chilton and M T Goosy, "Special polymers for electronics and optoelectronics", Kluwer Academic Publishers, (1995).

15CHY252**SOLID STATE CHEMISTRY****3 0 0 3****Unit 1**

Symmetry in Crystal Systems: Types of symmetry, plane, axis and centre of symmetry, crystal systems and symmetry elements. Law of rational indices, miller indices, Weiss indices - plane systems, space lattices, unitcells - unitcell dimension, determination. Space lattice - definition and types Bravais lattice - kinds of bravais lattices, number of atoms in SC, BCC, FCC lattices, void space, Radius ratio rule and application. Crystal defects - types of defects in crystals - stoichiometric defect - schottky and frenkel defects - Non-stoichiometric defects - metal excess and metal deficiency defects, influence of defects on the properties of solids.

Unit 2

Electrical and Magnetic Properties: Development of free electron theory to band theory of solids - metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; Insulators - dielectric, ferroelectric, pyroelectric and peizolectric properties and the relationship between them. Dia, para, ferro, ferri, antiferro and antiferri magnetic types - selected magnetic materials such as spinels, garnets and perovskites, superconductors.

Diffraction Methods: X-ray diffraction - various methods of X-ray analysis of structure-ray diffraction pattern, X-ray scattering factor. Results and uses of X-ray diffraction. Limitations of X-ray diffractions.

Unit 3

Neutron diffraction - principles, electron diffraction patterns, limitations - applications of electron diffraction - structural elucidation. Distinction between X-ray, Neutron and electron diffraction. Structure factor - definition, factors influencing structure factor. Uses of structure factor.

Fourier synthesis - definition, applications of fourier synthesis in crystal structure analysis of S-Tetrazine. Structure of Rutile, Fluorite, Antifluorite, Zinc blende, Wurtzite, diamond and graphite.

REFERENCES:

1. Cotton F. A, Wilkinson G and Gaus P, "Basic Inorganic Chemistry", 3rd edition, John Wiley and Sons, (2003).
2. Shriver D. F and Atkins P. W, "Inorganic Chemistry", 3rd edition, ELBS, Oxford University Press, Oxford, (2004).
3. Huheey J. E, Keiter E. A and Keiter R. L, "Inorganic Chemistry", 4th edition, Addison-Wesley Pub. London, (1993).
4. Cotton F. A, Wilkinson G, Murillo C. A and Bochmann M, "Advanced Inorganic Chemistry", 6th edition, John Wiley and Sons, New York, (2003).

5. Jolly W. L, "Modern Inorganic Chemistry", 2nd edition, McGraw-Hill, Inc., (1991).

6. Miessler G. L and Tarr D. A, "Inorganic Chemistry", 3rd edition, Pearson Education, Singapore, (2004).

15CHY331**BATTERIES AND FUEL CELLS****3 0 0 3****Unit 1**

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.

Fuels for Fuel Cells: Hydrogen, methane, methanol - Sources and preparation, reformation processes for hydrogen – clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.

TEXTBOOKS:

1. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, (2001).
2. M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).

REFERENCES:

1. Kanani N, 'Electroplating and electroless plating of copper and its alloy', ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).
2. Curtis, 'Electroforming', London, (2004).
3. F. Barbir, 'PEM fuel cells: theory and practice', Elsevier, Burlington, MA, (2005).
4. G. Hoogers, 'Fuel cell handbook', CRC, Boca Raton, FL, (2003).

15CHY332**CORROSION SCIENCE****3 0 0 3****Unit 1**

Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2

Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

Unit 3

Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.

Corrosion protection: Automobile bodies – engines – building construction.

TEXTBOOKS:

1. Fontana and Mars G, "Corrosion Engineering", 3rd edition, McGraw Hill, (1987).
2. Uhlig H H and Reviees R W, "Corrosion and its Control", Wiley, (1985).

REFERENCES:

1. ASM Metals Handbook, "Surface Engineering", Vol. 5, ASM Metals Park, Ohio, USA, (1994).
2. ASM Metals Handbook, "Corrosion", Vol. 13, ASM Metals Park, Ohio, USA, (1994).
3. Brain Ralph, "Material Science and Technology", CRC Series, Boston, New York.

15CSE100**COMPUTATIONAL THINKING AND
PROBLEM SOLVING****3 0 2 4****Unit 1**

Basics: Introduction, Information and data, Data encoding. Logic: Boolean logic, Applications of propositional logic.

Unit 2

Problem Solving and Algorithmic Thinking: Problem definition, Logical reasoning, Problem decomposition, Abstraction. Flowcharting, Name binding, Selection, Repetition, Modularization. Data organization: List and Arrays. Simple algorithms, comparison of performance of algorithms.

Unit 3

Problem Solving Techniques: Factoring and Recursion Techniques, Search and Sort techniques, Text processing and Pattern matching.

TEXTBOOKS:

1. David Riley and Kenny Hunt, *Computational Thinking for Modern Solver*, Chapman & Hall / CRC, 2014
2. R. G. Dromey, "How to solve it by Computer", PHI, 2008

15CSE102**COMPUTER PROGRAMMING****3 0 0 3****Unit 1**

Introduction to C language: Structure of a C program, comments, Data types, Variables, constants, Data input and output statements, input assertions; expressions and evaluation. Functions: inter function communication, standard functions, scope. Selection: two way selection, multi-way selection, repetition: concept of loop, loop invariant, pretest and post-test loops, initialization and updating, event and counter controlled loops. Recursion: recursive definition, recursive solution, designing recursive functions, limitations of recursion.

Unit 2

Files and streams, file input output. Arrays - 1D numeric, searching and sorting, 2D numeric arrays: problems with matrices. Pointers: introduction, compatibility, arrays and pointers, Dynamic memory allocation, array of pointers, pointer arithmetic.

Unit 3

Strings: fixed length and variable length strings, strings and characters, string input output, array of strings, string manipulation functions, sorting of strings. Enumerated types, Structures: Structure vs array comparison, complex structures, Structures and functions, Union, binary input output, Command line arguments.

TEXTBOOK:

Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A structured programming approach using C", Third Edition, Cengage Learning, 2006.

REFERENCES:

1. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", Second Edition, Prentice Hall, 1988.
2. Eric S. Roberts, "Art and science of C", Addison Wesley, 1995.
3. Jeri Hanly and Elliot Koffman, "Problem solving and program design in C", Fifth Edition, Addison Wesley (Pearson), 2007.

15CSE180 COMPUTER PROGRAMMING LAB. 0 0 2 1

Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while, for), programs using user defined functions and library functions, programs on Files, arrays, matrices (single and multi-dimensional arrays), programs using DMA, programs on strings, structures.

REFERENCE:

Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A structured programming approach using C", Third Edition, Cengage Learning, 2007.

15CUL101 CULTURAL EDUCATION I 2 0 0 2**Unit 1**

Introduction to Indian Culture; Introduction to Amma's Life and Teachings; Symbols of Indian Culture.

Unit 2

Science and Technology in ancient India; Education in Ancient India; Goals of Life - Purusharthas; Introduction to Vendanta and Bhagavat Gita.

Unit 3

Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India.

TEXTBOOKS:

1. *The Glory of India (in-house publication)*
2. *The Mother of Sweet Bliss (Amma's Life & Teachings)*

15CUL111 CULTURAL EDUCATION II 2 0 0 2**Unit 1**

1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

Unit 2

4. Who is a Wise Man?
5. A Ruler's Dharma
6. The Story of King Shibi

Unit 3

7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

Unit 4

9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

Unit 5

11. Patanjali's Astanga-Yoga System for Personality Refinement
12. Examples of Heroism and Patriotism in Modern India

TEXTBOOKS:

Common Resource Material II (in-house publication)
Sanatana Dharma - The Eternal Truth (A compilation of Amma's teachings on Indian Culture)

15CUL230 ACHIEVING EXCELLENCE IN LIFE - AN INDIAN PERSPECTIVE 2 0 0 2

OBJECTIVES: *The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.*

Unit 1

Goals of Life – Purusharthas

What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)

Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);

Experiencing life through its Various Stages

Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2

Personality Development

What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)

Art of Relaxed Learning; Art of Listening; Developing 'Shraddha' – a basic qualification for obtaining Knowledge;

Communication Skills - An Indian Perspective;

Unit 3

Developing Positive Attitude & Friendliness - (Vedic Perspective);

Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);

Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

REFERENCE BOOKS:

1. *Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9*
2. *Complete works of Swami Vivekananda (Volumes 1 to 9)*
3. *Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)*
4. *Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)*
5. *Message of Upanishads, by Swami Ranganathananda published by Bharatiya Vidya Bhavan, Bombay.*
6. *Personality Development – Swami Vivekananda published by Advaita Ashram, Kolkatta.*

7. *Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay*
8. *Will Power and its Development- Swami Budhananda published by Advaita Ashram, Kolkatta*
9. *Ultimate Success - Swami Ramakrishnananada Puri published by Mata Amritanandamayi Math, Kollam*
10. *Yoga In Daily Life - Swami Sivananda – published by Divine Life Society*
11. *Hindu Dharma - H. H. Sri Chandrasekharandra Saraswati published by Bharatiya Vidya Bhavan, Bombay*
12. *All about Hinduism – Swami Sivananda - Published by Divine Life Society*
13. *The Mind and its Control by Swami Budhananda published by Advaita Ashram, Kolkatta*
14. *Krida Yoga - Vivekananda Kendra, Publication.*
15. *Valmiki Ramayana – Four volumes - published by Parimal Publications, Delhi*
16. *New perspectives in Stress Management - Dr H R Nagendra & Dr R Nagaratna published by Swami Vivekananda Yoga Prakashana, Bangalore.*
17. *Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.*
18. *Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.*

15CUL231**EXCELLENCE IN DAILY LIFE****2 0 0 2****Unit 1**

- 1 The anatomy of 'Excellence'. What is 'excellence'? Is it judged by external factors like wealth?
- 2 The Great Flaw. The subject-object relationship between individual and world. Promote subject enhance excellence.
- 3 To work towards excellence, one must know where he is. Our present state... An introspective analysis. Our faculties within.

Unit 2

- 4 The play of the mind. Emotions – convert weakness into strength.
- 5 The indispensable role of the intellect. How to achieve and apply clear thinking?
- 6 The quagmire of thought. The doctrine of Karma – Law of Deservance.
- 7 Increase Productivity, reduce stress.. work patterning.

Unit 3

- 8 The art of right contact with the world. assessment, expectations.
- 9 Myths and Realities on key issues like richness, wisdom, spirituality.
- 10 Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:

The Bhaja Govindam and the Bhagavad Gita.

**15CUL232 EXPLORING SCIENCE AND TECHNOLOGY 2 0 0 2
IN ANCIENT INDIA**

OBJECTIVES: This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as well as actual techniques.

Unit 1

1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2

6. Astronomy & mathematics in Jain and Buddhist literature;
7. The transition to the Siddhantic period; Aryabhata and his time;
8. The Aryabhata: concepts, content, commentaries;
9. Brahmagupta and his advances;
10. Other great Siddhantic savants;
11. Bhaskara II and his advances;

Unit 3

12. The Kerala school of mathematics;
13. The Kerala school of astronomy;
14. Did Indian science die out?;
15. Overview of recent Indian scientists, from S. Ramanujan onward;
16. Conclusion: assessment and discussion;

TEXTBOOK:

Indian Mathematics and Astronomy: Some Landmarks, by S. Balachandra Rao

REFERENCE:

FIH's interactive multimedia DVD on Science & Technology in Ancient India.

15CUL233 YOGA PSYCHOLOGY 2 0 0 2

OBJECTIVES: This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.

Unit 1

Introduction
Introduction to Modern Psychology

A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology

What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of all Yoga-schools.

Patanjali Yoga Sutra – 1

Introduction to Rishi Patanjali - Bird view of Yoga-Sutra - Definition of Yoga – Vrittis.

Patanjali Yoga Sutra – 2

Five Kinds of Vrittis - Pramanam - sources of right knowledge - Viparyayah – unfolded belief - Vikalpah – Unfolded belief - Smriti – Memory.

Unit 2

Patanjali Yoga Sutra – 3

Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

Patanjali Yoga Sutra – 4

Introduction to Samadhi - Samprajnata-Samadhi - Reasoning in S.amprajnata-Samadhi - Reflection in Samprajnata-Samadhi - Bliss in Samprajnata-Samadhi - Sense of Individuality in Samprajnata-Samadhi.

Patanjali Yoga Sutra – 5

Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6

How to make mind peaceful? - Cultivating opposite virtues: happiness – friendliness - misery – compassion - virtue – gladness - vice – indifference.

Patanjali Yoga Sutra – 7

Five causes of Pain - avidya – ignorance (Root Cause) - asmita – 'I-Feeling' - raga – attraction - dwesha – repulsion - abhinivesha – clinging to life.

Unit 3

Patanjali Yoga Sutra – 8

Necessity of Yoga practice - eight parts of Yoga practice - five Yamas: ahimsa – satya – asteya – brahmacharyam – aparigraha.

Patanjali Yoga Sutra – 9

Five Niyamas: Soucha – Santhosha – Tapas – Swadyah – Ishwara - Pranidhanam.

Patanjali Yoga Sutra – 10

Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

Report review

Conclusion

REFERENCES:

- The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
- “The message of Upanishads” written by Swami Ranganathananda. Published by Bharathiya Vidya Bhavan.
- Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttaranjal.
- ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

15CVL102 MECHANICS: STATICS AND DYNAMICS 2 1 0 3**Unit 1**

Principles of statics: Introduction to vector approach – free body diagrams – forces in plane – forces in space – concurrent forces - resolution of forces – equilibrium of particle.

Statics of rigid bodies in two dimensions and three dimensions: Moment of a force about a point – moment of a force about an axis – moment of a couple – equivalent force couple system – rigid body equilibrium – support reactions.

Unit 2

Applications of statics: Friction – contact friction problems. Analysis of trusses – method of joints – method of sections.

Properties of surfaces and solids - Centroid, Moment of inertia, Polar moment of inertia, Mass moment of inertia, Product of inertia and Principal moment of inertia.

Unit 3

Dynamics: Rectangular and cylindrical coordinate system - Combined motion of rotation and translation - Newton's second law in rectilinear translation - D'Alembert's principle - Mechanical vibration - Simple harmonic motion - Spring-mass model.

TEXTBOOKS:

1. Beer, F. P. and Johnston, E. R., “Vector Mechanics for Engineers- Statics and Dynamics”, 8/e, McGraw Hill International Book Co., 2008.
2. Shames, I. H., “Engineering Mechanics – Statics and Dynamics”, 4/e, Prentice–Hall of India Pvt. Ltd., 2003.

REFERENCES:

- Hibbeler, R. C., “Engineering Mechanics”, 12/e, Pearson Education Pvt. Ltd., 2007.
Meriam, J. L., “Dynamics”, 5/e, John Wiley & sons, 2003.
K. L. Kumar, “Engineering Mechanics”, 3/e, Tata McGraw Hill, 2003.

15CVL111 INTRODUCTION TO CIVIL ENGINEERING 1 0 0 1

Introduction to the various areas of Civil engineering - Simple concepts in each of the areas - Respective tasks performed by each specialty which contributes to a constructed facility.

Introduction to the Civil engineering undergraduate curriculum map - the relationship between the courses in the curriculum.

15CVL112 ENGINEERING GRAPHICS – CAD 1 0 2 2

Section of Solids: Introduction, Section planes, Sectional views, apparent shapes and true shapes of sections of right regular prisms, cylinders, pyramids and cones.

Development of lateral surfaces: Introduction, Development of lateral surfaces of prisms, cylinders, pyramids and cones.

Isometric Projection: Introduction, Isometric scale, Isometric projection of prisms, pyramids, cylinders, cones

Orthographic Views of 3 dimensional solids.

Building Drawing: Construction details – Masonry, Footings.

Development of Plan, Section and Elevation of Simple Residential building.

TEXTBOOKS:

1. Bhat N. D. and Panchal V. M., "Engineering Drawing Plane and Solid Geometry, 42e, Charotar Publishing House, 2010
2. Dr. Balagopal T S Prabhu, Dr. K. Vinent Paul and Dr. C. Vijayan., "Building Design and Civil Engineering Drawing", Spades Publishers & Distributors, Calicut, 2012.

REFERENCE BOOKS:

1. James D. Bethune, "Engineering Graphics with AutoCAD", Pearson Education, 2014
2. K. R. Gopalakrishna, "Engineering Drawing", 2014, Subhas Publications
3. Narayan K. L. and Kannaiah P, Engineering Drawing, SciTech Publications, 2003

15CVL201**CONSTRUCTION MATERIALS****3 0 0 3****Unit 1**

Commonly used building materials - relationship between material structure and properties.

Masonry materials - stones, bricks, blocks; Refractory products; Timber and wood based products - Classification, properties, testing and selection criteria.

Unit 2

Binding materials (Lime, gypsum, cement) and Mortars - types, properties, tests.

Concrete – Aggregates – Mechanical and Physical properties and tests – Grading requirements – Water quality – Admixtures. Properties of concrete in fresh and hardened state – workability – segregation and bleeding – tests on workability and strength. Stress – strain characteristics and elastic properties – shrinkage and creep. Mix proportioning (B.I.S method) – nominal mixes.

Unit 3

Metals – Structural steel - properties and uses - sections – Reinforcing steel – use of Aluminium. Bituminous materials – types and properties of asphalt, bituminous concrete.

Modern construction materials – Paints, Glass, Ceramics, Polymers and plastics, Adhesives, Composites and smart materials. Recycling of industrial waste as building materials.

TEXTBOOKS:

1. Duggal, S. K., "Building Materials", New Age International Publishers, 2012.
2. Santhakumar. A. R., "Concrete Technology", Oxford University press, 2006.

REFERENCE BOOKS:

1. Young. J. F. and Mindess, S., "The Science and Technology of Civil Engineering Materials", Prentice Hall, 1997.

2. Mehta, P. K. and Monteiro, P. J. M., "Concrete-Microstructure, Properties and Materials", Tata McGraw Hill, 2006.
3. Rangwala S. C., "Engineering Materials", Charotar Publishing House, 2011.
4. Shetty, M. S., "Concrete Technology-Theory and Practice", S. Chand & Co., New Delhi, 2009.
5. Gambhir, M. L. and Neha Jamwal, "Building Materials", Tata McGraw Hill, 2011.

15CVL202**PINCIPLES OF FLUID MECHANICS****2 1 0 3****Unit 1**

Elementary concepts – properties - concept of gauge and absolute pressure, measurement of pressure using manometers of different types.

Hydrostatic force on plane and curved surface – center of pressure – lock gates - buoyancy and stability of submerged and floating bodies - metacentric height - period of oscillation.

Types of flow, definitions and explanations of unsteady, steady, non-uniform, laminar and turbulent flows. Ideal flow - rotational and irrotational, stream function, potential function. Path line, streak line and stream line – continuity equation – derivation, application of one dimensional steady flow – circulation and vorticity - Basic flow fields such as uniform flow, source, sink, doublet, vortex flow, spiral flow – superposed flows.

Unit 2

Derivation of Bernoulli's energy equation and Euler's equation, examples illustrating the use of energy equation. Flow meters - venturimeter, Orifice meter, nozzle, derivation of equations of discharge, pitot tubes – applications to flow measurements - notches and weirs.

Laminar flow through circular pipe – shear stress, pressure gradient, velocity profile, Hagen-poiseuille's equation, power calculations, laminar flow between parallel plates - Couette flow and Poiseuille flow.

Flow in closed conduits – friction loss and flow calculations, turbulent flow, Reynolds number, Darcy-Weisbach equation. Use of Moody's diagram, minor losses – pipe networks – pipes in parallel and series - equivalent length.

Unit 3

Boundary layer theory, boundary layer equation – Prandtl equation, Blasius solution, drags on flat plate, boundary layer separation and its control.

Dimensional Analysis, Similitude and Model Analysis: Methods of Dimensional Analysis – Rayleigh's method – Buckingham Pi-theorem – Hydraulic Similitude –

model analysis – dimensionless numbers – Model testing of partially submerged bodies – Distorted models and scale effects.

TEXTBOOKS:

1. Streeter Victor L and E. Benjamin Wylie, "Fluid Mechanics", Tata McGraw Hill, 2010.
2. Modi P. N. and Seth S. M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Publishers & Distributors, 2013.

REFERENCE BOOKS:

1. Cengel and Cimbala, "Fluid Mechanics", Tata McGraw Hill Publishers, 2010.
2. Som S K, Gautam Biswas and Suman Chakrabarty, "Introduction to Fluid Mechanics and Fluid machines", Tata McGraw Hill Education Pvt. Ltd, 2013
3. N. N. Pillai, "Fluid Mechanics and Fluid Machines", Universities Press, 2008.
4. Subramanya K., "Theory and Applications of Fluid Mechanics", Tata McGraw Hill Publishing Co, 1993.
5. J. F. Douglas, J. M. Gasiorek and J. A. Swaffield, "Fluid Mechanics", Pearson Education, 2008.
6. White, Frank. M, "Fluid Mechanics", Tata McGraw Hill, 2011.

15CVL203**SOLID MECHANICS****3 1 0 4****Unit 1**

Stress and strain at a point – tension, compression and shear stresses – Hooke's law - Poisson's ratio - relationship between elastic constants – compound bars - thermal stresses – strain energy in tension, compression and shear - resilience – stresses due to impact and suddenly applied load.

Different types of beam – statically determinate and indeterminate beams - shear force and bending moment diagrams - relationship between intensity of loading, shear force and bending moment.

Unit 2

Theory of simple bending - Stress distribution at a cross-section due to bending moment for statically determinate beams - flitched beams.

Shear stress distribution.

Unsymmetrical bending and Shear centre.

Torsion of circular solid and hollow shafts – combined bending moment and torsion on shafts – close coiled and open coiled helical springs

Complex stresses – principal stresses and principal planes - principal strains – graphical method.

Unit 3

Deflection of beams – double integration method – Macaulay's method – Area Moment method – Conjugate beam method – Strain energy approach.

Theory of columns – members subjected to axial load and bending moment – Euler's theory for long columns – assumptions and limitations – Rankine's formula.

Thin and thick cylinders – Lamé's equation - compound cylinders.

Theories of failure and applications in design.

TEXTBOOKS:

1. Gere, J. M. and Goodno. B. J., "Mechanics of Materials", CL Engineering, 2012.
2. Beer, Johnston, DeWolf, Mazurek., "Mechanics of Materials", McGraw-Hill Education, 2013.

REFERENCE BOOKS:

1. Timoshenko, S. P., and Young, D. H., "Elements of Strength of Materials", East West Press, New Delhi, 2003.
2. Popov E. P., "Mechanics of Materials", Prentice Hall India, New Delhi, 2002
3. Crandall, S. H., Dahal, N. C., and Lardener, T. J., "An Introduction to Mechanics of Solids", McGraw Hill Books Co, 1985, 2nd Edition 2007
4. Nash W. A. "Strength of Materials", McGraw Hill Book Company, 2006

15CVL204**SURVEYING****3 1 0 4****Unit 1**

Introduction - classification of surveys – reconnaissance - principle of working from whole to part – provision of control – conventional signs

Chain survey – instruments – principles of chain survey – field book – plotting – tie line and check line.

Compass survey – types of compass – types of bearings – dip and declination – local attraction – traversing – plotting - error of closure.

Plane table survey - two point problem – three point problem – errors in plane tabling.

Unit 2

Leveling – leveling instruments and its adjustments – fly leveling – booking - corrections for refraction and curvature – reciprocal leveling – longitudinal leveling and cross sectioning – contour surveying – definition – characteristics, methods and uses of contouring – plotting – areas and volumes – planimeter - Earthwork volume calculation.

Theodolite surveying – study of theodolite and its adjustments - measurement of horizontal angles - vertical angles – heights and distances – theodolite traverse – calculation of co-ordinates – corrections – traversing conditions for closure.

Unit 3

Minor instruments – hand levels – clinometer – Ceylon ghat tracer – hypsometer – pantagraph – edigraph – box sextant - telescopic alidade.

Curves – simple, transition and vertical curves - curve setting by various methods.

Tacheometric surveying – various methods – instrument constants – analytic lens – tangential system – direct reading tacheometer - subtense bar – trigonometric leveling. Total station - introduction to photogrammetry, remote sensing, global positioning systems, and Geographic information systems. EDM.

Introduction to Hydrographic surveying.

TEXTBOOKS:

1. Kanetkar T. P. and Kulkarni S. V., "Surveying and Levelling", Vol. I & II, Vidyarthi Griha Prakashan, 2006.
2. Arora K. R., "Surveying", Vol. I & II, Standard Publishers, 2010.

REFERENCE BOOKS:

1. Bannister, A. and Baker, R., "Solving Problems in Surveying", Addison Wesley Longman, 1996.
2. R. Agor, "Textbook of Surveying and Levelling", Khanna Publishers, 2012.
3. S. K. Duggal, "Surveying", Vol. 1 & 2, McGraw Hill Education, 2013.
4. R. Subramanian, "Surveying and Leveling", Oxford University Press, 2012.
5. Pradip Kumar Guha, "Remote Sensing for the Beginner", Affiliated East West Press, 2003.

15CVL211

BUILDING TECHNOLOGY

3 0 0 3

Unit 1

Occupancy classification of buildings - Essentials of National Building Code.

Loads on buildings; Foundations - deep and shallow foundations – introduction to mat and grillage foundations – caissons.

Super structure - load bearing masonry - brick and stone masonry, arches, lintels, scaffolding, shoring; plastering and pointing.

Unit 2

Concrete construction – batching, mixing, conveying, placing, compacting, curing. Durability of concrete. Special concretes.

Reinforced concrete - Form work - Prestressed concrete. Principles of prefabricated construction.

Roofs and Floors - flat and pitched roofs, floor types and finishes; Doors and windows.

Damp and water proofing techniques.

White washing, colour washing, painting and distemping;

Unit 3

Tall buildings – structural systems – Steel and concrete framed construction - Vertical transportation, plumbing systems, electrical services

Thermal insulation of buildings - Natural and mechanical ventilation - Air conditioning. Principles of fire resistant construction. Acoustics - requirements for good acoustics - sound insulation.

Functional planning – Building development rules - Space planning of buildings – Design process – planning principles.

TEXTBOOKS:

1. Arora.S. P. and Bindra.S. P., "Building Construction", Dhanpat Rai Publications, New Delhi, 2005.
2. Santha Kumar, A. R., "Concrete Technology", Oxford University Press, 2006.

REFERENCE BOOKS:

1. Rangwala S. C. "Building Construction", Charotar Publishing House, 2007.
2. National Building Code, Bureau of Indian Standards, 2005.
3. Neville.A. M. And Brooks.J. J., "Concrete Technology", Pearson Education, 2004.
4. Punmia, "Building Construction", Laxmi Publications, 2009.
5. Subir K Sarkar and Subhajit Saraswati, "Construction technology", Oxford University Press, 2008.

15CVL212

GEOLOGY AND SOIL MECHANICS

2 1 0 3

Unit 1

General geology – Weathering - Geological work of wind, rivers and oceans. Mineralogy.

Petrology – Three-fold classification of rocks and their characteristic features.

Structural geology - Types and classification of structures (Joints, Unconformities, Folds and faults) and their effect on civil engineering projects.

Geology in Civil Engineering - Tunnels, dams, reservoirs, bridges, runways, roads and buildings. Physico-Mechanical properties of rock. Origin and formation of soils.

Unit 2

Soil structure and clay mineralogy – Adsorbed water – Mass-volume relationship – Relative density. Index Properties of Soils: Grain size analysis – Sieve and hydrometer methods – consistency limits and indices – I.S. Classification of soils.

Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law- permeability – Factors affecting permeability – laboratory determination of coefficient of permeability – Permeability of layered systems.

Seepage through soils: Total, neutral and effective stresses – quick sand condition – Seepage through soils – Flownets: characteristics and uses.

Unit 3

Stress distribution in soils: Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart.

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties – Field compaction equipment - compaction control.

Consolidation: stress history of clay; e-p and e-log p curves – magnitude and rate of 1-D consolidation – Terzaghi's Theory.

TEXTBOOKS:

1. Venkat Reddy, D., "Engineering Geology", Vikas Publishing House, 2010.
2. Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 2005.

REFERENCE BOOKS:

1. Blyth. F. G. H. and M. H. De Freitas, "Geology for Engineers", 7th Edition, Elsevier Science, 2006.
2. Parbin Singh., "Engineering and General Geology", S. K. Kataria and Sons, 2009.
3. Das, B. M., "Principles of Geotechnical Engineering", CL Engineering, 2013.
4. C. Venkataramiah, "Geotechnical Engineering", New Age International Publishers, 2006.
5. T. W. Lambe and Whitman, "Soil Mechanics", Wiley, 2008.
6. Manoj Dutta and Gulhati S. K, "Geotechnical Engineering", Tata McGraw Hill Publishers, 2005.

15CVL213

HYDRAULIC ENGINEERING

2 1 0 3

Unit 1

Impulse momentum principle – application – impact of jet-force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases – torque in rotating machines – jet propulsion.

Hydroelectric power: low, medium and high head plants - Power house components – Micro-hydel schemes. Turbines - classifications – construction and working of Pelton Wheel, Francis and axial flow reaction turbines - selection of turbines – draft tube.

Classification of pumps – Centrifugal pumps – types and working – characteristics. Reciprocating pumps - types and working – selection of pumps.

Unit 2

Open channel flow - Comparison with pipe flow, Types of channels - Classification of flow, uniform flow – Uniform flow using chezy's and Manning's formulae - Most efficient channel section – Circular, Rectangular and Trapezoidal channel sections, open channel section for constant velocity at all depths of flow. Specific energy and critical depth, Specific force curve, critical flow computation.

Non-uniform flow, Gradually Varied Flow, Dynamic equation for gradually varied flow, Different forms of the dynamic equation, Flow profiles in prismatic channels, integration of the varied flow equation - Computation of the length of the backwater curve and afflux. Rapidly Varied Flow - Hydraulic Jump, Hydraulic jump equations for a rectangular channel, Practical applications.

Unit 3

Rivers - their behaviour - Control and training. Design of stable channels in India - problem in India - Classification of irrigation canals, Canal alignment, Design procedure for an irrigation channel - Considerations for fixing longitudinal section of a channel - Cross sections of an irrigation channel, Maintenance of canals, Canals in alluvial soils – Regime Theory - Kennedy's and Lacey's Theories, Silting in canals, Scour and protection against scour. Canal lining - losses in irrigation canals, Advantages and disadvantages of lining, Types of lining. Water logging - Causes and preventive measures. Design of lined canals - irrigation canals - Kennedy's Theory - Lacey's Theory.

TEXTBOOKS:

1. Modi P. N. and Seth S. M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Book House, 2002.
2. Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, 2006.

REFERENCE BOOKS:

1. Chow V. T., "Open Channel Hydraulics", McGraw Hill, Inc. 1959.
2. Rajput R K, "Fluid mechanics and Hydraulic Machines", S Chand Publishers, 2008.
3. N. N. Pillai, "Fluid Mechanics & Fluid Machines", Universities Press, Third Edition, 2009.
4. K. Subramanya, "Flow in Open Channels", Tata McGraw Hill, 1997.
5. M. Hanif Chaudhry, "Open Channel Flow", Prentice Hall of India, 1994.

6. K. G. Rangaraju, "Flow Through Open Channels", Tata McGraw Hill, 1984.
7. Jagdish Lal, "Hydraulic Machines including Fluidics", Metropolitan Book Co, 2003.
8. P. N. Modi, "Irrigation, Water Resources, and Water Power Engineering", Standard Publishers Distributors, 2008.

15CVL214 STRUCTURAL ANALYSIS 2 1 0 3

Unit 1

Statically indeterminate structures - degree of static and kinematic indeterminacies. Introduction to force and displacement methods of analysis.

Energy principles – Castigliano's theorems - Engesser's theorem - Maxwell Betti's theorem - Principle of least work – Method of virtual work (unit load method) - applications in statically determinate and indeterminate structures.

Analysis of Propped cantilever and fixed beams.

Unit 2

Cables – maximum tension – types of supports – forces in towers – suspension bridges with three and two hinged stiffening girders.

Theory of arches – Eddy's theorem – analysis of three hinged and two hinged arches – settlement and temperature effects.

Beams curved in plan – analysis of cantilever beam curved in plan – analysis of circular beams over simple supports.

Unit 3

Moving loads and influence lines – influence lines (IL) for statically determinate beams for reaction, SF and BM – effect of moving loads – concentrated and uniformly distributed loads – load position for maximum BM and SF - equivalent UDL.

IL for determinate structures – truss, arch and suspension bridge.

TEXTBOOKS:

1. Devdas Menon, "Structural Analysis", Narosa Book Distributors Pvt Ltd, 2013.
2. S P Gupta and G S Pundit, "Theory of Structures", Vol. I & II, Tata McGraw Hill, 1999

REFERENCEBOOKS:

1. Wang C. K., "Intermediate Structural Analysis" Tata McGraw - Hill Education 2010.
2. Norris C. H, Wilbur J. B. and Utku. S., "Elementary Structural Analysis", Tata McGraw Hill, 1991.

3. Sujit Kumar Roy and Subrata Chakrabarty, "Fundamentals of Structural Analysis", S. Chand & Co., 2010.
4. S. B. Junnarkar and H. J. Shah, "Mechanics of Structures Vol. II", 20th Edition, Charotar Publishing House, 2008.
5. Reddy C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2015.
6. L. S. Negi and R. S. Angid, Structural Analysis, Tata McGraw Hill, 2003.
7. D S Prakash Rao, "Structural Analysis A Unified Approach", Universities Press (India) Ltd., 1996.

15CVL281 MATERIALS TESTING LAB. 0 0 2 1

1. Tension test on metals
2. Tensile test on thin wires – Mild steel and Copper
3. Compression test – Wood specimen and brick
4. Hardness test on Ferrous and non-ferrous material - Rockwell Hardness test - Brinell Hardness test
5. Double shear test on mild steel rods
6. Deflection test on beams
7. Impact test on metal specimens – Izod and Charpy
8. Flexural test on timber beams
9. Test on helical Spring - Open coiled and close coiled
10. Fatigue test on metals

15CVL282 SURVEY PRACTICE 1 0 2 2

1. Chain & Compass survey- Traversing and plotting of details
2. Plane table survey - two point & three point problems – traversing
3. Levelling - Plane of collimation & Rise and fall method
4. Levelling - Longitudinal & cross sectioning
5. Contour surveying
6. Theodolite surveying - Measurement of angles and traversing
7. Heights and distances by tacheometry and solution of triangles
8. (a) Total Station – Traversing and Area Calculation
(b) Area calculation using Planimeter.
9. Mapping using GPS
10. Study of Minor instruments
11. Study of modern survey instruments - Automatic levels, Electronic theodolite.

15CVL285 CONSTRUCTION MATERIALS LAB. 0 0 2 1

1. Tests on cement - Fineness, Normal consistency, Initial and Final Setting times, Specific gravity, Compressive strength, Soundness

2. Tests on fine aggregate - Grain size distribution – Uniformity coefficient and fineness modulus, Specific gravity, Density, Void ratio, Bulking & Absorption
3. Tests on coarse aggregate - Grain size distribution – Uniformity coefficient and fineness modulus, Specific gravity, Density, Void ratio, Absorption, Crushing & Impact values, Flakiness & Elongation, Los Angel's Abrasion test
4. Test on fresh and hardened concrete
 - (a) Workability test - Slump test, Compaction factor test, Flow table test, Vee-Bee Consistometer,
 - (b) Use of water reducing admixtures
 - (c) Compressive strength, Split tensile strength, Flexure test on beams, Modulus of elasticity
5. Tests on bricks – Crushing strength, water absorption and efflorescence
6. Basic tests on Bitumen.

15CVL286**HYDRAULIC ENGINEERING LAB.****0 0 2 1**

1. Study of instruments: pressure gauge - piezometer – manometer-pressure transducers - pitot tubes - current meter.
2. Verification of Bernoulli's equation.
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of Triangular Notch
6. Determination of friction factor of pipes
7. Impact of jet on vanes
8. Calibration of Venturimeter, Orificemeter, rotameter and watermeter
9. Determination of metacentric height
10. Performance test on Pelton wheel turbine and Francis turbine.
11. Efficiency test on centrifugal pump and reciprocating pump.
12. Open channel flow: Manning's coefficient, specific energy curve, Tracing back water profiles/draw down profiles, Hydraulic jump parameters

15CVL301**ADVANCED STRUCTURAL ANALYSIS****2 1 0 3****Unit 1**

Slope deflection method – application to the analysis of statically indeterminate beams with and without settlement of supports - rigid jointed plane frames with and without side sway - gable frames.

Analysis of continuous beams - theorem of three moments.

Sway and non-sway analysis by Moment distribution method and Kani's method.

Unit 2

Approximate Methods of Analysis of Multistoried Frames: Analysis for vertical loads – substitute frames - loading conditions for maximum moments in beams and columns – portal method and cantilever method for lateral load analysis.

Unit 3

Matrix methods of structural analysis - stiffness and flexibility matrices for elements and structure - analysis of continuous beams, simple rigid jointed frames and plane trusses by stiffness and flexibility method.

Introduction to FEM.

TEXTBOOKS:

1. Devdas Menon, "Structural Analysis", Narosa Book Distributors Pvt. Ltd, 2013.
2. Gupta S. P and G .S Pundit, "Theory of Structures", Vol. I & II, Tata McGraw Hill, 1999.

REFERENCE BOOKS:

1. Hibbeler, R. C., "Structural Analysis", Pearson, 2008.
2. Wang C. K., "Intermediate Structural Analysis" Tata McGraw - Hill Education 2010.
3. Norris C. H, Wilbur J. B. and Utku. S., "Elementary Structural Analysis", Tata McGraw Hill, 1991.
4. Sujit Kumar Roy and Subrata Chakrabarty, "Fundamentals of Structural Analysis" S. Chand & Co., 2010.
5. Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill, 2015.

15CVL302**DESIGN OF CONCRETE STRUCTURES****3 1 0 4****Unit 1**

Introduction to R. C structures – Review of basic material properties- Concrete and Reinforcing steel.

Design philosophies - Working stress method (WSM), Ultimate load method (ULM), Limit state method (LSM).

Design of Beams - singly and doubly reinforced rectangular and flanged sections. Serviceability requirements. Behaviour in Shear and Torsion; analysis and design with and without shear reinforcement.

Unit 2

Design for Bond: development length, splicing, curtailment.

Design of one-way slabs and two-way rectangular slabs (wall-supported) - as per IS 456: 2000.

Design of Compression Members: effective length, short columns subject to axial compression with and without uniaxial / biaxial eccentricities.

Unit 3

Introduction to slender columns. Design of isolated footing for axially loaded & eccentrically loaded columns, combined footing. Design of staircases.

Introduction to Prestressed concrete with simple examples.

TEXTBOOKS:

1. Pillai S. U. and Menon D, "Reinforced Concrete Design", Tata McGraw Hill, 2009.
2. M. L. Gambhir, "Design of Reinforced Concrete Structures", PHI learning, 2009.

REFERENCE BOOKS:

1. Park and Paulay, "Reinforced Concrete Structures", Wiley India (P) Ltd, 2010
2. Varghese P. C., "Limit State Design of Reinforced Concrete", PHI Learning, 2009.
3. P. Dayaratnam, "Design of Reinforced Concrete Structures", Oxford University Press, 2011.
4. Jain A. K., "Reinforced Concrete - Limit State Design", Nem Chand & Bros., 2009.
5. Sinha S. N., "Reinforced Concrete Design", Tata McGraw Hill, 2005.
6. BIS Codes (SP 23, SP 24, IS 456, IS 875, IS 10262, IS 800, SP 16, IS 883, IS 2750)
7. Arthur H Nilson, "Design of Concrete Structures", Tata McGraw-Hill Publications, 2005.

15CVL303

GEOTECHNICAL ENGINEERING

3 1 0 4

Unit 1

Shear strength of soils: Mohr – Coulomb Failure theories – Types of laboratory strength tests – strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction - shear strength of clays.

Soil Exploration: Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Plate load test – Pressure meter – Planning of programme and preparation of soil investigation report.

Unit 2

Shallow Foundations: Types - choice of foundation – Location of depth – Safe Bearing Capacity – Terzaghi, Meyerhof, Skempton and IS Methods.

Safe bearing pressure based on N-value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – allowable settlements of structures – Settlement Analysis.

Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile load tests - Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.

Well Foundations: Types – Components of well foundation – functions and design. Design Criteria – Sinking of wells – Tilts and shifts.

Unit 3

Earth Slope Stability: Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices, Bishop's Simplified method – Taylor's Stability Number.

Earth Pressure Theories: Rankine's theory of earth pressure – Earth pressure in layered soils – Coulomb's earth pressure theory – Culmann's graphical method.

Retaining Walls: Types of retaining walls – stability of retaining walls.

TEXTBOOKS:

1. Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd, 2004.
2. Venkataramaiah. C., "Geotechnical Engineering", New Age International Publishers, 2006.

REFERENCE BOOKS:

1. Varghese, P. C., "Foundation Engineering", PHI Learning, 2009.
2. Das, B. M., "Principles of Foundation Engineering", CL Engineering, 2013.
3. Bowles, J. E., "Foundation Analysis and Design", Tata McGraw Hill, 1996.
4. Swami Saran, "Analysis and Design of Substructures", Oxford and IBH Publishing Company Pvt Ltd, 2008 .
5. Teng, W. C, "Foundation Design", Prentice Hall, 1998.

15CVL311

DESIGN OF STEEL STRUCTURES

3 1 0 4

Unit 1

Introduction to structural steel sections, material property, geometric properties, classes of sections, stresses, residual temperature stresses in rolled steel sections, loads. Types of design - rigid, semi rigid. Limit state design method – basic concepts, partial safety factors, load combinations, deflection limitations as per IS:800.

Analysis and design of bolted and welded connections to resist direct force and moment.

Design of tension members - single and double angle ties.

Unit 2

Plastic behaviour of structural steel – shape factor – plastic hinge concept – collapse load – methods of plastic analysis – plastic design of beams and portal frames. Local buckling of plates – stiffened edges.

Compression members: Axially and eccentrically loaded compression members - built up columns - lacing and battens - design of column bases.

Analysis and design of laterally restrained & unrestrained simple & compound beams - Design for flexure, shear, deflection, and bearing.

Unit 3

Industrial roofs: Introduction to steel roof systems - various elements - loads - wind analysis – design of plane roof trusses – design of roofing elements and purlins – wind bracings - Gusset connections.

Introduction to cold-formed steel structures (Light gauge steel sections).

TEXTBOOKS:

1. Subramanian N, "Design of Steel Structures", Oxford University Press, 2008.
2. Duggal, S. K., "Limit State Design of Steel Structures", Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. Ramchandra and Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, 2010.
2. Dayaratnam P, "Design of Steel Structures", S. Chand & Co., 2003.
3. Arya and Ajmani, "Design of Steel Structures", Nem Chand Brothers, 2007.
4. BIS codes (IS 800-2007, IS 875-1987-Parts I, II, III, SP: 6 – Part 1 to 6).
3. Emil Smith and Robert Scanlan, "Wind Effects on Structures". Wiley-Interscience, 1986.
4. Edwin Gaylord, "Design of Steel Structure", Tata McGraw Hill Publishing Company Limited, 2010.

15CVL312

ENVIRONMENTAL ENGINEERING I

2 1 0 3

Unit 1

Water Supply Systems: Need for protected water supply - objectives of water supply system. Factors affecting per capita consumption, fire demand, fluctuations in rate of consumption - population forecasting - Design periods for water supply components.

Intake Works and Transportation: Intakes - types, location, requirements and features. Transportation of water - Types of conduits - relative merits, selection, joints, hydraulic design, and cross-connected parallel pipe to increase capacity - pipe laying and testing.

Quality and Analysis of Water: Impurities in raw water - causes - effects / significance - analysis - tests - Bacteriology of water, bacteriological analysis - Water borne diseases - Standards of water quality.

Unit 2

Treatment of Water – Conventional Treatment flow charts - Principles of coagulation, flocculation and sedimentation - Design principles of - Flash mixer –Design and drawing (Detailed sketch) of Flocculator and Sedimentation tank.

Filtration - Principles of Filtration - Classification. Constructional and operational features of slow sand filters and rapid sand filters - Design criteria. Design and drawing (Detailed sketch) of slow sand filters and rapid sand filters.

Disinfection - methods and disinfectants - Disinfection devices – Chlorination, other methods. Miscellaneous treatment methods - aeration, taste and odour control, iron and manganese removal, water softening, fluoridation and defluoridation and demineralization - Residue Management

Unit 3

Distribution of Water: Distribution network - Requirements of distribution system - Analysis by Hardy Cross method – Equivalent Pipe method – Computer application. Service reservoirs - functions, classification - Service reservoir design. Waste detection and prevention - Metered and unmetered water supplies. Necessity of pumping in water supply - classification and brief description of types of pumps - selection of pump - calculation of head, horsepower - economical diameter of pumping main.

Plumbing and Pumping: Drainage layout - plumbing components - traps and fittings - water seal - plumbing systems - choice - Principles governing drainage - plumbing design, IS Code provisions. Water supply of buildings - service connection to buildings.

TEXTBOOK:

Birdie G. S and Birdie J. S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2010.

REFERENCE BOOKS:

1. Garg S. K, "Environmental Engineering", Vol. I, Khanna Publishers, 2004 .
2. Duggal, K. N., "Elements of Environmental Engineering", S Chand & Co. Ltd., 2007.
2. Mark J. Hammer and Mark J. Hammer Jr., "Water and Waste Water Technology", Prentice Hall of India Pvt. Ltd., 2008.
3. Sawyer and McCarty, "Chemistry for Environmental Engineering", Tata McGraw-Hill, 2003.

15CVL313

TRANSPORTATION ENGINEERING I

2 1 0 3

Unit 1

Highway Engineering: Introduction to Transportation Systems and Study of System Characteristics; Salient features of first, second, third and fourth road development plans in India - planning surveys and master plan preparations.

Classification of Roads; Highway Planning; Geometrical Design – Road Cross Sections, Sight Distance and Applications, Super elevation, Horizontal and Vertical Alignment.

Unit 2

Pavement Materials, Design, Construction & Maintenance: Pavement Materials – Aggregate and Bitumen Characteristics and Testing, Bituminous Mix Design - Marshall Mix Design; Pavement Design – Design Elements and Loads. Design of flexible and rigid pavements – CBR method and guidelines of IRC method. Pavement Construction and maintenance– related equipment.

Unit 3

Traffic engineering and control: Introduction - Road user, vehicle and traffic characteristics - Speed and volume studies - Principles of design of at-grade intersections - Simple layouts - Objectives, classification and uses of traffic signs and road markings. Classification of transport technologies-intermodal co-ordination - ITS and automated highways.

TEXTBOOKS:

1. Khanna S K and Justo C E G., "Highway Engineering", Nem Chand and Bros, 2011.
2. Kadiyali, L. R., "Traffic Engineering and Transportation Planning", Khanna, Publishers, 2008.

REFERENCE BOOKS:

1. Papacostas, C S, and Prevedouros. P. D, "Transportation Engineering and Planning", Prentice Hall, 2009.
2. Chandola, S. P., "A Text Book of Transportation Engineering", S Chand & Co. Ltd., 2001.

15CVL314 WATER RESOURCES AND IRRIGATION ENGINEERING 3 1 0 4

Unit 1

Introduction - hydrologic cycle – catchment - stream patterns - description of the basin - hydrometeorology - constituents and vertical structure of atmosphere - general circulation - transitory systems - meteorological observations - formation of precipitation, types of precipitation, forms of precipitation, climate and weather seasons in India, rainfall variations, measurement, presentation of rainfall data, mean precipitation, abstractions from precipitation, evapotranspiration, runoff, hydrograph – concepts, assumptions and limitations of unit hydrograph. Ground water - aquifer types - flow of ground water – well hydraulics - types of wells - other sources of ground water. Irrigation - total planning concept - water requirements of crops - command area – duty-delta. Irrigation efficiency - irrigation requirement of crops.

Unit 2

Reservoir planning - site investigation - zones of storage - Reservoir yield - Estimation of Reservoir Capacity - Reservoir Sedimentation - Reservoir losses and control - Life of Reservoir.

Diversion headworks - Types of diversion works - location of canal headworks - components of headworks - weir and barrages – causes of failure of weirs on permeable foundation and their remedies - criteria for the design of weirs and barrages – Design of impervious floor for subsurface flow - Bligh's creep theory – Khosla's theory design procedure.

Dams - Types of dams and their selection - Gravity dam, arch dam, buttress dam, earth dams. Gravity dam - analysis and design. Spillways - Different types and suitability – Energy dissipation structures below spillway.

Unit 3

Canal Regulation structures - intake structures, canal falls - canal regulators - canal escapes - Tank irrigation - Surplussing arrangements in minor irrigation tanks - Metering flumes - canal outlets – outlet works through dams and river intakes - cross drainage works-types and selection of type of cross drainage works.

Design and detailing of surplus weir, canal regulator and canal drop.

TEXTBOOKS

1. Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, 2006.
2. P. N Modi, Irrigation, Water Resources, and Water power Engineering, Standard Book House, 2014.

REFERENCES:

1. Linsley. R. K.et.al., Water Resources Engineering, McGraw-Hill International Edition, 1996.
2. Ven Te Chow et.al, Applied Hydrology, McGraw Hill Book Co, New York, 1988.
3. K. Subramanya, Engineering Hydrology, Tata McGraw - hill publishers, New Delhi, 2008.
4. Mays. L. W. Water Resources Handbook, McGraw – Hill International Edition, 1996
5. Singh V. P, Elementary hydrology, Prentice Hall, Englewood Cliffs, New Jersey, 1992.

15CVL381

BUILDING DRAWING

1 0 2 2

Part A

Detailed drawing of components

- Footings
- Roof trusses
- Reinforced Concrete staircase

From given line sketch and specification, develop working drawings of:

- Single storied residential building with flat and tiled roof
- Public buildings like office, dispensary, post office, bank etc.
- Factory building with trusses

Part B (Computer aided drafting)

Preparation of drawings as per building development rules.

- Residential building- flat and pitched roof, economic domestic units, cottages, bungalows
- Public building – small public utility shelters, dispensaries, banks, schools, offices, libraries, hostels, restaurants, commercial complexes, factories etc.
- Preparation of site plans and service plans as per Building Rules.

TEXTBOOKS:

1. Balagopal T S Prabhu, "Building Design and Civil Engineering Drawing", Spades Publishers, 2008.
2. Shaw, Kale and Patki, "Building Drawing", Tata McGraw Hill, 2009.

REFERENCE BOOKS:

1. SP 7: 2005, National Building Code of India.
2. G. Muthu Shoba Mohan, "Principles of Architecture", Oxford University Press, 2006.
3. Crosbie, M. J. And Callender, J. H., "Time-Saver Standards for Architectural Design Data", McGraw Hill, 1997.
4. Sham Tickoo, "Autodesk Revit architecture 2010 for architects and building designers", Dreamtech Press, 2010.

15CVL382 GEOTECHNICAL ENGINEERING LAB. 0 0 2 1

1. Specific gravity of coarse and fine-grained soils
2. Grain size analysis
3. Atterberg's limits and indices
4. Determination of field density (a) sand replacement method (b) core cutter method
5. Determination of coefficient of permeability (a) Constant head method; (b) Variable head method
6. Consolidation test
7. Compaction test (a) IS light compaction test (b) IS heavy compaction test
8. California Bearing Ratio test
9. Direct shear test
10. Triaxial shear test
11. Unconfined compressive strength test & Laboratory vane shear test
12. Demonstration of Plate Load & Standard Penetration Tests

15CVL385 ENVIRONMENTAL ENGINEERING LAB. 0 0 2 1

1. Determination of solids (total, dissolved, organic, inorganic and settleable) in water
2. Determination of turbidity and the optimum coagulant dose
3. Determination of alkalinity and pH of water

4. Determination of hardness and chlorides in water
5. Determination of iron and manganese in water
6. Determination of sulphates and sulphides in water
7. Determination of D.O
8. Determination of available chlorine in bleaching powder and the chlorine dose required to treat the given water sample
9. Determination of coliforms in water
10. Determination of B.O.D and C.O.D

REFERENCES:

Standard method for the examination of water and waste water, 2005, APHA, AWWA, WPCF Publication.

15CVL386 ESTIMATION AND VALUATION PRACTICE 1 0 2 2

1. Introduction - Types of estimate - plinth area method - cubic rate method - unit rate method - bay method - approximate quantity from bill method - comparison method - cost from materials and labour - preparation of detailed estimate
2. Preparation of detailed estimate using Centre line method
3. Preparation of detailed estimate using Long wall - short wall method
4. Preparation of detailed estimate for R.C.C Structures.
5. Preparation of detailed estimate for Steel Structures.
6. Preparation of detailed estimate for roads
7. Preparation of detailed estimate for sanitary and water supply works
8. Specifications - Detailed specifications for common building materials and items of work as per I.S specifications - Preparation of conveyance statement - Calculation of quantities of materials for items of work - Analysis of rate for items of works required for civil engineering works - Preparation of abstract of estimate of civil engineering works.
9. Valuation - types of values – concept of time - value of money - sinking fund - years purchase - Depreciation - obsolescence - valuation of real property - valuation of land - lease and lease hold property.

TEXTBOOKS:

1. Chakraborti, M., "Estimation, Costing, Specification and Valuation in Civil Engg", Chakraborti, 2008.
2. B. N. Dutta "Estimating & Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributors Limited, 2008.

REFERENCE BOOKS:

1. Kohli, D. D and Kohli, R. C, "A text book of Estimating and Costing (Civil)", S. Chand & Company Ltd., 2004.
2. IS: 1200 – 1974 – Parts 1 to 25, Methods of Measurement of Building and Civil Engineering Works, Bureau of Indian Standards, New Delhi.
3. Standard Data Books of Central Public Works Departments and Public Work Department of States.

15CVL390 / 15CVL490**LIVE-IN-LAB.****3 cr**

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester or sixth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth or seventh semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

15CVL401**CONSTRUCTION MANAGEMENT****3 1 0 4****Unit 1**

Construction management environment - Construction activities and sequence.

Construction planning - Network scheduling - Bar chart, linked bar chart, work-breakdown structures, activity-on-arrow diagrams - event based networks. Critical path method. PERT network analysis.

Unit 2

Network compression - Time-cost study. Resource management. Introduction to Precedence networks.

Construction procedure – contracts – types – bidding process – contract conditions - specifications – quality management principles.

Construction safety and Engineering ethics.

Unit 3

Materials management - inventory control.

Transportation model and application for distribution of materials.

Construction equipment - selection factors - planning of equipment – equipment for excavation, transport, hoisting, piling, and concrete construction.

Introduction to project management softwares.

TEXTBOOKS:

1. Kumar Neeraj Jha, "Construction Project Management", Pearson Education, 2011.

2. R. L. Peurifoy and Schexnayder, "Construction Planning, Equipment, and Methods", Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. Gahlot, P. S. and Dhir, B. M., "Construction Planning and Management", New Age International, 2012.
2. Jerome D. Wiest, Ferdinand K. Levy, "A Management guide to PERT / CPM", PHI Learning, 2009.
3. L. S. Srinath, "PERT and CPM-Principles and Applications", Affiliated to East West Press, 2001.
4. Shrivastava. U. K., 'Construction Planning and Management', Galgotia Publications Pvt. Ltd, New Delhi, 2013.
5. Chitkara, K. K. "Construction Project Management - Planning, Scheduling and Control", Tata McGraw-Hill Publishing Co., 2010.

15CVL402**ENVIRONMENTAL ENGINEERING II****2 1 0 3****Unit 1**

Domestic Waste Water System: Importance and scope of sanitary engineering – Sewerage system – classification– relative merits and situations for adoption. Sources of wastewater – Quantity - fluctuations in flow and their significance. Storm runoff estimation. Factors affecting storm water drainage – empirical and rational methods – time of concentration.

Waste Water Pipe Hydraulics: Hydraulics of waste water flow – Hydraulic element charts – Design Criteria – construction procedure – Testing and maintenance – Shapes and materials of sewers – Sewer appurtenances – Design of storm water line – surface drains for storm water.

Characteristics: Wastewater characteristics and significance – Decomposition – cycles of decomposition – Dissolved oxygen – Biochemical Oxygen Demand – Formulation – Test for 5 day BOD – significance and limitations – Relative stability – Sewage sampling – population equivalent of industrial effluents – Effluent disposal standards.

Unit 2

Waste Water Treatment – Primary Treatments: Objectives – Selection of unit operation and process – Principle and Design of Preliminary Treatments: Screens, skimming tank – types, grease traps – grit chamber - proportional flow weir – Principle and Design of Primary Treatments settling tanks – Types – Design of sedimentation tanks.

Secondary Treatment Processes: Biological process – object, principles of action – Suspended culture systems – Attached culture systems – Activated sludge process and its types – Design of conventional activated sludge process –

Oxidation / stabilization ponds – aerobic and facultative ponds, Trickling Filters (conventional and high rate) .

Sludge characteristics – Weight volume relationship, sludge conditioning, dewatering, sludge digestion – process and parameters. Design and Drawing (Detailed sketch) of Septic Tank, IS Code provisions – Methods of septic tank effluent disposal – Testing soil permeability for determination of area.

Unit 3

Disposal of Waste Water: Disposal on water – conditions favoring – standards and criteria for dilution – pollution and self-purification of streams – oxygen sag curve and stages of self-purification – Disposal on land – criteria methods of broad irrigation – subsurface irrigation – sewage sickness of soil.

Solid Waste Management: Solid waste management – causes, effects and control measures of urban and industrial wastes.

Sustainable Development: Sustainable development – Environmental Protection Acts – Introduction to EIA and ISO 14000.

TEXTBOOK:

Birdie G. S and Birdie J. S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2010.

REFERENCE BOOKS:

1. Garg S. K, "Environmental Engineering", Vol. II, Khanna Publishers, 2004.
2. Duggal, K. N., "Elements of Environmental Engineering", S Chand & Co. Ltd., 2007.
3. Mark J. Hammer and Mark J. Hammer Jr., "Water and Waste Water Technology", Prentice Hall of India Pvt. Ltd., 2008.
4. Metcalf and Eddy, "Waste Water Engineering Treatment, Disposal & Reuse", Tata McGraw Hill, 2003.

15CVL403 TRANSPORTATION ENGINEERING II 2 1 0 3

Unit 1

Railway Engineering: Components and Geometrical Design of Railways – Horizontal Curves, Radius, Super elevation, Cant Deficiency, Transitional Curves, Different types of Gradients, Grade Compensation, Points and Crossings and their Design; Signaling & Interlocking; Layout of Railway Station and Yards.

Unit 2

Tunnel Engineering: Tunnel Alignment and Grade, Size and Shape of Tunnels, Tunneling methods in Soft Soils and Hard Rocks – Modern methods and equipment for tunneling; Ventilation of Tunnels; Lining of Tunnels.

Airport Engineering: Location and Spacing of Airports; Geometrical Design Considerations – Taxiways, Runways and Aprons; Runway Orientation – Wind rose Diagram; Terminal Area Planning, Airport Drainage.

Unit 3

Docks and Harbour Engineering: Definition of Terms; Basic Planning Principles; General Layout and Basic Operational Aspects, Requirements and Classification of Harbours, Ports and Docks; Navigational Facilities; Inland Water Transport.

TEXTBOOKS:

1. Satish Chandra and M. M Agarwal, "Railway Engineering", Oxford university Press, 2009.
2. Rangwala, "Airport Engineering", Charotar Publishing House, 2011.

REFERENCE BOOKS:

1. Arora and Saxena, "Railway Engineering", Dhanpat Rai Publications, 2011.
2. R Srinivasan, "Harbour, Dock and Tunnel Engineering", Charotar Publishing House, 2012.
3. Dr. S. Seetharaman, "Tunnel and Airport Engineering", Umesh Publications, 2012.
4. Khanna S K, Arora, M G and Jain S S., "Airport Planning and Design", Nem Chand and Bros, 2009.
5. Chandola, S. P., "A Text Book of Transportation Engineering", S. Chand & Co., 2001.
6. Subramanian, K. P., "Highway, Railway, Airport and Harbour Engineering, Scitech Publications, 2010.
7. Oza, H. P and Oza, G. H., "Dock and Harbour Engineering", Charotar Book House, 2011.

15CVL430 ADVANCED CONCRETE DESIGN 2 1 0 3

Unit 1

Yield line theory for slabs - Basic principles - methods of yield line analysis.

Deep beams - analysis - design as per BIS - design using strut and tie method.

Chimneys: Analysis of stresses in concrete chimneys - uncracked and cracked sections - codal provisions - design of chimney.

Unit 2

Large span concrete roofs: Introduction – classification - behaviour of flat slabs - direct design and equivalent frame method - codal provisions - waffle slabs.

Shells and Folded plates: Forms of shells and folded plates - structural behaviour of cylindrical shell and folded plate - method of analysis - membrane analysis – beam arch approximation - codal provisions - design of simply supported circular cylindrical long shells and folded plates.

Unit 3

Bridges: General – IRC Bridge code – loading standards – impact effect – wind load – longitudinal forces – centrifugal forces – force due to water currents – buoyancy effect – temperature effects – secondary stresses – erection – seismic force.

Design of slab culvert – R.C box culverts – T-beam bridges – Concept on design of continuous bridges, balanced cantilever bridges, arch bridges and rigid frame bridges.

TEXTBOOKS:

1. N. Krishnaraju, "Advanced Reinforced Concrete Design", CBS Publisher, 2013.
2. M. L. Gambhir, "Design of Reinforced Concrete Structures", PHI Learning, 2009.

REFERENCE BOOKS:

1. Varghese P.C., "Advanced Reinforced Concrete Design", PHI, 2009.
2. Jaikrishna, "Plain & Reinforced Concrete - Vol. I & II", Nem Chand & Bros., 2008.
3. Purushothaman. P, "Reinforced Concrete Structural Elements", Tata McGraw Hill, 1984.
4. G. S. Ramaswamy, "Design and Construction of Concrete Shell Roofs", CBS Publishers, 2005.
5. Ashok K Jain, "Reinforced Concrete – Limit State Design", Nem Chand & Bros., 2012.
6. Pillai S.U and Menon D, "Reinforced Concrete Design" Tata McGraw Hill, 2009.
7. Nilson. A. H., "Design of Concrete Structures", Tata McGraw Hill, 2005.
8. BIS codes (IS 456, IS 2210, IS 4998, IS 3370, SP 16, SP 24, SP 34).
9. IRC Codes (IRC 5, IRC 6, IRC 21)

15CVL431 ADVANCED MECHANICS OF MATERIALS 2 1 0 3**Unit 1**

Stress at a point – stress on an arbitrarily oriented plane - stress transformations - strain theory – principal stresses & strains (2D & 3D) - Generalized Hooke's law - Equations of thermo-elasticity for isotropic materials - strain energy density - stress concentration.

Failure & Failure criteria: Modes of failure – yield failure criteria - introduction to fracture mechanics - cracks & brittle fracture – fatigue - elastic and inelastic buckling.

Unit 2

Beams on elastic foundation: Basic equations - Winkler foundations - semi-infinite beams with concentrated loads – infinite beams with concentrated loads - uniformly distributed load - beams of finite length.

Curved Beams: Circumferential stresses - radial stress and shear stress in curved beams - sections having thinflanges - closed sections with thin walls - deflections of sharply curved beams.

Unit 3

Displacements - strains and compatibility - equilibrium equations and boundary conditions – stressfield solutions for plane stress problems - polynomial solutions in Cartesian coordinates – displacements calculated from stresses - plane stress problems in polar coordinates.

TEXTBOOK:

1. A. P. Boresi and O. M. Sidebottom, "Advanced Mechanics of Materials", Wiley, 2009.
2. Budynas, R. G., "Advanced Strength and Applied Stress Analysis", Tata McGraw Hill, 2011.

REFERENCE BOOKS:

1. Timoshenko S. P and Goodier J. N, "Theory of Elasticity", Tata McGraw Hill, 2010.
2. Srinath L. S, "Advanced Mechanics of Solids", Tata McGraw Hill, 2008.
3. S P Timoshenko, "Strength of Materials - Part 2" CBS Publishers & Distributors; Third edition, 1956.
4. R. D. Cook and W. C. Young, "Advanced Mechanics of Materials", Prentice Hall, 1999.

15CVL432 ADVANCED STEEL DESIGN 2 1 0 3**Unit 1**

Gantry Girder - Design of gantry girder – gantry to column connection.

Water Tanks - Design of rectangular, pressed steel tanks – design of suspended bottom tanks – cylindrical tank with hemispherical bottom – design of staging.

Chimneys - Design of self-supporting chimney – design principles of guyed chimney.

Bunkers, Silos – Introduction – Janssen's theory – Airy's theory – design criteria.

Unit 2

Transmission Towers – Introduction – loads on towers – analysis – design of members and foundation.

Light gauge members – Light gauge sections – design considerations – allowable stresses – buckling, design of compression members, tension members and laterally supported beams – connections.

Unit 3

Plate girder bridges - Plate girders – loads – equivalent uniformly distributed loads – Indian railway code of practice – design of plate girder bridges – bearings.

REFERENCE BOOKS:

1. Duggal, S. K., "Limit State Design of Steel Structures", Tata McGraw Hill, 2010.
2. Ramchandra and Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, 2010.
3. N. Subramanian, "Design of Steel Structures", Oxford University Press, 2008.
4. G. W. Owens and P. R. Knowles, "Steel Designers' Manual", John Wiley & Sons, 2012
5. P. Dayaratnam, "Design of Steel Structures", S. Chand & Co., 2003.
6. M. Raghupathi, "Design of Steel Structures", Tata McGraw Hill, 1985.
7. Murthy and Santhakumar, "Transmission Line Structures", McGraw Hill, 1990.
8. Lin and Breslar, "Design of Steel Structures", John Wiley & Sons, 1968.
9. BIS codes (IS 800, SP 6, IS 804, IS 805, IS 6533, IS 9178, IS 801, IS 811)

15CVL433**BRIDGE ENGINEERING****2 1 0 3****Unit 1**

Investigations for culverts and minor bridges, Investigations for major bridges - topography, catchment, hydrology, geotechnical aspects, construction resources - design flood discharge - methods, linear waterway. choice of foundation for piers and abutments - types - cost ratio - clearance - choice of foundation - open, pile, well, block foundations - relative suitability. setting out for piers and abutments for minor and major bridges. classification of culverts and bridges - components of bridge structures - loading standards - railway and road loading standards. Types of foundations.

Unit 2

Piers and abutments - function, aesthetics, materials; wing walls - construction aspects. super structure - types - choice of materials - design principles, considerations and criteria of pipe culverts, slab culvert, box culvert, causeways.

Design of T beam and slab bridge - design principles of RC balanced cantilever bridge and articulation. Design concepts of rigid frame bridges - thumb rule design of masonry arch bridges - design of bowstring girder bridge and components.

Unit 3

Suspension bridges, cable stayed bridges and their components; bearings - types - design of rocker and roller bearings.

Bridge superstructure construction - supports and centering for RC bridges - erection of precast RC girders and steel girder bridges - maintenance of bridges, strengthening of masonry arch bridges.

TEXTBOOKS:

1. D. Johnson Victor, "Essentials of bridge engineering", Oxford University Press, 2008.
2. N. Krishna Raju, "Design of bridges", Oxford University Press, 2008.

REFERENCE BOOKS:

1. E. J. O'Brien and D. L. Keogh, "Bridge deck analysis", Spon's Architecture, 1999.
2. Raina, V. K. "Concrete Bridge Practice", Shroff Pub & Dist. Pvt. Ltd, 2007.
3. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill Education, 2007.
4. Relevant Codes of Practice

15CVL434 COMPUTER METHODS OF STRUCTURAL ANALYSIS 2 1 0 3**Unit 1**

Force and Displacement measurement - generalized or independent measurements - constrained or dependent measurements - n dimensional space - principle of superposition - methods of structural analysis. Structure with single and two coordinates - flexibility and stiffness matrices in n coordinates – examples - symmetric nature - constrained measurements - stiffness and flexibility matrices of the element as well as the system - computing the influence coefficient.

Strain energy in terms of stiffness and flexibility matrices - interpretation of coefficient - Betti's law - other energy theorems using matrix notation.

Unit 2

Flexibility and Stiffness Methods (Element Approach): Choice of redundant - ill and well condition equation - Transformation Matrices - transformation of one set redundant to other set - thermal expansion - lack of fit – application to pin-jointed plane truss - continuous beams, frames and grids.

Development of stiffness method - analogy between flexibility and stiffness - analysis due to thermal expansion, lack of fit - Stiffness matrix with rigid body motion - application to pin jointed plane and space trusses - continuous beams - frames and grids - static condensation techniques. Problem solving by computer - choice of the method.

Unit 3

Introduction to Finite Element Method: Basic concepts - Rayleigh-Ritz Method - Finite difference method – Variational principles - MWR (theory only) - Steps in finite element method - Axial element force formulation by displacement method only - Theory of stress model - Displacement model - Hybrid models.

Analysis and Design of Pin-jointed and Rigid-jointed Framed Structures using STADD pro (2D and 3D), Introduction to SAP, ETABS, ABAQUS.

TEXTBOOKS:

1. Rajasekaran S, Sankara Subramanian G, "Computational Structural Mechanics", Prentice-Hall of India Pvt, 2006.

2. Krishnamoorthy C. S., Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 1991.

REFERENCE BOOKS:

1. Wang. C. K., "Intermediate Structural Analysis", Tata McGraw Hill, 1983.
2. Timoshenko and Young, "Theory of Structures", McGraw Hill, 1965.
3. Kanchi. M. B., "Matrix Methods of Structural Analysis", New Age International, 1993.
4. Reddy. J. N., "An introduction to finite element method", Tata McGraw Hill, 2005.

15CVL435**FINITE ELEMENT METHODS****2 1 0 3****Unit 1**

Boundary value problems and the need for numerical discretization: Introduction, examples of continuum problems, history of finite element method.

Weighted residual methods: Approximation by trial functions, weighted residual forms, piecewise trial functions, weak formulation, Galerkin method, examples of one-, two- and three-dimensional problems.

Variational methods: Variational principles, establishment of natural variational principles, approximate solution of differential equations by Rayleigh-Ritz method, the use of Lagrange multipliers, general variational principles, penalty functions, least-square method.

Unit 2

Isoparametric formulation: The concept of mapping, isoparametric formulation, numerical integration, mapping and its use in mesh generation.

Higher order finite element approximation: Degree of polynomial in trial functions and rate of convergence, the patch test, shape functions for C0 and C1 continuity, one-, two- and three-dimensional shape functions.

Unit 3

Coordinate Transformation: Transformation of vectors and tensors, transformation of stiffness matrices, degree of freedom within elements, condensation, condensation and recovery algorithm, substructuring, structural symmetry.

Formulation of stiffness matrix, member approach for truss and beam element, node numbering, assembly of element equations, formation of overall banded matrix equation, boundary conditions and solution for primary unknowns, Equilibrium and compatibility in solution- applications to truss and beam.

TEXTBOOKS:

1. Rao, S. S., "Finite Element Method in Engineering", Elsevier, 2011.

2. Reddy, J. N., "An Introduction to the Finite Element Method", Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. Bathe K. J., "Finite Element Procedures in Engineering Analysis", Prentice Hall of India, 1996.
2. Cook R. D., Malkus D. S., Plesha M. F., and Witt R. J., "Concepts & Applications of Finite Element Analysis", Wiley India, 2007.
3. Chandrupatla T. R. and Belegundu A. D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 2007.
4. Zienkiewics O. C., Taylor R. L. and Zhu, J. Z., "The Finite Element Method: Its Basis and Fundamentals", Butterworth-Heinemann, 2005.

15CVL436**INDUSTRIAL STRUCTURES****2 1 0 3****Unit 1**

Functional design of industrial buildings:

Classification of industrial structures - layout planning requirements – Guidelines from factories act – Lighting - Illumination levels – Natural / Mechanical ventilation – Fire safety requirements – Corrosion protection – Protection against noise – Cladding systems - vibration isolation techniques - Industrial floors.

General overview of Thermal power plant / Nuclear power plant structures / Process plant steelwork – conveyor structures – Boiler supporting structures - Substation structures.

Unit 2

Braced Industrial buildings – Unbraced Industrial frames – Gantry girders – Design of steel beam connections - Flexible & Rigid (Bolted and welded types).

Machine foundations – Types - Design Requirements - Analysis and design of block type machine foundations (IS 2974 method).

Unit 3

Design of Reinforced concrete bunkers and silos as per IS:4995

Tall Chimneys (RCC) – Types - Chimney sizing parameters - Overview of wind and temperature effects - Design principles of Reinforced concrete chimneys as per IS:4998.

Cooling Towers – Types and functions - Design principles of RC natural draught cooling towers as per IS:11504.

REFERENCE BOOKS:

1. S. N. Manohar, "Tall Chimneys: Design and Construction", Tata McGraw Hill, 1985.
2. P. Dayaratnam, "Design of Steel Structures", S. Chand & Co., 2003.

3. Ramchandra and Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, 2010.
4. P. Srinivasulu and G. V. Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 2004.
5. SP: 32-1986, "Hand Book on Functional Requirements of Industrial Buildings (Lighting and ventilation)".
6. G. W. Owens and P. R. Knowles, "Steel Designers' Manual", John Wiley & Sons, 2012.
7. V. Kalayanaraman (editor), "Advances in Steel Structures", Tata McGraw Hill, 1990.
8. Krishnaraju N., "Advanced Reinforced Concrete Design", CBS Publishers, 2013.
9. K. K. McKelvey and Maxey Brooke, "The Industrial Cooling Tower", Elsevier Publishing Co., 1959.

15CVL437 SMART MATERIALS AND STRUCTURES 2 1 0 3

Unit 1

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self-diagnosis – Signal processing consideration – Actuation systems and effectors.

Measuring techniques: Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

Unit 2

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques.

Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

Unit 3

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro rheological fluids – Electromagnetic actuation – Role of actuators and Actuator Materials.

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.

REFERENCE BOOKS:

1. Srinivasan, A. V. and Michael McFarland, D., "Smart Structures: Analysis and Design", Cambridge University Press, 2009.

2. Michelle Addington and Daniel L. Schodek, "Smart Materials and Technologies: For the Architecture and Design Professions", Routledge 2004.
3. Brain Culshaw, "Smart Structure and Materials", Artech House – Borton. London, 1996.
4. L. S. Srinath, "Experimental Stress Analysis", Tata McGraw-Hill, 1998.
5. J. W. Dally and W. F. Riley, "Experimental Stress Analysis", Tata McGraw-Hill, 1998.

15CVL438 STRUCTURAL DYNAMICS AND SEISMIC DESIGN 2 1 0 3

Unit 1

Introduction to structural dynamics – importance of structural dynamics - types and sources of dynamic loads - distinguishing features of a dynamic problem – methodology for dynamic analysis – types of structural vibration - basic terminology.

Single Degree of Freedom: Linear systems: Equation of motion - components of vibration system - natural frequency - viscous damping - response to undamped and damped free and forced vibration - response to support motion – principle of accelerometers and displacement meters.

Unit 2

Two Degrees of Freedom: Equations of motion - Eigen value problem - free vibration response – forced vibration response to harmonic excitation - response to support motion - modal analysis.

Earthquake Resistant Design: Elements of Engineering Seismology - Indian Seismicity – faults – seismic waves – earthquake intensity and magnitude – earthquake ground motion - behaviour of structures in the past Earthquakes – basic terminology.

Earthquake Response: Linear systems: Earthquake ground motion – response spectrum - response history analysis

Unit 3

IS codal provisions for the determination of lateral loads – modal analysis. Soil liquefaction – soil-structure interaction effects.

Design Concepts: Seismic Design Concepts - design spectrum - Earthquake Resistant Design of simple framed structures – IS:1893 codal provisions - ductile detailing of Reinforced Concrete frames as per IS:13920.

TEXTBOOKS:

1. Mario Paz, "Structural Dynamics", Springer, 2007.
2. Pankaj Agarwal, Manish Shrikhande, "Earthquake Resistant Design of Structures", PHI Learning, 2009.

REFERENCE BOOKS:

1. Anil K Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, 2008.
2. Duggal.S. K., "Earthquake Resistant Design of Structures", Oxford University Press, 2013.
3. IS:1893 - (Part I), Criteria for Earthquake Resistant structures - General Provisions and Buildings
4. IS:13935 – Repair and Seismic strengthening of buildings
5. IS:4326 - Earthquake Resistant Design and Constructions of buildings
6. IS:13920 – Ductile detailing of RC Structures subject to Seismic forces

15CVL440**ADVANCED SURVEYING****2 1 0 3****Unit 1**

Field astronomy - definitions - solution of an astronomical triangle - co-ordinate systems - time - solar, sidereal and standard equation of time - sundial - determination of time, azimuth, latitude and longitude. Map Projection: introduction - methods of projection.

Unit 2

Electronic distance measurement – principle – reduction of E.D.M lines - geodimeter – tellurimeter - total station – global positioning system.

Photogrammetry – terrestrial and aerial photogrammetry – heights and distances from photographs – flight planning – elements of stereoscopy – photo mosaic – photo interpretation – applications of photogrammetry.

Unit 3

Remote sensing – introduction – electromagnetic radiation – target interactions – remote sensing systems – remote sensing from space – applications of remote sensing.

TEXTBOOKS:

1. Agor, R. A, "Textbook of Advanced Surveying", Khanna Publishers, 2002.
2. Punmia. B. C., "Higher Surveying", Laxmi Publications, 2006.

REFERENCE BOOKS:

1. Joshi M. D. and Jawaharlal Sharma, "Text Book of Advanced Surveying", CBS Publishers, 1985.
2. Arora K. R., "Surveying – Vol. III", Standard Publishers, 1993
3. Ram Pal K. K. "Text Book of Photogrammetry", Oxford & IBH Publishers, 1982.
4. Duggal, S. K, "Surveying Vol.II", McGraw Hill Education, 2013.

15CVL441**ARCHITECTURAL SCIENCE****2 1 0 3****Unit 1**

Principles of architectural design: Factors influencing architectural development – characteristic features of style – historic examples – creative principles. Principles

of architectural composition – Unity – balance – proportion – scale – rhythm – harmony – Accentuation and contrast.

Organising principles in architecture – Symmetry – hierarchy – axis – linear – concentric, radial – and asymmetric grouping – primary and secondary masses. Role of colour, texture, shapes/ forms in architecture.

Architectural space and mass, visual and emotional effects of geometric forms; activity space and tolerance space. Forms related to materials and structural systems. Architecture as part of the environment.

Unit 2

The Thermal Environment: Climatic elements: climate graph – comparison and classification of climates. Earth's thermal balance. Thermal balance of human body – thermal comfort indices – comfort zone.

Thermo physical properties of building materials: resistance and transmittance – sol- air temperature - solar gain factor. Heat flow through buildings – thermal transmittance of structural elements - periodic heat flow.

Design criteria for control of climate – passive and active building design – passive approach. Active systems – low energy cooling.

Unit 3

The Luminous Environment: Types of visual tasks – principles of day lighting – evaluation of lighting by windows, skylights – artificial lighting – illumination requirements – lamps and luminaries – coefficient of utilisation – flood lighting of building exteriors.

The Sonic Environment: Physics of sound – airborne and structure borne propagation – behavior of sound in free field and enclosures – design criteria for spaces – acoustical defects – sound reduction, sound insulation and reverberation control.

TEXTBOOKS:

1. Francis D. K. Ching., "Architecture – Form, Space and Order", John Wiley & Sons, Inc., 2007
2. Steven V. Szokolay., "Introduction to Architectural Science - The Basis of Sustainable Design", Elsevier, 2007.

REFERENCE BOOKS:

1. Muthu Shobha Mohan, "Principles of architecture", Oxford University Press, 2006.
2. Koenigseberger, "Manual of Tropical housing and Building – Climatic Design", Universities Press, 2010.
3. Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987
4. Narasimham V., "An Introduction to Building Physics", Kabeer Printing Works, Chennai, 1974.
5. Krishnan, "Climate Responsive Architecture", Tata McGraw Hill, 1999.

15CVL442**CONCRETE TECHNOLOGY****2 1 0 3****Unit 1**

Materials: cement - different types - chemical composition and physical properties - tests on cement - I.S. specifications - aggregates - classification - mechanical properties and tests as per I.S. - alkali aggregate reaction - grading requirements - heavy weight - light weight - normal weight - aggregate - sampling of aggregate - water - quality of water - admixtures - accelerators - retarders - water reducing agents – super plasticizers- use of silica fumes.

Properties of fresh concrete - workability - factors affecting workability - tests for workability - segregation and bleeding.

Unit 2

Properties of hardened concrete - factors affecting strength of concrete - strength of concrete in compression, tension and flexure - stress- strain characteristics and elastic properties - shrinkage and creep - durability of concrete - permeability - chemical attack - sulphate attack - resistance to abrasion and cavitation - resistance to freezing and thawing - resistance to fire - marine atmosphere - quality control - frequency of sampling - test specimens - statistical analysis of test results - standard deviation - acceptance criteria.

Manufacture of concrete - measurement of materials - storage and handling - batching plant and equipment - mixing - types of mixers - transportation of concrete - pumping of concrete - placing of concrete - under water concreting - compaction of concrete - curing of concrete - ready mix concrete.

Unit 3

Mix proportioning - nominal mixes - design mixes - factors influencing mix design - A.C.I method - I.S method - design for high strength mixes. Special concretes - lightweight concrete - high density concrete - vacuum concrete - shotcrete - Fibre reinforced concrete - polymer concrete - ferrocement - high performance concrete - self compacting concrete.

Introduction to Non-destructive test methods.

TEXTBOOKS:

1. Neville. A. M. and Brooks. J. J., "Concrete Technology", Pearson Education, 2004
2. Santha Kumar, A. R., "Concrete Technology", Oxford University Press, 2006.

REFERENCE BOOKS:

1. Mehta, P. K. And Monteiro, P. J. M., "Concrete - Microstructure, Properties and Materials", Tata McGraw Hill Edition, 2006.
2. Shetty, M. S., "Concrete Technology -Theory and Practice", S. Chand & Co., New Delhi, 2009.
3. A. M. Neville, "Properties of Concrete", Pearson Education, 2008.

15CVL443**CONSTRUCTION ECONOMICS AND FINANCE****2 1 0 3****Unit 1**

Engineering economics: Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence - Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A, A/P), Future payment compared to uniform series payments (F/A, A/F), Arithmetic gradient, Geometric gradient.

Unit 2

Comparison of alternatives: Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.

Depreciation, Inflation and Taxes.

Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

Unit 3

Cost estimating: Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost.

Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

TEXTBOOKS:

1. Bose, D. C., "Fundamentals of Financial management", 2nd ed., PHI, New Delhi, 2010.
2. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", Tata McGraw - Hill Education, 2009

REFERENCE BOOKS:

1. Gould, F. E., "Managing the Construction Process", 4th ed., Pearson Education, 2012.
2. Harris, F., McCaffer, R. and Edum-Fotwe, F., "Modern Construction Management", 6th ed., Wiley India, New Delhi, 2006.
3. Jha, K. N., "Construction Project Management, Theory and Practice", Pearson, New Delhi, 2011.
4. Peurifoy, R. L. and Oberlender, G. D., "Estimating Construction Costs", 5th ed., Tata McGraw-Hill, New Delhi, 2004.

15CVL444 DISTRESS MONITORING AND REPAIR OF STRUCTURES 2 1 0 3

Unit 1

Durability: Life expectancy of different types of buildings – influence of environmental elements such as heat, moisture, precipitation and frost on buildings- Effect of biological agents like fungus, moss, plants, trees, algae - termite control and prevention - chemical attack and impact of pollution on building materials and components - Aspects of fire damage and assessment.

Unit 2

Building failures – causes and effects - cracks in buildings – types, classification. Investigation and condition assessment – Semi-destructive and Non-destructive testing methods.

Common defects in buildings and control measures - maintenance philosophy - phases of maintenance.

Materials for repair - special mortar and concretes, concrete chemicals, admixtures, special cements and high grade concrete.

Unit 3

Techniques for repair - surface repair – material selection – surface preparation - rust eliminators and polymer coatings for rebars – repair methods of cracks in concrete and masonry - epoxy injection. Guniting and shotcreting. Waterproofing methods.

Strengthening measures - flexural strengthening, beam shear capacity strengthening, column strengthening, shoring, under pinning and jacketing.

Conservation of historic buildings - materials and methods - examples.

TEXTBOOKS:

1. Peter H. Emmons, "Concrete Repair and Maintenance", Galgotia Publications, 2010.
2. Vidivelli. B., "Rehabilitation of Concrete Structures", Standard Publishers, 2009.

REFERENCE BOOKS:

1. James Douglas, Bill Ransom, "Understanding Building Failures", Taylor & Francis Group, 2007.
2. Philip H. Perkins, "Repair, Protection and Water proofing of Concrete Structures", E & FN Spon, 1997.
3. SP:25 - 1984, "Causes and prevention of cracks in buildings", BIS
4. Santhakumar A. R., "Concrete Technology", Oxford University Press, 2006.
5. Sidney M. Johnson, "Deterioration, Maintenance and Repair of Structures", McGraw Hill, 1965.

6. Raikar, "Durable Structures – Through planning for preventive maintenance", R & D Centre, Structural Designers and Consultants Pvt. Ltd. New Bombay, 1994.
7. Raikar, "Diagnosis and Treatment of Structures in Distress", R & D Centre, Structural Designers and Consultants Pvt. Ltd., New Bombay, 1994.

15CVL445 SUSTAINABLE CONSTRUCTION 2 1 0 3

Unit 1

Sustainability in the built environment: sustainable development relative to ecological, economic and social conditions – efforts in sustainable development and construction – international organisations involved. Ethics and sustainability: environmental and resource concerns – resource consumption by construction industry - Green building movement. Ecological design – concept – major contributions. Building assessment and eco labels – standards (LEED, GRIHA) – assessment structure and process. Green building design process – documentation requirements.

Unit 2

Sustainable site and landscape – storm water management, heat island mitigation - assessment of sustainable sites. Building energy issues - building energy design strategy - building envelope – internal load reduction – energy optimisation - renewable energy systems. Reducing carbon footprint. Built environment hydrologic cycle – water resources issues – strategies for conservation and recycling – waste water and storm water handling strategies. Materials resources - Life cycle assessment – embodied energy – Green building materials and products – assessing for environmental impacts – design for deconstruction – LEED credits for different aspects.

Unit 3

Indoor environmental quality – issues and causes, components of integrated design – emissions from building materials. Construction operations – site planning, indoor air quality during construction – materials management – Construction and Demolition – waste management – building commissioning – LEED credits for different aspects. Green building economics – quantifying benefits. Recent advances in sustainable construction.

TEXTBOOK:

"Sustainable Building Design Manual - Volume II", Published by TERI, New Delhi, 2004.

REFERENCE BOOKS:

1. Kibert, C. J., "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2013.
2. Steven V. Szokolay., "Introduction to Architectural Science - The Basis of Sustainable Design", Elsevier, 2007.

3. Sandy Halliday, "Sustainable Construction", Routledge, (Taylor & Francis Group), 2013.
4. Dejan Mumovic and Mat Santamouris (Ed), "A Handbook of Sustainable Building Design and Engineering", Earthscan Publishing, 2009.
5. Osman Attmann, "Green Architecture: Advanced Technologies and Materials", McGraw Hill, 2010.

15CVL450 **ADVANCED FOUNDATION ENGINEERING** **2 1 0 3**

Unit 1

Foundation on expansive soils: Introduction to expansive soil - Clay mineralogy and mechanism of swelling - Identification of expansive soils - Swelling potential, swelling pressure, free swell - Free swell index - Classification of expansive soil - Tests for swell pressure (IS code method) - Prediction of swell pressure from index properties - Damages in buildings on expansive soils - Elimination of swelling - Environmental solutions such as soil replacement techniques and lime columns - Principles of design of foundations in expansive soil deposits - Structural solutions such as provision of rigid foundation, under reamed piles, T Beams as strip footing for walls etc. (basic aspects).

Unit 2

Soil dynamics and Machine foundations: Introduction to soil dynamics - Soil behavior under dynamic loads - Difference between static and dynamic load behavior of soil - Dynamic soil properties - Free vibrations and forced vibrations - Types of machines - Types of machine foundations - Vibration analysis of a machine foundation - General design criteria for machine foundations - Design criteria for foundation for reciprocating machines (IS specifications) - Design procedure for block foundation for a reciprocating machine (IS code method) - Vibration isolation and control.

Unit 3

Special foundations: Introduction to shell foundations - Structural form and efficiency - Different types of shell foundations - General principles of geotechnical design of shell foundations and soil-structure interaction.

Special features of the foundations for water tanks, silos, chimneys and transmission line towers.

Foundations for marine structures - Design principles.

TEXTBOOKS:

1. Varghese P. C., "Foundation Engineering", Prentice-Hall of India Private Ltd, 2009.
2. Swami saran, "Soil dynamics and Machine Foundations", Galgotias, 2012.

REFERENCE BOOKS:

1. Ninan P Kurian, "Design of Foundation Systems", Narosa Publishers, 2009

2. Shamsheer Prakash, "Soil Dynamics", McGraw Hill, 1981.
3. Tomlinson M. J., "Foundation Design & Construction", Prentice-Hall, 2003.
4. Joseph E. Bowles, "Foundation Analysis & Design", Tata McGraw Hill, 1996.
5. Coduto, "Geotechnical Engineering Principles and Practices", PHI, New Delhi, 2010.
6. Srinivasalu and Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 2004.
7. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH, 2008.

15CVL451 **EARTH RETAINING STRUCTURES** **2 1 0 3**

Unit 1

Earth dams – types of dams – selection of type of dam based on material availability – foundation conditions and topography. Design details – crest, free board, upstream and downstream slopes, upstream and downstream slope protection – central and inclined cores – types and design of filters. Seepage analysis and control – seepage through dam and foundations – control of seepage in earth dam and foundation. Stability analysis – critical stability conditions – Evaluation of stability by Bishop's and sliding wedge methods under critical conditions.

Unit 2

Construction techniques – methods of construction – quality control. Instrumentation – measurement of pore pressures. Earth pressure theories – Rankine's and Coulomb's earth pressure theories for cohesionless and cohesive backfills – Computation of earth pressures for various cases – inclined – with surcharge – submerged and partly submerged – stratified backfills.

Rigid retaining structures – active and passive earth pressures against gravity retaining walls – Surcharge - Computation of earth pressures by Trial wedge method – a mathematical approach for completely submerged and partly submerged backfills – Importance of capillarity tension in earth pressure.

Graphical methods of earth pressure computation – Trial wedge method for coulomb's and Rankine's conditions, for regular and irregular ground and wall conditions – Rebhan's construction for active pressure – Friction circle method – Logarithmic spiral method.

Unit 3

Design of gravity retaining wall – Cantilever retaining walls Flexible retaining structure – type and methods of construction – Design strength parameters – safety factor for sheet pile walls – Computation of earth pressures against cantilever sheet piles in cohesionless and cohesive soils – anchored sheet piles – free earth method – fixed earth method – Rowe's moment reduction method – Stability of sheet piling.

Diaphragm walls and coffer dams – type of diaphragm walls and their construction techniques in various soil types – Earth pressure on braced cuts and coffer dams – Design of coffer dams.

TEXTBOOKS:

1. Winterkorn H. F. and Fand H. Y., "Foundation Engineering handbook", Galgotia, 2000.
2. Clayton C. R. I, Militisky, J and Woods, "Earth Pressure and Earth Retaining Structures", Survey university press, 1993.

REFERENCE BOOKS:

1. Das, B. M., "Principles of Foundation Engineering", CL Engineering, 2013.
2. Das, B. M., "Fundamentals of Geotechnical Engineering", CL Engineering, 2013.
3. Swami Saran, "Analysis and Design of Foundations and Retaining Structures", IK International Publishing, 2012.

15CVL452 ENVIRONMENTAL GEOTECHNOLOGY 2 1 0 3**Unit 1**

Environmental cycles - Soil and water - Environmental interaction relating to geotechnical problems - Effect of pollution on soil - water behaviour.

Origin, nature and distribution of soil - Description of individual particle - Soil fabric and structure - Gravitational and surface forces - Intersheet and interlayer bonding in the clay minerals - Basic structural units of clay minerals - Isomorphous substitution - Kaolinite mineral - Montmorillonite mineral - Illite mineral - Electric charges on clay minerals - Ion exchange capacity - Diffused double layer - Adsorbed water - Soil structure - Methods for the identification of minerals (introduction only).

Effect of drying on Atterberg limits - Shrinkage, swelling and cracking characteristics of soil - Electrochemical characteristics of soil-water system - Sensitivity of soil to environment - Soil-water-air interaction - Activity, sensitivity, causes of sensitivity - Influence of exchangeable cations, pH and organic matter on properties of soils - Permeability of soils - Hydraulic conductivity of different types of soils - Darcy's law and its validity - Factors affecting permeability

Unit 2

Sources, types and composition of different wastes - Characteristics and classification of hazardous wastes - Generation rates - Potential problems in soils due to contaminants.

Ground water flow - Sources of ground water contamination - Contaminant transport - Pollution of aquifers by mining and liquid wastes - Ground water pollution downstream of landfills - Transport mechanisms.

CPCB rules and regulations on waste handling and management - Criteria for selection of sites for waste disposal - Disposal techniques - Disposal systems for typical wastes.

Ground modification and waste modification techniques in waste management - Ground modification - Mechanical modification, hydraulic modification, chemical modification.

Unit 3

Liners and covers for waste disposal - rigid and flexible liners - Leachate and gas collection system - Engineered landfills (including basal liner and cover liner systems) – components - design criteria.

Hydrological design for ground water pollution control.

Soil contamination and remediation technology for both ground and aquifers.

REFERENCE BOOKS:

1. Mitchell J. "Fundamentals of soil behaviour", John Wiley and Sons., Third Edition, 2005.
2. Robert M. Koerner, "Construction and Geotechnical methods in Foundation Engineering", McGraw Hill Book Co., 1996.
3. Abdel M. O. Mohamed and Hogan E. Antia, "Developments in Geotechnical Engineering", Elsevier, 1998.
4. Hari D. Sharma and Krishna R. Reddy, "Geoenvironmental Engineering – Site Remediation, Waste Containment, Emerging waste management technologies", John Wiley and sons, 2004.
5. Daniel D. E. "Geotechnical Practice for Waste Disposal", Chapman and Hall. 1993.
6. Hsai Yang Fang and John Daniel, "Introduction to Environmental Geotechnology", CRC press, Taylor and Francis, Second Edition, 2013.

15CVL453 GROUND IMPROVEMENT TECHNIQUES 2 1 0 3**Unit 1**

Objective of ground improvement - In-situ ground improvement methods - Introduction to soil improvements without the addition of many material - surface compaction – compaction piles in sand - impact compaction / dynamic compaction of sands – vibratory compaction in sand - vibroflotation in sand – explosions in sand - Terra probe method - replacement process - vibroflotation in clays - preloading techniques - sand drains - stone columns - introduction to soil improvement by thermal treatment - introduction to biotechnical stabilization.

Unit 2

Introduction to soil improvement by adding materials - lime stabilization – Mechanism - optimum lime content - lime fixation point - effect of lime on physical and engineering properties of soil - lime column method - stabilization of soft clay or silt

with lime – stabilization with cement -suitability for soils - effect on properties of soils. Grouting – types - desirable characteristics of grouts - grouting methods - grouting pressure - grouting materials - grouting technology - permeation grouting - compaction grouting - soil fracture grouting - jet grouting - application and limitations - slab jacking, grouted columns - application to dams.

Unit 3

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development - soil types - reinforcing materials - Reinforced earth retaining walls - reinforced embankments - soil nailing.

Geosynthetics – Types - general applications - types of geotextiles and geo-grids - physical and strength properties of geotextiles and geogrids - behaviour of soils on reinforcing with geotextiles and geogrids - design aspects with geotextiles and geogrid.

TEXTBOOKS:

1. Purushothama Raj.P., "Ground Improvement Techniques", University Science Press, 2009.
2. Swami Saran., "Reinforced soil and its engineering applications", I. K. International Pvt Ltd, 2010

REFERENCE BOOKS:

1. Moseley and Kirsch, "Text Book on Ground Improvement", Spon Press, 2004.
2. Shashi K. Gulhati and Manoj Dutta, "Geotechnical Engineering", Tata McGraw Hill, 2005.
3. Boweaven R., "Text Book on Grouting in Engineering Practice", John Wiley and Sons, 1981.
4. Jewell R. A., "Soil reinforcement with geotextiles – Special Publication 123", CIRIA Special Publication, Thomas Telford, 1996.
5. Donald H. Gray and Robbin B. Sotir, "Text Book on Biotechnical & Soil Engineering Slope Stabilization", Wiley International, 1996.
6. Korener, "Construction & Geotechnical Methods in Foundation Engineering", McGraw Hill, 1986.
7. Nihar Ranjan Patra, "Ground Improvement Techniques", Vikas Publishing House, 2012.

15CVL455

GROUND WATER HYDROLOGY

2 1 0 3

Unit 1

Occurrence of ground water: origin - rock properties affecting ground water vertical distribution - geologic formations as aquifers - types of aquifers - aquifer parameters - ground water basins - springs - Laplace equation - potential flow lines - flow net – flownet for anisotropic soils - seepage under a dam - groundwater contours - determination of flow direction - steady unidirectional flows in aquifers - confined and unconfined - aquifer with percolation - steady radial flow towards a well - well in uniform flow - steady flow with uniform discharge - partially penetrating wells - steady flow in leaky aquifer.

Unit 2

Unsteady flow - general equation - Cartesian and polar coordinate - unsteady radial flow in to a well - confined, unconfined and leaky aquifers – multiple well system - pumping tests – non-equilibrium equation for pumping tests - Thies' method - Jacob method - Chow's method - characteristics well losses – step draw down test - well near aquifer boundaries - determination of boundaries from pumping test. Image wells for various boundary conditions - Cavity well and open well - yield tests - pumping and recuperation test.

Unit 3

Tube wells: design - screened wells - gravel packed wells - well loss - selection of screen size - yield of a well - test holes - well logs - methods of construction - dug wells - shallow tube wells - deep wells - gravity wells - drilling in rocks - screen installation - well completion - well development - testing wells for yield - collector - or radial wells - infiltration galleries - well point system - failure of tube wells.

Ground water investigation methods.

TEXTBOOKS:

1. Raghunath, H. M., "Ground Water", New Age International, 2007.
2. Karanth, K. "Groundwater Assessment, Development and Management", Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. Todd, D. K. and Mays. L. W., "Ground Water Hydrology", Wiley India, 2011.
2. Garg S. P., "Ground Water and Tube wells", Oxford & IBH, 1993.
3. Raghunath H. M., "Hydrology: Principles, Analysis and Design", New Age International Publishers, 2006.

15CVL456

REMOTE SENSING AND GIS

2 1 0 3

Unit 1

Introduction, Basic concepts and principles of remote sensing; Definition components of remote sensing - energy sensor, interacting body – active and passive remote sensing – platforms - EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface. Application; Meteorology, land use, networking, hydrological studies, soil studies and coastal zone analysis.

Unit 2

Photogrammetry; Aerial and Terrestrial; photo interpretation. Sensors; Radar imaging; colour scanners; thematic mapper.

Geographic information system – components of GIS – hardware, software and organisational context – data – spatial and non-spatial maps – types of maps – projection - types of projection – data input - digitiser, scanner, editing – raster and vector data structures – comparison of raster and vector data structure.

Unit 3

Analysis using raster and vector data – retrieval, reclassification, overlaying, buffering - data output – printers and plotters. Open source softwares.

GIS and remote sensing applications – urban applications – water resources – urban analysis – watershed management – resources information system – hazard mitigation.

TEXTBOOKS:

1. Lillesand, Kiefer and Chipman, "Remote Sensing and Image Interpretation", Wiley student edition, 2013.
2. A. M. Chandra and S. K. Gosh, "Remote Sensing and GIS", Alpha Science, 2006.

REFERENCES:

1. Anji Reddy, "Remote sensing and Geographical systems", BS Publications, 2012.
2. L R A Narayana, "Remote Sensing and its applications", Universities Press, 1999
3. J. V. S. Murthy, "Watershed management", New Age International, 1998.
4. Wurbs, R. A., and James, W. P., "Water Resources Engineering". PHI Learning, 2009.
5. M G Srinivas (Edited by), "Remote sensing applications", Narosa Publishing House, 2001.
6. Burrough P A., "Principles of GIS for land resource assessment", Clarendon Press, 1994.
7. Michael N. Demers, "Fundamentals of geographic information system", Wiley student edition, 2012.

15CVL457 SURFACE HYDROLOGY AND WATER POWER 2 1 0 3

Unit 1

Introduction: Hydrologic cycle - systems concept - hydrologic system model - hydrologic model classification. Stream flow measurement - measurement of stage – discharge measurements. Stage – discharge relations - selection of a stream gauging site – stream gauge network.

Evaporation – measurement, estimation and control of evapo-transpiration (ET) – estimation of evapo-transpiration – evapo-transpiration and consumptive use – measurement of ET – lysimeters and field pots – potential ET and its computation – pan evaporation - Penman's method – Blaney Criddle method – reference crop ET and crop coefficient – interception and depression storage.

Infiltration processes – measurement using infiltrometers – infiltration capacity – infiltration indices – Horton's model of infiltration.

Rain water harvesting – manmade alterations in hydrologic cycle – methods of water conservation.

Unit 2

Runoff - components of runoff - Characteristics of runoff – factors affecting runoff – components of hydrograph – base flow separation – rain fall – runoff relations – flow duration curve - flow mass curve - hydrograph analysis - unit hydrograph theory – derivation of unit hydrograph – applications and limitations of unit hydrograph – 'S' hydrograph – instantaneous unit hydrograph – unit hydrograph for ungauged catchments – synthetic hydrograph – conceptual elements – linear reservoirs – Nash model. Yield from a catchment – flow duration curves – flow mass curve.

Floods – estimation of peak discharge – rational method - unit hydrograph method. Probabilistic and statistical methods – basic concept of probability and frequency distribution – skewness coefficient – return period discrete distribution – Binomial distribution – continuous distribution – flood frequency analysis – normal, lognormal, Gumbel and Log-Pearson Type III methods. Flood routing – reservoir routing – Modified pulse method – channel routing – Musking hum method.

Unit 3

Planning for water power development – estimation of available water power - power duration curve - storage and pondage - load studies - load duration curve - variations in load factor - power system load - system integrated operational studies - load prediction - market requirements of power - installed capacity - Benefits evaluation of installed capacity.

Classification of hydropower development - storage power development - runoff river power development - pumped storage power development - small hydro power development.

Hydro power plants - power plant structure - layout of hydropower plants - types of power houses - sizing of power house.

Water conductor system – intakes - location and types of intakes - penstock and pressure shafts - water hammer - water hammer equation - types of surge tanks.

TEXTBOOKS:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw - Hill publishers, New Delhi, 2008.
2. Duggel K. N., and J. P. Soni, "Elements of Water resources engineering", New Age International Publishers, 2005.

REFERENCES:

1. Raghunath H. M., "Hydrology: Principles, Analysis & Design", New Age International, 2015.
2. P. N. Modi, "Irrigation, Water Resources, and Water power Engineering", Standard Book House, 2014.

15CVL458 WATER RESOURCES SYSTEM PLANNING AND DESIGN 2 1 0 3

Unit 1

Water systems engineering – scope and approach. Issues and the systems planning approach - water system dynamics - water resource development alternatives – Water systems planning objectives - Constraints and Criteria – Economic and Econometric principles.

Hydrologic input analysis, Demand analysis, System elements & Subsystem planning - Stochastic planning and management - Design and management issues.

Unit 2

Optimization methods and their application in water resource systems. Linear programming and Dynamic programming models. Problem formulation for W. R systems – Multi-objective planning – Large scale system analysis - Case studies.

Unit 3

Ground water system planning – Conjunctive surface and G. W development - Hierarchical approach - Water quality management planning - Regional planning - Policy issues.

REFERENCE BOOKS:

1. S K Jain and V P Singh, "Water Resources Systems Planning and Management", Elsevier Science, 2003
2. Maass. A. et.al., "Design of Water Resources Systems", Harvard University Press 2013.
3. M. C. Chaturvedi, "Water Resources Systems: Planning & Management", Tata McGraw Hill Publications, 1987.
4. Louks D P et.al, "Water Resources System Planning & Analysis", Prentice Hall, 1981.
5. Goodman. A. S. and Major D. C., "Principles of Water Resources Planning", Prentice Hall, 1984.

15CVL460 ADVANCED ENVIRONMENTAL ENGINEERING 2 1 0 3

Unit 1

Instrumental methods for analysis of contaminants in air, water and soil - colorimetry,

Chromatography, spectroscopy, electrochemical probes

Indoor and outdoor air pollution – meteorology - influence of solar radiation and wind fields - lapse rate and stability conditions - characteristics of stack plumes - effective stack height.

Characteristics and health effects of various air pollutant particulates (PM2.5, PM10) and gaseous pollutants (CO, NOx, SOx, etc) - their behaviour in atmosphere – monitoring.

Photochemical reactions - secondary pollutants.

Control devices for Particulate and Gaseous pollutants – applications.

Unit 2

Advances in waste water treatment – Aerobic Suspended growth Process - Process for biological nitrogen removal – design criteria – anoxic, aerobic process design – sequencing batch reactor (SBR) – process analysis - Process for biological phosphorus removal – design criteria.

Aerobic attached growth Process – Rotating biological contactor, Activated Biofilter – Fluidized bed bioreactor (FBBR) design criteria.

Anaerobic suspended and attached growth process - Up flow anaerobic sludge blanket reactor.

Unit 3

Tertiary treatment – disinfection of waste water - waste water recycling – Water reuse. Advances treatment units – Removal of organic and inorganic colloidal and suspended solids – Removal of dissolved organic constituents – Removal of dissolved inorganic constituents – Filtration – Membrane filtration – Adsorption - Distillation processes.

TEXTBOOK:

Metcalfe and Eddy, "Waste Water Engineering Treatment Disposal Reuse", Tata McGraw Hill, 2002.

REFERENCE BOOKS:

1. Clarence, J. Velz, "Applied Stream Sanitation", Krieger Pub Co., 1984.
2. C. S Rao, "Environmental Pollution Control Engineering", New Age Publications, 2006.
3. Nevers, Noel De, "Air Pollution Control Engineering", McGraw-Hill, 1999.

15CVL461 ENVIRONMENTAL IMPACT ASSESSMENT 2 1 0 3

Unit 1

Concept of environment, Concept of environmental impact, Environmental impact assessment (EIA) – definitions, terminology and overview, Evolution of EIA in the USA, Key features of the National Environmental Policy Act and its implementation and the Council on Environmental Quality (CEQ) guidelines, Role of the USEPA, Evolution of EIA in India, Sustainable development, Generalised EIA process flow chart, Screening, Initial environmental examination (IEE), Scoping, Public participation.

Unit 2

Environmental baseline, Impact assessment methods – checklists – matrices - quantitative methods – networks - overlay mapping. Introduction to impact prediction and evaluation, Factors to be considered while assessing the impacts of water related projects, power projects, waste water treatment facilities etc. Major features of the EIA notification in India, Present status and procedures of EIA in India.

Unit 3

Prediction and assessment of impacts of developmental activities on surface water, land and soil, groundwater, air, biological environment etc.

Prediction and assessment of visual impacts, Socioeconomic impact analysis, Evaluation of alternatives, Preparing the EIA document, Environmental impact statement (EIS), Environmental monitoring, Environmental audit (EA). Case studies.

REFERENCE BOOKS:

1. Larry W Canter, *Environmental Impact Assessment*, McGraw Hill, Inc, 1995.
2. Betty Bowers Marriot, *Environmental Impact Assessment: A Practical Guide*, McGraw Hill, Inc, 1997.
3. Barrow, C. J., *Environmental and Social Impact Assessment – An Introduction*, Edward Arnold, 1997.
4. Evan. K. Paleologos and Ian Lerche, *Environmental Risk Analysis*, McGraw Hill Inc, 2001.
5. Peter Morris (ed.) and Riki Therivel (ed.), *Methods of Environmental Impact Assessment*, Routledge, 2001.
6. UNEP, *Environmental Impact Assessment Training Resource Manual*, 2002.
7. Website of the Ministry of Environment and Forests, Govt. of India and the USEPA.

15CVL462**INDUSTRIAL WASTE TREATMENT****2 1 0 3****Unit 1**

Nature and characteristics of Industrial wastes - prevention versus control of industrial pollution - Linkage between technology and pollution prevention - tools for clean processes - reuse, recycle, recovery, source reduction, raw material substitution, toxic use reduction and process modification - separation technologies as tools for waste minimization - Flow sheet analysis - Energy and resource audits - waste audits.

Unit 2

Preliminary treatment of industrial waste water – volume reduction – strength reduction – neutralization – equalization and proportioning.

Treatment of industrial waste - suitability of different techniques - disposal of industrial waste.

Unit 3

Effluent generation from textile industry – paper industry – dairy – fertilizer – thermal power plants - effluent characteristics - treatment.

Membrane process, ion exchange process, Reverse osmosis, Ultra filtration, electrolysis.

Study of damages caused by industrial pollution in India.

REFERENCE BOOKS:

1. Nelson Leonard Nemerow, *Industrial waste treatment – contemporary practice and vision for the future*, Elsevier, Singapore, 2007
2. Gerard Kiely, *Environmental Engineering*, McGraw Hill, 2009.
3. Sincero A. P. and Sincero G. A., *Environmental Engineering - A Design Approach*, Prentice Hall, 1996.
4. Mahajan S. P., *Pollution Control in Process Industries*, Tata McGraw Hill, 2001.
5. Babbitt H. E., *Sewerage & Sewage Treatment*, Nabu Press, 2010.
6. Abbasi S. A, and Ramasami E, *Biotechnical Methods of Pollution Control*, Universities Press(India) Ltd., 1999.

15CVL470**PAVEMENT DESIGN****2 1 0 3****Unit 1**

Introduction: Types and component parts of pavements – factors affecting design and performance of pavements - comparison between highway and airport pavements - functions and significance of sub grade properties – various methods of assessment of sub grade soil strength for pavement design - cause and effects of variations in moisture content and temperature - depth of frost penetration - design of bituminous mixes by Marshall method.

Unit 2

Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - burmister 2 layer and 3 layer theories - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi-empirical and theoretical approaches for flexible pavement design - group index, CBR, triaxial, mcLeod and burmister layered system methods.

Unit 3

Stresses analysis and methods of rigid pavement design: types of stresses and causes - factors influencing stresses, general conditions in rigid pavement analysis – ESWL - wheel load stresses - warping stresses – friction stresses - combined stresses - functions of various types of joints in cement concrete pavements -

design and detailing of slab thickness; longitudinal, contraction and expansion joints by IRC recommendations.

Pavement evaluation and rehabilitation.

TEXTBOOK:

Khanna S. K. and Justo, C E G, "Highway Engineering", Nem Chand and Bros, 2011.

REFERENCE BOOKS:

1. Yoder and W Nitezak, "Principles of Pavement Design", John Wiley, 1975.
2. Yang. H. H., "Pavement Analysis and Design", Pearson Education, 2010.
3. IRC: 37 - 2001, "Guidelines for the Design of Flexible Pavements"
4. IRC: 58 - 2002, "Guidelines for the Design of Rigid Pavements"
5. David Cronney, "The Design and Performance of Road pavements", McGraw Hill, 1997.
6. Haas R., Hudson W. R., and Zaniewski, J., "Pavement Management System", McGraw Hill Book Co, 1994.
7. IRC 81-1981- "Tentative Guidelines for Strengthening of Flexible Pavements by Benkman Beam Deflections Techniques".

15CVL471 TRAFFIC ENGINEERING AND MANAGEMENT 2 1 0 3

Unit 1

Introduction - Objectives and scope of traffic engineering - Components of road traffic: vehicle, driver and road - Road user and vehicle characteristics and their effect on road traffic - Traffic manoeuvre - Traffic Stream Characteristics - Relationship between Speed, Flow and Density.

Objectives, methods, equipment, data collection, analysis and interpretation (including case studies) of (a) Speed and delay, (b) Origin and destination, (c) Parking, (d) Accident and other studies.

Unit 2

Design, Regulation and Management of Traffic Engineering Facilities: Control of traffic movements through time sharing and space sharing concepts - Design of channelising islands, T, Y, skewed, staggered, roundabout, mini-roundabout and other forms of at-grade crossings including provision for safe crossing of pedestrians and cyclists - Grade separated intersections: Warrants and design features - Bus stop location and bus bay design - Road lighting - Regulations on vehicles, drivers and traffic - Planning and design of traffic management measures: one-way streets, reversible lanes and roadways, turn regulation, transit and carpool lanes - Planning and design of pedestrian facilities – Traffic calming.

Unit 3

Traffic Control Devices and Environmental Control: Different methods of signal design - Redesign of existing signals including case studies - Signal coordination - Air and Noise pollution of different transport modes – Visual impacts - Impacts on land development -Technological approaches to improving environment.

TEXTBOOKS:

1. Elena S. Prassas, Roger P. Roess, William R. McShane, "Traffic Engineering", Pearson, 2010.
2. Kadiyali, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 2007.

REFERENCE BOOKS:

1. O' Flaherty C. A., "Traffic Planning and Engineering", Elsevier India, 2006.
2. Fred L. Mannering, Scott S. Washburn, and Walter P. Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley, 2011.
3. Pignataro, L., "Traffic Engineering - Theory and Practice", Prentice Hall, 1973.
4. Institute of Transportation Engineers, "Transportation and Traffic Engg. Hand Book", 6th edition, 2009.
5. IRC-SP41, Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas, 1994.
6. Leonard Evans, "Traffic Safety", Science Serving Society, 2004.
7. Michael, A. P. Taylor, William Young, and Peter W. Bonsall, "Understanding Traffic Systems", Ashgate Publishing, 2000.
8. Mike Slinn, Paul Matthews, Peter Guest, "Traffic Engineering Design - Principles and Practice", Butterworth-Heinemann, 2005.

15CVL472 TRANSPORTATION SYSTEM MANAGEMENT 2 1 0 3 AND CONTROL

Unit 1

Traffic Engineering Facilities and Control: Control of Traffic Movements through Time Sharing and Space Sharing Concepts – Design of Channelising Islands - T, Y, Skewed, Staggered, Roundabout, Mini-Round about and other At-Grade Crossings and Provision for Safe Crossing of Pedestrians and Cyclists; Grade Separated Intersections, their warrants and Design Features, Bus Stop Location and Bus Bay Design.

Traffic Control Devices: Traffic Signs and Signals, Principle of Signal Design, Webster's Method, Redesign of Existing Signals including Case Studies; Signal System Coordination.

Unit 2

TSM Actions:

Combination and Interactions, Input Assessment and Evaluation, Monitoring and

Surveillance, Study of following TSM Actions with respect to:

- 1) Problems Addressed
- 2) Conditions for Applications
- 3) Implementation Problems
- 4) Evaluation and Impact Analysis.

Public Transportation and HOV Treatment, Toll discounts for Car Pools during Peak periods, Park and Ride, Car pooling, Exclusive Bus & Two-wheeler Lanes, Priority at Ramp Terminals, Bus Transfer Stations, Limited Skip & Stop Bus Services & Shared Rides.

Unit 3

Demand Management: Staggered Working hours, Flexible Work hours, High Peak Period Tolls, Shuttle Services, Circulation Services and Extended Routes.

Traffic Operations Improvements: On-Street, Parking ban, Freeway Ramp Control and Closure, Travel on Shoulders, One-way Streets, Reversible Lanes, Traffic Calming, Right Turn Phase, Right Turn Lanes, Reroute Turning Traffic.

TEXTBOOK:

Kadiyali, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 2007.

REFERENCE BOOKS:

1. Institute of Transportation Engineers, "Transportation and Traffic Engineering Hand Book", 6th edition, 2009.
2. Salter, R. J., "Highway Traffic Analysis and Design", Palgrave Macmillan, 1996.
3. Louis J. Pignataro, Edmund J. Cantilli, "Traffic Engineering – Theory and Practice", Prentice Hall, 1973.
4. IRC- SP41-1994: Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas.

15CVL473 URBAN TRANSPORTATION PLANNING 2 1 0 3

Unit 1

Urban Transportation Planning Process & Concepts: Role of transportation - Transportation problems - Urban travel characteristics - Evolution of transportation planning process - Concept of travel demand - Demand function - Independent variables - Travel attributes - Assumptions in demand estimation - Sequential, recursive and simultaneous processes.

Unit 2

Transportation Survey and Analysis: Definition of study area - Zoning - Types and sources of data - Road side interviews - Home interview surveys - Expansion factors - Accuracy checks.

Trip Generation Analysis: Trip generation models - Zonal models - Category analysis - Household models - Trip attractions of work centers.

Trip Distribution Analysis: Trip distribution models - Growth factor models - Gravity models - Opportunity models.

Unit 3

Mode Split Analysis: Mode choice behaviour, Completing modes, Mode split curves, Probabilistic models.

Route Split Analysis - Elements of transportation networks, coding - minimum path trees, all-or-nothing assignment.

TEXTBOOK:

Hutchinson B. G., "Principles of Urban Transportation System Planning", McGraw Hill, 1974.

REFERENCE BOOKS:

1. Khanna S. K and Justo. C. E. G., "Highway Engineering", Nem Chand & Bros., 2011
2. Kadiyali L. R., "Traffic Engineering and Transportation Planning", Khanna Publishers, 2008.
3. Khisty C. J. and Iall. B. K., "Transportation Engineering - An Introduction", Prentice Hall, 2002.
4. Bruton M. J., "Introduction to Transportation Planning", Hutchinson of London, 1992.
5. Papacostas, C S, and Prevedourous. P. D, "Transportation Engineering and Planning", Prentice Hall, 2009.
6. Dicky J. W., "Metropolitan Transportation Planning", Taylor & Francis, 1983.

15CVL481 STRUCTURAL DESIGN AND DETAILING 0 0 2 1

Design drawing and detailing of RC elements / structures – preparation of detailed design documents, schedules of structural elements and reinforcement details (structural drawing).

- Framed structure
- Retaining walls
- Water tanks

Design and detailing of steel elements / structures

- Built-up columns and Column bases
- Roof trusses and joints including purlins
- Gantry girder

Computer aided analysis and design

- Multi-storey frame analysis for dead, live and wind loads - Applications.
- Design of Reinforced concrete Beams, Columns – Footings – Steel beams – columns - Trusses

TEXTBOOKS:

1. N. Krishna Raju, "Structural Design and Drawing – Reinforced Concrete and Steel", Universities Press, 2005.

2. M. L. Gambhir, "Design of Reinforced Concrete Structures", PHI Learning, 2009.

REFERENCE BOOKS:

1. D. Krishnamoorthy, "Structural Design & Drawing Vol. I&II", CBS Publishers, 2012.
2. Karve, Shah, "Illustrated Design of R. C. Buildings (G+3)", Standard Publishers Distributors, 2008.
3. SP:34-1987, "Handbook on Concrete Reinforcement and Detailing", BIS.

15CVL491 PROFESSIONAL PROJECT 0 1 2 2

The objective of this course is to impart and improve the design capability of the student. This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of a RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

15CVL495 PROJECT PHASE I 2 cr

The student is expected to start the initial planning and preparation for the final year project. They have to identify their team, project advisor and, plan the objectives, scope, methodology and the work schedule. A detailed literature review is also expected in this phase.

15CVL499 PROJECT PHASE II 10 cr

The student is expected to work on a topic in the field of Civil Engineering which could involve theoretical and/or fabrication and/or experimental and/or computational work. Evaluation will be done at the mid-course, as well as at the end of the semester.

15EEE180 WORKSHOP B 0 0 2 1

Part A - Electronics

Identification of electronic components (Passive and Active)
Study of measuring instruments (Voltmeter, Ammeter and Multimeter)
Measurement and theoretical Verification of series and parallel combination of resistors and capacitors
Calibration of CRO and measurements of signal parameters (RMS, maximum value, peak value, time and frequency)
Calibration of function generator using CRO
Soldering practice

Part B - Electrical

1. Study on power supply and protective devices
2. Study on tools and electrical accessories
3. Study on sources of light
4. Study on energy efficiency
5. Study on water pump
6. Study on house hold appliances:
 - a. Iron box
 - b. Fan
 - c. Refrigerator
 - d. Air conditioner
7. House wiring I – Glow an incandescent lamp using SPST switch
8. House wiring II – Glow a fluorescent lamp using SPST switch
9. House wiring III – Operate a fan and an incandescent lamp using two independent SPST switch
10. House wiring IV – Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch
11. House wiring V – Staircase wiring
12. House wiring VI – Godown wiring

15ENG111 COMMUNICATIVE ENGLISH 2 0 2 3

OBJECTIVES: To make the students communicate their thoughts, opinions, and ideas freely and naturally; to make them understand the different styles in communication; to make the students understand the aesthetics of reading and writing; to bring in a spirit of enquiry; to motivate critical thinking and analysis; to help them ruminate on human values.

Unit 1

Reading: Different styles of communication – Reading Comprehension - critical thinking and analysis – Note-making – Any two pieces from the text.

Unit 2

Writing: Prewriting techniques - Kinds of paragraphs - basics of continuous writing.

Grammar & Usage: Parts of Speech, Tenses, Concord, Phrasal Verbs, Modal Auxiliaries, Modifiers (Workbook) - Any two pieces from the text.

Unit 3

Practical sessions (Listening & Speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – Listening comprehension and Note-taking - Any two pieces from the text.

Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews, etc.

Text: *Language through Reading: Compilation by Amrita University for internal circulation*

Poems:

- i. The Poplar Field by William Cowper
- ii. Telephone Conversation by Wole Soyinka

Prose:

- i. Higher Mathematics by R. K. Narayan
- ii. Wings of Fire by Abdul Kalam (Part III.11)

Short Stories:

- i. Best Investment I Ever Made by A. J. Cronin
- ii. Death of an Indian by Krishna Charan Das

1. *Language through Practice: Compilation by Amrita University for internal circulation*

15ENG230

BUSINESS COMMUNICATION

1 0 2 2

OBJECTIVES: *To introduce business vocabulary; to introduce business style in writing and speaking; to expose students to the cross-cultural aspects in a globalised world; to introduce the students to the art of persuasion and negotiation in business contexts.*

Unit 1

Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business news, Business articles.

Unit 2

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

Unit 3

Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques.

Activities

Case studies & role-plays.

BOOKS RECOMMENDED:

1. Jones, Leo & Richard Alexander. *New International Business English*. CUP. 2003.
2. Horner, David & Peter Strutt. *Words at Work*. CUP. 1996.
3. Levi, Daniel. *Group Dynamics for Teams*. 3 ed. Sage Publications India Pvt. Ltd. New Delhi, 2011.

4. Owen, Roger. *BBC Business English*. BBC. 1996.

5. Henderson, Greta Lafollette & Price R Voiles. *Business English Essentials*. 7th Edition. Glencoe / McGraw Hill.

6. Sweeney, Simon. *Communicating in Business*. CUP. 2000.

15ENG231

INDIAN THOUGHT THROUGH ENGLISH

1 0 2 2

OBJECTIVES: *To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about the societal changes in the recent past.*

Unit 1 Poems

Rabindranath Tagore's Gitanjali (1-10); Nizzim Ezekiel's Enterprise; A. K. Ramanujam's Small-Scale Reflections on a Great House.

Unit 2 Prose

Khushwant Singh's The Portrait of a Lady; Jhumpa Lahiri's Short Story - Interpreter of Maladies.

Unit 3 Drama and Speech

Vijay Tendulkar's Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru / S. Radhakrishnan / A. P. J. Abdul Kalam's My Vision for India etc. (any speech).

REFERENCES:

1. Lahiri, Jhumpa. *Interpreter of Maladies*, Harper Collins Publications, 2000.
2. Ramanujan A. K. ed. K. M. George, *Modern Indian Literature: An Anthology*, Vol. I, Sahitya Akademi, 1992.
3. Singh, Khushwant. *The Portrait of a Lady: Collected Stories*, Penguin, 2009.
4. Tagore, Rabindranath. *Gitanjali*, Penguin Books India Pvt. Ltd, 2011.
5. Tendulkar, Vijay. *Five Plays*, Oxford University Press, 1996.

15ENG232

INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE

1 0 2 2

OBJECTIVES: *To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.*

Unit 1 Poems

1. W. H. Auden: Refugee Blues; 2. A. K. Ramanujan: Obituary; 3. William Blake: The Little Black Boy; 4. Gieve Patel: Grandparents at a Family Get-together.

Unit 2 Short Stories

1. Chinua Achebe: Marriage is a Private Affair; 2. Ruskin Bond: The Thief; 3. Isai Tobolsky: Not Just Oranges; 4. K A Abbas: The Refugee

Unit 3 Prose

1. A G Gardiner: On The Philosophy Of Hats; 2. Robert Lynd: Mispronunciation

Practicals:

Role plays: The Proposal, Chekov / Remember Ceaser, Gordon Daviot / Final Solutions, Mahesh Dattani, Book reviews, Movie reviews.

SUGGESTED READING: *The Old Man and the Sea, Hemingway / Any one of the novels of R. K. Narayan, etc.*

15ENG233**TECHNICAL COMMUNICATION****1 0 2 2**

OBJECTIVES: To introduce the students to the elements of technical style; to introduce the basic elements of formal correspondence; to introduce technical paper writing skills and methods of documentation; to improve oral presentation skills in formal contexts.

Unit 1

Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style - graphical Representation.

Unit 2

Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

Unit 3

Technical paper writing: Library research skills - documentation style - document editing – proof reading – formatting.

Practice in oral communication and Technical presentations

REFERENCES:

1. Hirsh, Herbert. L. "Essential Communication Strategies for Scientists, Engineers and Technology Professionals". II Edition. New York: IEEE press, 2002
2. Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt Brace College Publication, 2003
3. Strunk, William Jr. and White. E. B. "The Elements of Style" New York. Alliyen & Bacon, 1999.
4. Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.

15ENG234**INDIAN SHORT STORIES IN ENGLISH****1 0 2 2**

OBJECTIVES: To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio - cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Unit 1

Introduction: Differences between novel and short stories – origin and development of short stories - Rabindranath Tagore: Kabuliwallah; Mulk Raj Anand: The Gold Watch.

Unit 2

R. K. Narayan: Sweets for Angels; K. A. Abbas: The Refugee; Khushwant Singh: The Mark of Vishnu.

Unit 3

Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

TEXT:

M. G. Narasimha Murthy (ed), *Famous Indian Stories*. Hyderabad: Orient Black Swan, 2014

REFERENCE;

Mohan Ramanan (Ed), *English and the Indian Short Story: Essays in Criticism*, Hyderabad, Orient BlackSwan, 2000.

15ENV300 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY 3 0 0 3**Unit 1**

State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels,

India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People's action.

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil / land degradation / pollution

Unit 2

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people's movements and activism, Indigenous knowledge systems and traditions of conservation.

Unit 3

Common goods and public goods, natural capital / tragedy of commons, Cost benefit analysis of development projects, Environment Impact Assessment (EIA), Environment Management Plan (EMP), Green business, Eco-labeling, Problems and solutions with case studies.

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes / Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.

TEXTBOOKS / REFERENCES:

1. R. Rajagopalan, *Environmental Studies: From Crisis to Cure*. Oxford University Press, 2011, 358 pages. ISBN: 9780198072089.
2. Daniel D. Chiras, *Environmental Science*. Jones & Bartlett Publishers, 01-Feb-2012, 669 pages. ISBN: 9781449645311.
3. Andy Jones, Michel Pimbert and Janice Jiggins, 2011. *Virtuous Circles: Values, Systems, Sustainability*. IIED and IUCN CEESP, London. URL: <http://pubs.iied.org/pdfs/G03177.pdf>

4. Annenberg Learner, *The Habitable Planet*, Annenberg Foundation 2015. URL: <http://www.learner.org/courses/envsci/unit/pdfs/textbook.pdf>.

15FRE230 PROFICIENCY IN FRENCH LANGUAGE (LOWER) 1 0 2 2

Unit 1 Population - Identity

How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions;

Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

Unit 2 The suburbs - At the train station

Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city (church, town hall, post office...)

Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3 Paris and the districts - Looking for a room

Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.

Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:

Metro St Michel - Publisher: CLE international

15FRE231 PROFICIENCY IN FRENCH LANGUAGE (HIGHER) 1 0 2 2

Unit 1 The first room of a student

A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière, dans...), Read advertisement; Appreciation (I like, I prefer,).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son...); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2 Small jobs

Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.

Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec ...); Pronoun as direct object (le, la, l', les).

Unit 3 University Restaurant

Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de...); Comparison (plus ...que, moins...que, autant ...que); Interrogation (continuation), inversion, Est-ce que, qu'est-ce que?.

TEXTBOOK:

Metro St Michel - Publisher: CLE International

15GER230 GERMAN FOR BEGINNERS I 1 0 2 2

Unit 1

Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation.

Numbers 1-100; Saying the telephone number.

Countries and Languages.

Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

Unit 2

Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.

Numbers till 1000. Saying a year.

Alphabets – spelling a word.

Filling up an application form; In the restaurant – making an order.

Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article

Vocabulary: Food items

Unit 3

Numbers above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.

Grammar: Accusative – definite article. Adjectives and plural forms.

Vocabulary: Furniture and currencies.

15GER231 GERMAN FOR BEGINNERS II 1 0 2 2

Unit 1

Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form.

Vocabulary: Consumables and measurements;

Unit 2

Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing up an appointment.

Grammar: Modal verbs; Prepositions with time and place; Ordinal numbers.

Vocabulary: Leisure activities, weekdays, months and seasons.

Unit 3

Family and household; Family and relations; household and daily routine.

Grammar: Possessive articles; Divisible and indivisible verbs.

Vocabulary: Family circle; Household articles.

15GER232 PROFICIENCY IN GERMAN LANGUAGE (LOWER) 1 0 2 2

To have an elementary exposure to German language; specifically

1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;

5. to be able to translate simple letters with the use of a dictionary; and
 6. to have some familiarity with the German life and culture.
 (This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.)

Some useful websites will be given.

15GER233 PROFICIENCY IN GERMAN LANGUAGE (HIGHER) 1 0 2 2

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative.

Some German culture. Films.

15HIN101 HINDI I 1 0 2 2

OBJECTIVES: To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.

Unit 1

Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindi language, Devanagari script and Hindi alphabet.

Shabda Bhed, Roopanthar ki Drishti se - Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed - Sangya ke Roopanthar - kriya.

Unit 2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender & number - General vocabulary for conversations in given context – understanding proper pronunciation – Conversations, Interviews, Short speeches.

Unit 3

Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit 4

Letter writing – personal and Formal – Translation from English to Hindi.

Unit 5

Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos.

BOOKS:

1. Prem Chand Ki Srvarshrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi
3. Kamtha Prasad Guru: Hindi Vyakaran, Best Book pub House, New Delhi
4. Poetry : Kavya Ras - Ed: T. V. Basker- Pachouri Press; Mathura

15HIN111 HINDI II 1 0 2 2

OBJECTIVES: Appreciation and assimilation of Hindi Literature both drisyā & shravya using the best specimens provided as anthology.

Unit 1

Kavya Tarang; Dhumil ke Anthim Kavitha [Poet-Dhumil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakh [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

Unit 2

Communicative Hindi - Moukhhik Abhivyakthi

Unit 3

Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. News reading and presentations in Radio and TV channels in Hindi.

Unit 4

Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

Unit 5

Translation: Theory and Practice - Letter writing: Formal and Personal – Introduction to Hindi Software.

BOOKS:

1. Kavay Tarang: Dr. Niranjana, Jawahar Pusthakaalay, Mathura.
2. Gadya Manjusha: Editor: Govind, Jawahar Pusthakaalay, Mathura

15HUM230**EMOTIONAL INTELLIGENCE****2 0 0 2****Unit 1**

Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2

Components of Emotional Intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills. Emotional Intelligence Competencies, Elements of Emotional Intelligence, Models of Emotional Intelligence: The Ability-based Model, The Trait Model of Emotional Intelligence, Mixed Models of Emotional Intelligence.

Unit 3

Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost-savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

REFERENCES:

1. Daniel Goleman (1996). *Emotional Intelligence- Why it can Matter More than IQ*. Bantam Doubleday Dell Publishing Group
2. Daniel Goleman (2000). *Working with Emotional Intelligence*. Bantam Doubleday Dell Publishing Group
3. Liz Wilson, Stephen Neale & Lisa Spencer-Arnell (2012). *Emotional Intelligence Coaching*. Kogan Page India Private Limited

15HUM231**GLIMPSES INTO THE INDIAN MIND:
THE GROWTH OF MODERN INDIA****2 0 0 2****Unit 1**

Introduction

General Introduction; 'His + Story' or 'History' ?; The concepts of 'nation', 'national identity' and 'nationalism'; Texts and Textualities: Comparative Perspectives.

Unit 2

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

Unit 3

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.

Conclusion.

REFERENCES:

1. Tilak, Bal Gangadhar. *The Orion / Arctic Home in the Vedas*.
2. Tagore, Rabindranath. *The History of Bharatavarsha / On Nationalism / Greater India*.
3. Vivekananda, Swami. "Address at the Parliament of Religions"/"The Future of India"/"In Defence of Hinduism" from *Selections from the Complete Works of Swami Vivekananda*.
4. Aurobindo, Sri. *The Renaissance in India / On Nationalism*.
5. Coomaraswamy, Ananda K. *Essays in Indian Idealism (any one essay) / Dance of Shiva*.
6. Nivedita, Sister. "Noblesse Oblige: A Study of Indian Caste" / "The Eastern Mother" from *The Web of Indian Life*.
7. Gandhi, Mahatma. *Hind Swaraj*.
8. Nehru, Jawaharlal. "The Quest" from *Discovery of India*.
9. Ambedkar, B. R. "Buddha and His Dhamma" from *Collected Works*.
10. Saraswati, Chandrasekharendra. "The Sastras and Modern Life" from *The Hindu Dharma*.
11. Dharampal. *Bharatiya Chitta, Manas and Kala / Understanding Gandhi*.
12. Naipaul, V. S. *India: A Wounded Civilization / India: A Million Mutinies Now*.

15HUM232**GLIMPSES OF ETERNAL INDIA****2 0 0 2****Unit 1**

Introduction

A peep into India's glorious past

Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira's ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy – Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2

India's contribution to the world: spirituality, philosophy and sciences
 Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools;
 Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient
 Indian medicine: towards an unbiased perspective; Ancient Indian mathematics;
 Ancient Indian astronomy; Ancient Indian science and technology.

The arrival of Europeans, British paramountcy and colonization
 What attracted the rest of the world to India?; India on the eve of the arrival of
 European merchants; The story of colonization and the havoc it wrecked on Indian
 culture and civilization; Macaulay and the start of the distortion of Indian education
 and history; Indian economy – before and after colonization: a brief survey; The
 emergence of modern India.

Unit 3

Women in Indian society
 The role and position of women in Hindu civilization; Gleanings from the Vedas,
 Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata,
 Manusmriti, Kautilya's Arthashastra and Mricchhakatikam of Sudraka; The role and
 position of Indian women vis-a-vis Islam and European cultures; The great women
 of India.

Modern India
 The national movement for freedom and social emancipation; Swami Vivekananda,
 Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation
 is born as a republic – the pangs of birth and growth; India since Independence –
 the saga of socio-political movements; Problems facing the nation today;
 Globalization and Indian Economy; Bharatavarsha today and the way ahead:
 Regeneration of Indian National Resources.

Conclusion
 The Wonder that was India; The 'politics' and 'purpose' of studying India.

REFERENCES:

1. Parameswaran, S. *The Golden Age of Indian Mathematics*. Kochi: Swadeshi Science Movement.
2. Somayaji, D. A. *A Critical Study of Ancient Hindu Astronomy*. Dharwar: 1972.
3. Sen, S. N. & K. V. Sarma eds. *A History of Indian Astronomy*. New Delhi, 1985.
4. Rao, S. Balachandra. *Indian Astronomy: An Introduction*. Hyderabad: Universities Press, 2000.
5. Bose, D. M. et. al. *A Concise History of Science in India*. New Delhi: 1971.
6. Bajaj, Jitendra & M. D. Srinivas. *Indian Economy and Polity*. Chennai: Centre for Policy Studies.
7. Bajaj, Jitendra & M. D. Srinivas. *Timeless India, Resurgent India*. Chennai: Centre for Policy Studies.
8. Joshi, Murlī Manohar. *Science, Sustainability and Indian National Resurgence*. Chennai: Centre for Policy Studies, 2008.

9. *The Cultural Heritage of India*. Kolkata: Ramakrishna Mission Institute of Culture.
10. Vivekananda, Swami. *Selections from the Complete Works of Swami Vivekananda*. Kolkata: Advaita Ashrama.
11. Mahadevan, T. M. P. *Invitations to Indian Philosophy*. Madras: University of Madras.
12. Hiriyanna, M. *Outlines of Indian Philosophy*. Motilal Banarsidass.
13. Tagore, Rabindranath. *The History of Bharatavarsha / On Nationalism / Greater India*.
14. Majumdar, R. C. et. al. *An Advanced History of India*. Macmillan.
15. Mahajan, V. D. *India Since 1526*. New Delhi: S. Chand & Company.
16. Durant, Will. *The Case for India*. Bangalore: Strand Book Stall, 2008.
17. Aurobindo, Sri. *The Indian Renaissance / India's Rebirth / On Nationalism*.
18. Nivedita, Sister. *The Web of Indian Life*. Kolkata: Advaita Ashrama.
19. Durant, Will. *The Story of Civilization. Volume 1 – Our Oriental Heritage*. New York: Simon & Schuster.
20. Ranganathananda, Swami. *Eternal Values for A Changing Society*. Bombay: Bharatiya Vidya Bhavan.
21. Ranganathananda, Swami. *Universal Message of the Bhagavad Gita*. Kolkata: Advaita Ashrama.
22. Seturaman, V. S. *Indian Aesthetics*. Macmillan.
23. Coomaraswamy, Ananda K. *The Dance of Shiva*. New Delhi: Sagar Publications.
24. Coomaraswamy, Ananda K. *Essays on Indian Idealism*. New Delhi: Munshiram Manoharlal.
25. Danino, Michel. *The Invasion That Never Was*.
26. Kautilya. *Arthashastra*.
27. Altekar, A. S. *State and Government in Ancient India*. New Delhi: Motilal Banarsidass.
28. Altekar, A. S. *The Position of Women in Hindu Civilization*. New Delhi: Motilal Banarsidass.
29. Sircar, D. C. *Studies in the Religious Life of Ancient and Medieval India*. New Delhi: Motilal Banarsidass.
30. Sircar, D. C. *Studies in the Political and Administrative Systems in Ancient and Medieval Times*. New Delhi: Motilal Banarsidass.
31. Madhavananda, Swami & R. C. Majumdar eds. *The Great Women of India*. Kolkata: Advaita Ashrama.
32. Dutt, R. C. *The Economic History of India*. London, 1902.
33. Dharampal. *Collected Works*.
34. Dharampal. *Archival Compilations (unpublished)*

15HUM233 GLIMPSES OF INDIAN ECONOMY AND POLITY 2 0 0 2**Unit 1**

Introduction
 General Introduction; Primitive man and his modes of exchange – barter system;
 Prehistoric and proto-historic polity and social organization.

Ancient India – up to 600 B.C.
 Early India – the vedic society – the varnashramadharma – socio-political structure

of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira's ramarajya; Sarasvati - Sindhu civilization and India's trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2

Classical India: 600B.C. – 1200 A.D.

The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthashastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharmavijaya, lobhavijaya and asuravijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.

Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3

Modern India: 1720 - 1947

the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was 'traditional' or 'Indian') – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations – division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947

India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new/emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

REFERENCES:

1. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*
2. *Kautilya. Arthashastra.*
3. *Altekar, A. S. State and Government in Ancient India. New Delhi: Motilal Banarsidass.*
4. *Sircar, D. C. Studies in the Political and Administrative Systems in Ancient and Medieval Times. New Delhi: Motilal Banarsidass.*
5. *Dutt, R. C. The Economic History of India. London, 1902.*
6. *Dharampal. Collected Works (Volumes IV & V).*
7. *Dharampal. Archival Compilations (unpublished).*
8. *Bajaj, Jitendra & M. D. Srinivas. Indian Economy and Polity. Chennai: Centre for Policy Studies.*
9. *Bajaj, Jitendra & M. D. Srinivas. Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*
10. *Joshi, Murl Manohar. Science, Sustainability and Indian National Resurgence. Chennai: Centre for Policy Studies, 2008.*
11. *Tripathi, Dwijendra. The Oxford History of Indian Business. New Delhi: Oxford University Press, 2004.*
12. *McGuire, John, et al, eds. Evolution of World Economy, Precious Metals and India. New Delhi: Oxford University Press, 2001.*
13. *Tripathi, Dwijendra and Jyoti Jumani. The Concise Oxford History of Indian Business. New Delhi: Oxford University Press, 2007.*
14. *Kudaisya, Medha M. The Life and Times of G. D. Birla. New Delhi: Oxford University Press, 2003.*
15. *Raychaudhuri, Tapan and Irfan Haib, eds. The Cambridge Economic History of India. Volume 1. New Delhi: Orient Longman, 2004.*
16. *Kumar, Dharmma, ed. The Cambridge Economic History of India. Volume 2. New Delhi: Orient Longman, 2005.*
17. *Sabavala, S. A. and R. M. Lala, eds. J. R. D. Tata: Keynote. New Delhi: Rupa & Co., 2004.*
18. *Mambro, Arvind ed. J. R. D. Tata: Letters. New Delhi: Rupa & Co., 2004.*
19. *Lala, R. M., For the Love of India: The Life and Times of Jamsetji Tata. New Delhi: Penguin, 2006.*
20. *Thapar, Romila. The Penguin History of Early India: From the Origins to AD 1300. New Delhi Penguin, 2002.*
21. *Majumdar, R. C., et. al. An Advanced History of India. Macmillan.*

15HUM234**HEALTH AND LIFE STYLE****1 0 2 2****Unit 1 Introduction to Health**

Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2 Food and Nutritional Requirements during Adolescence

Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3 Need for a Positive Life Style Change

Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire-healthy Snacks

TEXTBOOKS:

1. B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.
"Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Council of Medical Research, ICMR, 2010.

REFERENCE BOOKS:

1. K Park "Textbook of preventive and social medicine", 2010.
WHO Report on Adolescent Health: 2010

15HUM235**INDIAN CLASSICS FOR
THE TWENTY-FIRST CENTURY****2 0 0 2****Unit 1**

Introductory study of the Bhagavad Gita and the Upanishads.

Unit 2

The relevance of these classics in a modern age.

Unit 3

Goals of human life - existential problems and their solutions in the light of these classics etc.

REFERENCE:

The Bhagavad Gita, Commentary by Swami Chinmayananda

15HUM236**INTRODUCTION TO INDIA STUDIES****2 0 0 2**

PREAMBLE: This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Unit 1

A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2

Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3

Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

TEXTBOOK:

Material given by the Faculty

BACKGROUND LITERATURE:

- 1 Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
- 2 Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
- 3 Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
- 4 Outlines of Indian Philosophy, M. Hiriyanna, MLBD.
- 5 An Advanced History of India, R. C. Majumdar et al, Macmillan.
- 6 India Since 1526, V. D. Mahajan, S. Chand & Company
- 7 The Indian Renaissance, Sri Aurobindo.
- 8 India's Rebirth, Sri Aurobindo.

- 9 On Nationalism, Sri Aurobindo.
- 10 The Story of Civilization, Volume I: Our Oriental Heritage, Will Durant, Simon and Schuster, New York.
- 11 Eternal Values for a Changing Society, Swami Ranganathananda, Bharatiya Vidya Bhavan.
- 12 Universal Message of the Bhagavad Gita, Swami Ranganathananda, Advaita Ashrama.
- 13 Awaken Children: Conversations with Mata Amritanandamayi
- 14 Indian Aesthetics, V. S. Seturaman, Macmillan.
- 15 Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.
- 16 Web of Indian Thought, Sister Nivedita
- 17 Essays on Indian Nationalism, Anand Kumaraswamy
- 18 Comparative Aesthetics, Volume 2, Kanti Chandra Pandey, Chowkhamba, Varanasi
- 19 The Invasion That Never Was, Michel Danino
- 20 Samskara, U. R. Ananthamurthy, OUP.
- 21 Hayavadana, Girish Karnard, OUP.
- 22 Naga-Mandala, Girish Karnard, OUP.

15HUM237 INTRODUCTION TO SANSKRIT LANGUAGE AND LITERATURE 2 0 0 2

OBJECTIVES: To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit; to help students appreciate and imbibe India's ancient culture and values.

Unit 1

Sanskrit Language – Vakya Vyavahara (प्रथमादीक्षा) - Introduction to Sanskrit language - Devanagari script and Sanskrit alphabet - Vowels and Consonants – Pronunciation - Classification of Consonants – Samyukthakshara Words – Nouns and Verbs - Cases – Introduction to Numbers and Time – Verbs: Singular, Dual and Plural – Sarva Namah: First Person, Second Person, Third Person – Tenses: Past, Present and Future -Words for Communication – Selected Slokas – Moral Stories – Subhashithas – Riddles.

Unit 2

Language Studies - Role of Sanskrit in Indian & World Languages.

Unit 3

Introduction to Sanskrit Classical Literature – Kavya Tradition – Drama Tradition - Stotra Tradition – Panchatantra Stories.

Unit 4

Introduction to Sanskrit Technical Literature – Astronomy – Physics – Chemistry – Botany – Engineering – Aeronautics – Ayurveda – Mathematics – Medicine – Architecture - Tradition of Indian Art – Administration – Agriculture.

Unit 5

Indology Studies – Perspectives and Innovations.

TEXTBOOKS AND REFERENCE BOOKS:

1. Vakya Vyavahara - Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi
2. The Wonder that is Sanskrit - Dr. Sampadananda Mishra, New Delhi
3. Science in Sanskrit – Samskritha Bharathi, New Delhi

15HUM238 NATIONAL SERVICE SCHEME 2 0 0 2

Unit 1

Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.

NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2

Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3

Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.

Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style

Unit 4

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.

Youth and Crime: Sociological and psychological factors influencing youth crime, Peer mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice.

Unit 5

Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.

Project Work / Practical

15HUM239 PSYCHOLOGY FOR EFFECTIVE LIVING 2 0 0 2**Unit 1 Self-Awareness & Self-Motivation**

Self analysis through SWOT, Johari Window, Maslow's hierarchy of motivation, importance of self esteem and enhancement of self esteem.

Unit 2 The Nature and Coping of Stress

Conflict, Relationship issues, PTSD. Stress – stressors – eustress - distress, coping with stress, stress management techniques.

Unit 3 Application of Health Psychology

Health compromising behaviours, substance abuse and addiction.

TEXTBOOKS:

1. V. D. Swaminathan & K. V. Kaliappan "Psychology for effective living - An introduction to Health
2. Psychology. 2nd edition Robert J. Gatchel, Andrew Baum & David S. Krantz, McGraw Hill.

REFERENCE BOOKS:

1. S. Sunder, 'Textbook of Rehabilitation', 2nd edition, Jaypee Brothers, New Delhi. 2002.
2. Weiben & Lloyd, 'Psychology applied to Modern Life', Thompson Learning, Asia Ltd.2004.

15HUM240 PSYCHOLOGY FOR ENGINEERS 2 0 0 2**Unit 1**

Psychology of Adolescents: Adolescence and its characteristics.

Unit 2

Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills, Mnemonics.

Unit 3

Attention & Perception: Definition, types of attention, perception.

TEXTBOOKS:

1. S. K. Mangal, "General Psychology", Sterling Publishers Pvt. Ltd.2007
2. Baron A. Robert, "Psychology", Prentice Hall of India. New Delhi 2001

REFERENCE BOOKS:

1. Elizabeth B. Hurlock, *Developmental Psychology - A life span approach*, 6th edition.
2. Feldman, *Understanding Psychology*, McGraw Hill, 2000.
3. Clifford Morgan, Richard King, John Scholper, "Introduction to Psychology", Tata Mcgraw Hill, Pvt Ltd 2004.

15HUM241 SCIENCE AND SOCIETY – AN INDIAN PERSPECTIVE 2 0 0 2**Unit 1**

Introduction

Western and Indian views of science and technology

Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2

Indian sciences

Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD.

Science and technology under the British rule

Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3

Science and technology in Independent India

Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition

Introduction; Regeneration of Indian national resources; Annamhatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

REFERENCES:

1. Joseph, George Gheverghese. *The Crest of the Peacock: Non-European Roots of Mathematics*. London: Penguin (UK), 2003.
2. Iyengar, C. N. Srinivasa. *History of Hindu Mathematics*. Lahore: 1935, 1938 (2 Parts).

3. Amma, T. A. Saraswati. *Geometry in Ancient and Medieval India*. Varanasi: Motilal Banarsidass, 1979.
4. Bag, A. K. *Mathematics in Ancient and Medieval India*. Varanasi: Motilal Banarsidass, 1979.
5. Sarma K. V. & B. V. Subbarayappa. *Indian Astronomy: A Source-Book*. Bombay: Nehru Centre, 1985.
6. Sriram, M. S. et. al. eds. *500 Years of Tantrasangraha: A Landmark in the History of Astronomy*. Shimla: Indian Institute of Advanced Study, 2002.
7. Bajaj, Jitendra & M. D. Srinivas. *Restoring the Abundance: Regeneration of Indian Agriculture to Ensure Food for All in Plenty*. Shimla: Indian Institute of Advanced Study, 2001.
8. Bajaj, Jitendra ed. *Report of the Seminar on Food for All: The Classical Indian Discipline of Growing and Sharing Food in Plenty*. Chennai: Centre for Policy Studies, 2001.
9. Bajaj, Jitendra & M. D. Srinivas. *Annam Bahu Kurvita: Recollecting the Indian Discipline of Growing and Sharing Food in Plenty*. Madras: Centre for Policy Studies, 1996.
10. Parameswaran, S. *The Golden Age of Indian Mathematics*. Kochi: Swadeshi Science Movement.
11. Somayaji, D. A. *A Critical Study of Ancient Hindu Astronomy*. Dharwar: 1972.
12. Sen, S. N. & K. V. Sarma eds. *A History of Indian Astronomy*. New Delhi, 1985.
13. Rao, S. Balachandra. *Indian Astronomy: An Introduction*. Hyderabad: Universities Press, 2000.
14. Bose, D. M. et. al. *A Concise History of Science in India*. New Delhi: 1971.
15. Bajaj, Jitendra & M. D. Srinivas. *Indian Economy and Polity*. Chennai: Centre for Policy Studies.
16. Bajaj, Jitendra & M. D. Srinivas. *Timeless India, Resurgent India*. Chennai: Centre for Policy Studies.
17. Joshi, Murlī Manohar. *Science, Sustainability and Indian National Resurgence*. Chennai: Centre for Policy Studies, 2008.
18. *The Cultural Heritage of India*. Kolkata: Ramakrishna Mission Institute of Culture.

* The syllabus and the study material in use herein has been developed out of a 'summer programme' offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

15HUM242 THE MESSAGE OF BHAGAVAD GITA 2 0 0 2

Unit 1

Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha.

Arjuna Vishada Yoga: Arjuna's Anguish and Confusion – Symbolism of Arjuna's Chariot.

Sankhya Yoga: Importance of Self-knowledge – Deathlessness: Indestructibility of Consciousness – Being Established in Wisdom – Qualities of a Sthita-prajna.

Unit 2

Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3

Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine – Inner Qualities of a True Devotee.

Gunatraya Vibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattva – Going Beyond the Three Gunas – Description of a Gunatheetha.

TEXTBOOKS / REFERENCES:

1. Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust, 2002.
2. Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust, 2001.

15HUM243 THE MESSAGE OF THE UPANISHADS 2 0 0 2

OBJECTIVES: To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

Unit 1

An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

Unit 2

The challenge of human experience & problems discussed in the Upanishads – the True nature of Man – the Moving power of the Spirit – The Message of Fearlessness – Universal Man - The central problems of the Upanishads – Ultimate reality – the nature of Atman - the different manifestations of consciousness.

Unit 3

Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada's answers to the six questions in Prasnopanishad.

REFERENCES:

1. *The Message of the Upanishads* by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. *Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama*
3. *Indian Philosophy* by Dr. S. Radhakrishnan, Oxford University Press
4. *Essentials of Upanishads* by R L Kashyap, SAKSI, Bangalore
5. *Upanishads in Daily Life*, Sri Ramakrishna Math, Myslapore.
6. *Eternal stories of the Upanishads* by Thomas Egenes and Kumuda Reddy
7. *Upanishad Ganga series – Chinmaya Creations*

15HUM244 UNDERSTANDING SCIENCE OF FOOD AND NUTRITION 1 0 2 2

Unit 1 Food and Food Groups

Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food poisoning, food safety standards.

Cookery Practicals - Balanced Diet

Unit 2 Nutrients and Nutrition

Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

Practicals - Traditional Foods

Unit 3 Introduction to Food Biotechnology

Future foods - Organic foods and genetically modified foods, Fortification of food value addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

Practicals - Value added foods

TEXTBOOKS:

1. N. Shakuntalamanay, M. Shadaksharaswamy, "Food Facts and principles", New age international (P) Ltd, publishers, 2005.
2. B. Srilakshmi, "Dietetics", New age international (P) Ltd, publishers, 2010.

REFERENCE BOOKS:

1. B. Srilakshmi, "Food Science", New age international (P) Ltd, publishers, 2008.
2. "Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Council of Medical Research, ICMR, 2010.

15JAP230 PROFICIENCY IN JAPANESE LANGUAGE (LOWER) 1 0 2 2

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

15JAP231 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER) 1 0 2 2

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

15KAN101 KANNADA I 1 0 2 2

OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Unit 1

Adalitha Kannada: bhashe, swaropaa, belavanigeya kiru parichaya
Paaribhaashika padagalu
Vocabulary Building

Unit 2

Prabhandha – Vyaaghra Geethe - A. N. Murthy Rao
 Prabhandha – Baredidi...baredidi, Baduku mugiyuvudilla allige...- Nemi Chandra
 Paragraph writing – Development: comparison, definition, cause & effect
 Essay – Descriptive & Narrative

Unit 3

Mochi – Bharateepriya
 Mosarina Mangamma – Maasti Venkatesh Iyengar
 Kamalaapurada Hotelnalli – Panje Mangesh Rao
 Kaanike – B. M. Shree
 Geleyanobbanige bareda Kaagada – Dr. G. S. Shivarudrappa
 Moodala Mane – Da. Ra. Bendre
 Swathanryada Hanate – K. S. Nissaar Ahmed

Unit 4

Letter Writing - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5

Reading Comprehension; nudigattu, gaadegalu

Speaking Skills: Prepared speech, pick and speak

REFERENCES:

1. H. S. Krishna Swami Iyengar – Adalitha Kannada – Chetana Publication, Mysuru
2. A. N. Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste
3. Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication
4. Sanna Kathegalu - Prasaranga, Mysuru University , Mysuru
5. B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu
6. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.
7. Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

15KAN111**KANNADA II****1 0 2 2**

OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Unit 1

Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2

Nanna Hanate - Dr. G. S. Shivarudrappa

Mankuthimmana Kaggada Ayda bhagagalu – D. V. Gundappa (Padya Sankhye 5, 20, 22, 23, 25, 44, 344, 345, 346, 601)
 Ella Marethiruvaga - K. S. Nissaar Ahmed
 Saviraru Nadigalu – S Siddalingayya

Unit 3

Sayo Aata – Da. Ra. Bendre

Unit 4

Sarva Sollegala turtu Maha Samelana - Beechi
 Swarthakkaagi Tyaga - Beechi

Unit 5

Essay writing: Argumentative & Analytical
 Précis writing

REFERENCES:

1. H. S. Krishnaswami Iyengar – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
3. Shrikanth - Mankuthimmana Kagga – Taatparya – Sri Ranga Printers & Binders
4. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house
5. Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication
6. Beechi – Sahukara Subbamma – Sahitya Prakashana

15MAL101**MALAYALAM I****1 0 2 2**

OBJECTIVES: To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Unit 1

Ancient poet trio: Adhyatmaramayanam,
 Lakshmana Swanthanam (valsa soumitre... mungikidakayal), Ezhuthachan -
 Medieval period classics – Jnanappana (kalaminnu... vilasangalingane), Poonthanam

Unit 2

Modern Poet trio: Ente Gurunathan, Vallathol Narayana Menon - Critical analysis of the poem.

Unit 3

Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer -
 Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4

Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

Unit 5

Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettillatha Malayalam

Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. P. K. Balakrishnanan, *Thunjan padhanangal*, D. C. Books, 2007.
2. G. Balakrishnan Nair, *Jnanappanayum Harinama Keerthanavum*, N. B. S, 2005.
3. M. N. Karasseri, *Basheerinte Poonkavanam*, D. C. Books, 2008.
4. M. N. Vijayan, *Marubhoomikal Pookkumbol*, D. C. Books, 2010.
5. M. Thomas Mathew, *Lavanyanubhavathinte Yukthisasthram*, National Book Stall, 2009.
6. M. Leelavathy, *Kavitha Sahityacharitam*, National Book Stall, 1998.
7. Thayattu Sankaran, *Vallathol Kavithapadhamam*, D. C. Books, 2004.

15MAL111**MALAYALAM II****1 0 2 2**

OBJECTIVES: To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Unit 1

Ancient poet trio: Kalayanasougandhikam, (kallum marangalun... namukkennarika vrikodara) Kunjan Nambiar - critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Translated by Attor Krishna Pisharody).

Unit 2

Modern / romantic / contemporary poetry: Manaswini, Changampuzha Krishna Pillai – Romanticism – modernism.

Unit 3

Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

Unit 4

Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.

Unit 5

Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam

Writing - a. Expansion of ideas; b. Précis Writing ; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. Narayana Pillai. P. K, *Sahitya Panchanan. Vimarsanathrayam, Kerala Sahitya Academy, 2000*
2. Sankunni Nair. M. P, *Chathravum Chamaravum, D. C. Books, 2010.*
3. Guptan Nair. S, *Asthiyude Pookkal, D. C Books. 2005*
4. Panmana Ramachandran Nair, *Thettillatha Malayalam, Sariyum thettum etc., D. C. Book, 2006.*
5. M. Achuthan, *Cherukatha-Innale, innu, National Book Stall, 1998.*
6. N. Krishna Pillai, *Kairaliyude Katha, National Book Stall, 2001.*

15MAT111**CALCULUS AND MATRIX ALGEBRA****2 1 0 3****Unit 1 Calculus**

Graphs: Functions and their Graphs. Shifting and Scaling of Graphs.

Limit and Continuity: Limit (One-Sided and Two-Sided) of Functions. Continuous Functions, Discontinuities, Monotonic Functions, Infinite Limits and Limit at Infinity.

Unit 2 Differentiation and its Applications: Derivative of a function, non differentiability, Intermediate Value Property, Mean Value Theorem, Extreme Values of Functions, Monotonic Functions, Concavity and Curve Sketching, Integration: Definite Integrals, The Mean Value Theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques.

Unit 3 Matrix Algebra

Review: System of linear Equations, linear independence

Eigen values and Eigen vectors: Definitions and Properties, Positive definite, Negative Definite and Indefinite Matrices, Diagonalization and Orthogonal Diagonalization, Quadratic form, Transformation of Quadratic Form to Principal axes, Symmetric and Skew Symmetric Matrices, Hermitian and Skew Hermitian

Matrices and Orthogonal Matrices Iterative Methods for the Solution of Linear Systems, Power Method for Eigen Values and Eigen Vectors.

TEXTBOOKS:

1. 'Calculus', G. B. Thomas Pearson Education, 2009, Eleventh Edition.
2. 'Advanced Engineering Mathematics', Erwin Kreyszig, John Wiley and Sons, 2015, Tenth Edition.

REFERENCE BOOKS:

1. 'Calculus', Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, 3rd Edition, 2002.
2. 'Advanced Engineering Mathematics', by Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.

15MAT121 VECTOR CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS 3 1 0 4

Unit 1

Vector Differentiation: Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field. (Sections: 9.4, 9.5, 9.6, 9.9, 9.10, 9.11)

Vector Integration: Line Integral, Line Integrals Independent of Path. Green's Theorem in the Plane (Sections: 10.1, 10.2, 10.3, 10.4).

Unit 2

Surface Integral: Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke's Theorem. (Sections: 10.5, 10.6, 10.7, 10.9)

First Order Differential Equations: First Order ODE, Exact Differential Equations and Integrating Factors (Sections 1.1 and 1.4).

Unit 3

Second Order Differential Equations: Homogeneous and non-homogeneous linear differential equations of second order (Review), Modelling: Free Oscillations,

Euler-Cauchy Equations, Solution by Undetermined Coefficients, Solution by the Method of Variation of Parameters (Sections 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.10).

System of Order Differential Equations: Basic Concepts and Theory, Constant Coefficient systems – Phase Plane method, Criteria for Critical Points, Stability. (Sections 4.1 – 4.4).

TEXTBOOK:

'Advanced Engineering Mathematics', Erwin Kreyszig, John Wiley and Sons, Tenth Edition, 2015.

REFERENCE BOOKS:

1. 'Advanced Engineering Mathematics', Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.
2. 'Calculus', G. B. Thomas Pearson Education, 2009, Eleventh Edition.
3. 'Calculus', Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, 3rd Edition, 2002.

15MAT204 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 2 1 0 3

Unit 1

Laplace Transform: Laplace Transforms, Inverse Transforms, Linearity, Shifting, Transforms of Derivatives and Integrals, Differential Equations, Unit Step Function, Second Shifting Theorem, Dirac's Delta Function. Differentiation and Integration of Transforms.

Unit 2

Convolution, Integral Equations, Partial Fractions, Differential Equations, Systems of Differential Equations. (Sections: 6.1 to 6.7)

Fourier Series: Fourier series, Half range Expansions, Parseval's Identity, Fourier Integrals, Fourier integral theorem. Sine and Cosine Integrals. (Sections: 11.1 -11.3)

Unit 3

Fourier Transforms: Sine and Cosine Transforms, Properties, Convolution theorem. (Sections: 11.1 -11.3, 11.7-11.9)

Partial Differential Equations: Basic Concepts, Modeling; Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series, Heat Equation; Solution by Fourier Series. (Sections: 12.1-12.5)

TEXTBOOK:

Advanced Engineering Mathematics, E Kreyszig, John Wiley and Sons, Ninth Edition, 2012.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.
2. Larry C. Andrews and Bhimson. K. Shivamoggi, The Integral Transforms for Engineers, Spie Press, Washington, 1999.
3. J. L. Schiff, The Laplace Transform, Springer, 1999.

15MAT212 COMPLEX ANALYSIS AND NUMERICAL METHODS 2 1 0 3

Unit 1

Complex Numbers, Complex Plane, Polar Form of Complex Numbers. Powers and

Roots, Derivative. Analytic Functions, Cauchy - Riemann Equations, Laplace Equation, Conformal mapping, Exponential Function, Trigonometric Functions, Hyperbolic Functions, Logarithms, General Power, Linear Fractional Transformation.

Unit 2

Complex Line Integral, Cauchy Integral Theorem, Cauchy Integral Formula, Derivatives of Analytic Functions. Power Series, Taylor Series and Maclaurin Series. Laurent Series, Zeros and Singularities, Residues, Cauchy Residue Theorem, Evaluation of Real Integrals using Residue Theorem.

Unit 3

Numerical Methods: Solution of Equations by iteration methods. Interpolations.

Numerical Integration and Differentiation. (Sections: 19.1-19.5)

TEXTBOOK:

Advanced Engineering Mathematics, E Kreyszig, John Wiley and Sons, Ninth Edition, 2012.

REFERENCE BOOK:

1. S. Ponnusamy, *Foundations of Complex Analysis, 2nd Edition, Narosa Publishing House, 2005.*
2. R. Roopkumar, *Complex Analysis, Pearson Education, 2014, Chennai.*

15MAT214**PROBABILITY AND STATISTICS****2 1 0 3****Unit 1**

Probability Concepts: Review of probability concepts - Bayes' Theorem.

Random Variable and Distributions: Introduction to random variable – discrete and continuous distribution functions - mathematical expectations – moment generating functions and characteristic functions. Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (MGF, mean, variance and simple problems) – Chebyshev's theorem

Unit 2

Sampling Distributions: Distributions of Sampling Statistics, Chi-square, t and F distributions (only definitions and use). Central Limit Theorem.

Theory of estimation: Point Estimation, Unbiased estimator - Maximum Likelihood Estimator - Interval Estimation.

Unit 3

Testing of Hypothesis: Large and small sample tests for mean and variance – Tests based on Chi-square distribution.

TEXTBOOK:

Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, (2005) John Wiley and Sons Inc.

REFERENCE BOOKS:

1. J. Ravichandran, "Probability and Random Processes for Engineers", First Edition, IK International, 2015.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, *Probability and Statistics for Engineers and Scientists, 8th Edition (2007), Pearson Education Asia.*
3. Sheldon M Ross, *Introduction to Probability and Statistical Inference, 6th Edition, Pearson.*
4. A. Papoulis, and Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", Fourth Edition, McGraw Hill, 2002.

15MEC100**ENGINEERING DRAWING - CAD****2 0 2 3**

Introduction, Drawing Instruments and their uses, Layout of the Software, standard tool bar / menus, navigational tools. Co-ordinate system and reference planes. Creation of 2 dimensional environment. Selection of drawing size and scale. Commands and Dimensioning.

Orthographic Projections: Introduction, Planes of projection, reference line. Projection of points in all the four quadrants. Projection of straight lines, Projection of Plane Surfaces, and Projection of Solids in first angle projection system.

TEXTBOOK:

Bhat N. D. and Panchal V. M, "Engineering Drawing Plane and Solid Geometry", 42e, Charoatar Publishing House, 2010

REFERENCES:

1. James D. Bethune, "Engineering Graphics with AutoCAD", Pearson Education, 2014
2. K. R. Gopalakrishna, "Engineering Drawing", 2014, Subhas Publications
3. Narayan K. L. and Kannaiah P, *Engineering Drawing, SciTech Publications, 2003*

15MEC180**WORKSHOP A****0 0 2 1****1. Product Detailing Workshop**

Disassemble the product of sub assembly - Measure various dimensions using measuring instruments - Free hand rough sketch of the assembly and components - Name of the components and indicate the various materials used - Study the functioning of the assembly and parts - Study the assembly and components design for compactness, processing, ease of assembly and disassembly - Assemble the product or subassembly.

2. Pneumatics and PLC Workshop

Study of pneumatic elements - Design and assembly of simple circuits using basic

pneumatic elements - Design and Assembly of simple circuits using Electro-pneumatics.
Study of PLC and its applications - Simple programming using ladder diagrams.

3. Sheet Metal Workshop

Study of tools and equipments - Draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray etc.) Fabrication of components using small shearing and bending machines - Riveting and painting practice.

4. (a) Welding Workshop

Study of tools and equipments - Study of various welding methods - Arc welding practice and demonstration of gas welding and cutting.

(b) Demo and practice Workshop

Fitting: Study of tools, practice in chipping, filing and making joints.

Carpentry: Study of tools, planning practice and making joints

REFERENCE:

Concerned Workshop Manual

15PHY100

PHYSICS

3 0 0 3

Unit 1 Review of Classical Physics and dual nature of Waves / particle

Review of Kinematics, Force, Newton's Laws, Linear Momentum, Work, Energy, Power, Angular Motion - Kinematics and Mechanics, Angular momentum Torque, Conservation laws (linear and angular).

Particle properties of waves: Photoelectric effect, quantum theory of light, X-ray diffraction, Compton effect, pair production. Wave properties of particles: Waves, De Broglie waves, Group velocity and phase velocity, uncertainty principle.

Unit 2 Atomic Structure and Quantum Mechanics

Atomic Structure: Various models of atom, Atomic Spectra, Energy Levels, Correspondence Principle, Nuclear Motion, Atomic Excitation, and Rutherford Scattering.

Quantum Mechanics: Introduction - wave equation - Schrodinger's equation (time dependent and independent) - expectation values, operators, Eigen value (momentum and energy) - 1D potential box (finite and infinite) - tunnel effect - harmonic oscillator.

Unit 3 Statistical Mechanics and Solid State Physics

Statistical Mechanics: Classical Distribution - Maxwell's Boltzmann-Molecular energies

of an ideal gas - most probable speed. Quantum Statistics - Bose-Einstein and Fermi-Dirac. Applications - Black Body Radiation, Specific heat of solids, free electrons in metals, Electron energy.

Solid State Physics: Types of solids, Crystallography, Bonds - Ionics, Covalent, and Van der Waals, Band Theory and energies, Semiconductor Devices, and Superconductivity.

TEXTBOOK:

"Concept of Modern Physics", Arthur Beiser, Tata-McGraw Hill, edition.

REFERENCE BOOK:

"Principles of Physics" by Halliday, Resnick and Walker, 9th edition

15PHY181

PHYSICS LAB.

0 0 2 1

Young's Modulus - Non Uniform Bending

Newton's Rings

Laser - Determination of Wavelength and Particle Size Determination

Spectrometer

Carey Foster's Bridge

Rigidity Modulus - Tensional Pendulum

Viscosity of Liquid by Stokes's method

Ultrasonic Interferometer

Hysteresis - B H curve

15PHY230

ADVANCED CLASSICAL DYNAMICS

3 0 0 3

Unit 1

Introduction to Lagrangian dynamics

Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert's principle and Lagrange's equation, simple applications of the Lagrangian formulation, variational principles and Lagrange's equations, Hamilton's principles, derivation of Lagrange's equations from Hamilton's principle, conservation theorems and symmetry properties.

Unit 2

Central field problem

Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.

Unit 3

Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneuvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

TEXTBOOKS:

1. H. Goldstein, *Classical Mechanics*, Narosa Publishing House, New Delhi, 1980, (Second Edition)
2. H. Goldstein, Charles Poole, John Safko, *Classical Mechanics*, Pearson education, 2002 (Third Edition)
3. Howard D. Curtis, *Orbital Mechanics for Engineering Students*, Elsevier, pp.475 - 543
4. Anderson John D, *Modern Compressible flow*, McGraw Hill.

REFERENCE BOOKS:

1. D. A. Walls, *Lagrangian Mechanics*, Schaum Series, McGraw Hill, 1967.
2. J. B. Marion and S. T. Thornton, *Classical dynamics of particles and systems*, Ft. Worth, TX: Saunders, 1995.

15PHY233**BIOPHYSICS AND BIOMATERIALS****3 0 0 3**

OBJECTIVE: To equip the students with the knowledge on different kinds of biomaterials and other medical need, basic research, and to provide an over view of theory and practice of bio materials.

Unit 1

Quantum mechanics – Schrodinger's time dependent and independent equations – Pauli's exclusion principle – ionization energy – electron affinity – chemical binding – electro negativity and strong bonds - secondary bonds – inter atomic potential for strong bonds and weak bonds – bond energies – spring constants – free energy – internal energy – reaction kinetics.

Definition and classification of bio-materials, mechanical properties, visco-elasticity, wound-healing process, Application of biomaterial for the human body, body response to implants, blood compatibility. Implementation problems - inflammation, rejection, corrosion, structural failure. Surface modifications for improved compatibility.

Unit 2

Bioceramics, Biopolymers, Metals, ceramics and composites in medicine: Properties, applications, suitability & modifications required for certain applications.

X-ray diffraction and molecular structure – Nuclear Magnetic Resonance – scanning tunneling microscope – Atomic force microscopy – optical tweezers – patch clamping – molecular dynamics – potential energy contour tracing – SEM – TEM – spectroscopy methods differential thermal analysis, differential thermo gravimetric analysis – NDT methods.

Unit 3

Materials for bone and joint replacement – dental metals and alloys – ceramic – bioinert – bioactive ceramics – polymers - dental restorative materials – dental amalgams – cardiovascular materials – cardiac prosthesis; vascular graft materials – cardiac pacemakers – cardiac assist devices – materials for ophthalmology contact lens – intraocular materials – materials for drug delivery.

TEXTBOOKS AND REFERENCES:

1. Rodney M J Cotterill, *Biophysics an introduction*, John Wiley & sons Ltd., NY, 2002
2. Vasantha Pattabhi and N.Gautham, *Biophysics*, Alpha science International Ltd. UK, 2002.
3. Jonathan Black, *Biological Performance of Materials, Fundamentals of Biocompatibility*, Marcel Dekker Inc., New York, 1992.
4. D. F. Williams (ed.), *Material Science and Technology - A comprehensive treatment*, Vol.14, *Medical and Dental Materials*, VCH Publishers Inc., New York, 1992.
5. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, *Instrumental Methods of Analysis*, CBS Publishers, New Delhi, 1986.

15PHY234 INTRODUCTION TO COMPUTATIONAL PHYSICS 3 0 0 3**Unit 1**

Differentiation: Numerical methods, forward difference and central difference methods, Lagrange's interpolation method.

Integration: Newton - cotes expression for integral, trapezoidal rule, Simpsons's rule, Gauss quadrature method.

Unit 2

Solution of differential equations: Taylor series method, Euler method, Runge Kutta method, predictor-corrector method.

Roots of equations: Polynomial equations, graphical methods, bisectional method, Newton-Raphson method, false position method.

Unit 3

Solution of simultaneous equations: Elimination method for solving simultaneous linear equations, Gauss elimination method, pivotal condensation method, Gauss-seidal iteration method, Gauss Jordan method, matrix inversion method.

Eigen values and Eigen vectors of matrix: Determinant of a matrix, characteristic equation of a matrix, eigen values and eigen vectors of a matrix, power method.

TEXTBOOK:

Rubin H Landau & Manuel Jose Paez Mejia, "Computational Physics", John Wiley & Sons

REFERENCES:

Suresh Chandra, "Computer Applications in Physics", Narosa Publishing House, New Delhi
M Hijroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

15PHY238 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3**Unit 1**

Conducting materials: The nature of chemical bond, crystal structure Ohm's law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it's consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it's applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

TEXTBOOK:

A J Decker, "Electrical Engineering materials", PHI, New Delhi, 1957.

REFERENCES:

1. A J Decker, "Solid State Physics", Prentice Hall, Englewood Cliffs, N J 1957.
2. C Kittel, "Introduction to solid state Physics", Wilely, New York, 1956 (2nd edition).
3. Allison, "Electronic Engineering materials and Devices, Tata Mc Graw Hill
4. F K Richtmyer E H Kennard, John N Copper, "Modern Physics", Tata Mc Graw Hill, 1995 (5th edition).

15PHY239 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3**Unit 1**

Electrostatics: Coulombs law and electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of sheet of charge, electric flux density, Gauss's law, application of Gauss's law, Maxwell's first equation.

Poisson's and Laplace's equations: The potential field of a point charge, potential field of a system of charges: conservative property, potential gradient, the dipole.

Unit 2

Poisson's and Laplace's equations, uniqueness theorem, examples of the solution of Laplace's equation, solution of Poisson's equation.

Electromagnetics: Biot Savart law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, derivation of steady magnetic field laws, Faraday's laws, displacement current, Maxwells equations in point and integral form, retarded potentials

Unit 3

Electromagnetic waves: EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio.

Transmission line equations, line parameters - examples, dipole radiation, retarded potentials, electric dipole radiation.

TEXTBOOK:

William H Hayt, "Engineering Electromagnetics", Tata Mc Graw Hill, New Delhi, 2002 (5th edition).

REFERENCES:

1. David J Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India, New Delhi, 1999 (2nd edition).
2. J D Jackson, "Classical Electrodynamics", Wiley Eastern, 2004 (2nd edition).
3. B. Chakraborty, "Principles of Electrodynamics", Books and Allied Publishers, 2002

15PHY240 ELECTRONIC MATERIALS SCIENCE 3 0 0 3**Unit 1**

Types of bonding in solids, Crystallography and crystalline defects: Crystallography, Directions and planes, Crystalline defects, line defects, Planar defects, Volume defects; Binary and Ternary Phase Diagrams: Lever rule and phase rule, Eutectic, peritectic and Eutectoid systems, Applications of Phase diagrams; Basic Quantum Physics - atomic structure, Use of band theory and occupation statistics to explain existence and basic properties of metals and nonmetals. Working of Semiconductor Devices using band diagrams and their electrical characteristics: pn junctions, BJT, MOSFET.

Unit 2

Use of band theory to explain optoelectronic properties of materials and optoelectronic devices: LEDs, Solar Cells, Lasers, pin diodes, photodiodes; Magnetic properties and Superconductivity: Magnetic moments and Magnetic Permeability, types of magnetism, saturation magnetization, magnetic domains, soft and hard magnetic materials, superconductivity and its origin, Giant Magneto Resistance, Josephson effect, Energy band diagrams and Magnetism, Applications of magnetic materials - Magnetic recording materials, etc.

Unit 3

Optical Properties of Materials: Reflection, Refraction, Dispersion, Refractive Index, Snells Law, Light Absorption and Emission, Light Scattering, Luminescence, Polarization, Anisotropy, Birefringence; Dielectric Properties of Materials: Polarization and Permittivity, Mechanisms of polarization, dielectric properties - dielectric constant, dielectric loss, dielectric strength and breakdown, Piezoelectricity, Ferroelectricity, and Pyroelectricity, Dielectric Materials

TEXTBOOK:

S. O. Kasap, *Principles of Electronic Materials and Devices*, 2006, 3rd edition, Tata McGraw Hill.

REFERENCE:

D. Jiles: *Introduction to the Electronic Properties of Materials*, Chapman & Hall. 1994.

15PHY241 LASERS IN MATERIAL PROCESSING 3 0 0 3**Unit 1**

Basic optical theory: Nature of electromagnetic radiation, interaction of radiation with matter, reflection, refraction, polarization, laser fundamentals, laser beam characteristics, beam quality (laser cavity modes), Q-switching, mode locking, continuous wave, types of lasers, energy and power.

Laser interaction with materials: Optical properties of materials, laser interaction with metals, insulators, semiconductors, polymers and biological materials.

Laser surface treatment: Introduction to laser surface hardening, laser surface melting, laser surface alloying, laser surface cladding, laser cleaning. Laser ablation: mechanisms (photothermal, photophysical and photochemical), mask projection techniques, laser micro and nano structuring.

Unit 2

Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting, factors controlling cut quality and kerf width. Laser assisted drilling.

Laser welding: Introduction to laser keyhole welding and contrast with conduction limited welding, applications,

Direct laser fabrication (DLF): Laser sintering & laser rapid manufacturing, comparison with rapid prototyping. Main potential and limitations of DLF for direct fabrication and for the production of novel engineering materials and structures.

Unit 3

Laser forming: Mechanisms involved, including thermal temperature gradient, buckling, upsetting. Applications in alignment and straightening and in rapid production processes.

Scope of application of laser materials processing: focused on industrial application of laser in materials processing including laser welded tailored blanks.

Laser safety: Introduction to safety procedures in the use of lasers, including wavelength effects and laser safety standards.

REFERENCES:

1. Steen, W M, *Laser Material Processing (3rd Edition)*, Springer Verlag, 2003, ISBN 1852336986.
2. Silvest, W T, *Laser Fundamentals*, Cambridge University Press, 1998, ISBN 0521556171.
3. J. F. Ready, D. F. Farson. *LIA Handbook of Laser Materials Processing Laser Institute of America*, 2001.
4. M. von Allmen. *Laser-Beam Interactions with Materials*, Springer, 1987
5. D. Bauerle. *Laser Processing and Chemistry*, Springer, 2000
6. W. W. Duley, *UV lasers: effects and applications in materials science*, Cambridge University, Press, Cambridge ; New York, 1996.
7. J. Dutta Majumdar, and I. Manna, *Laser Material Processing, Sadhana*, Vol. 28, Year: 2003, 495-562.

15PHY243 MICROELECTRONIC FABRICATION 3 0 0 3**Unit 1**

Introduction to semiconductor fabrication – scaling trends of semiconductor devices; crystal structure of semiconductor materials, crystal defects, phase diagrams and

solid solubility; physics of Czochralski growth of single crystal silicon, Bridgeman method for GaAs, float zone process; diffusion science: Ficks laws of diffusion, atomistic models of diffusion, dopant diffusion mechanisms; kinetics of thermal oxidation, Deal-Grove Model, nitridation of silicon, structure and characteristics of oxides, effect of dopants on oxidation kinetics, dopant redistribution;

Unit 2

Physics of ion implantation: Coulombic scattering and projected range, nuclear and electronic stopping, channeling, implantation damage removal, dopant activation by rapid thermal annealing; principles of optical lithography – optics and diffraction, light sources and spatial coherence, physics of pattern transfer, nodulation transfer function; chemistry of lithographic processes: organic and polymeric photoresists, developing and exposure, contrast; principles of non-optical lithography: electron beam, X-ray lithography, resists, sources; etching: Chemistry of wet etching, plasma physics, chemistry of plasma etching and reactive ion etching; chemical mechanical polishing.

Unit 3

Vacuum science: Kinetic theory of gases, gas flow and conductance, vacuum pumps and seals; deposition of thin films: physics of sputtering and evaporation, step coverage and morphology of deposited films, chemical vapor deposition: chemical equilibrium and law of mass action, gas flow and boundary layers, types of CVD, plasma assisted CVD; thermodynamics of epitaxial growth, types molecular beam epitaxy, isolation and contact formation – LOCOS and trench, silicides, metallization with Al and Cu; process Integration: CMOS, bipolar process flow.

TEXTBOOK:

Stephen Campbell, *Science and Engineering of Microelectronic Fabrication*, Oxford University Press, 2001

REFERENCES:

1. S K Gandhi, *VLSI Fabrication Principles*, John Wiley & Sons, 1994
2. Gary S May and Simon M Sze, *Fundamentals of Semiconductor Fabrication*, John Wiley, 2003.
3. S Wolfe, *Silicon Processing for the VLSI Era*, Lattice Press, 1998.

15PHY245 NUCLEAR ENERGY: PRINCIPLES AND APPLICATIONS 3 0 0 3

Unit 1

Basics: Atomic theory, nuclear composition, sizes and masses of nuclei, binding energy, radioactive decay, radioactive chains. Nuclear reactions, transmutation of elements, conservation laws, neutron cross sections, interaction of charged particles and gamma radiation with matter.

Fission and fusion: The fission process, energetic of fission, byproducts of fission, energy from nuclear fuels. Fusion reactions, electrostatic and nuclear forces,

thermo nuclear reactions in plasma. Energetics of fusion. Comparison of fusion and fission reactions.

Unit 2

Neutron chain reactions and nuclear power: Criticality and multiplication, factors governing the multiplication, neutron flux and reactor power, reactor types and reactor operations. Methods of heat transmission and removal, steam generation and electric power generation, waste heat disposal.

Unit 3

Breeder reactors and fusion reactors: The concept of breeding nuclear fuel, isotope production and consumption, fast breeder reactor, breeding and uranium sources. Technical problems in the functioning of fusion reactor, requirements for practical fusion reactors, magnetic confinement, inertial confinements and other fusion concepts. Prospects of fusion power.

Radiation protection and waste disposal: Biological effects of radiation, radiation dose units, protective measures, internal exposure, and radon problem. Nuclear fuel cycle and waste classification, spent fuel storage and transportation, high level waste disposal, low level waste disposal.

TEXTBOOK:

Raymond L Murray, *Nuclear Energy: An Introduction to the Concepts, Systems and Applications of Nuclear Processes*, Butterworth-Heimann-Elsevier Inc (2009)

REFERENCES:

1. David Bodansky, *Nuclear Energy: principles, practices and prospects*, Springer Verlag
2. S K Rajput, *Nuclear Energy*, Mahaveer & Sons (2009)

15PHY247

PHOTOVOLTAICS

3 0 0 3

Unit 1

Introduction to semiconductors: Semiconductors: concept of electron and holes, conduction in semiconductors and concentration of charge carriers in semiconductors. Direct and indirect band gap semiconductors (quantum mechanical treatment). Extrinsic semiconductors: n-type, p-type & compensation doping, carrier concentration; PN junction - concept of bands at PN junction, junction under forward and reverse biases (conceptual).

Unit 2

Optical Processes: Optical absorption, Photoelectric Effect, Beer-Lambert law (Qualitative). Wavelength to band gap relation. Generation of electron-hole pairs. Recombination processes - direct and indirect recombination, other recombination processes - Shockley Reed Hall recombination, Auger recombination.

Solar Cell – Principle: Introduction & history of Solar cells. Constituents of solar radiations (Solar Spectrum). Separation of electrons and holes. Transport of charge carriers - diffusion & drift of carriers, continuity equation, field current, diffusion current, total charge current.

Unit 3

Solar Cell – Properties: Measurement of solar cell parameters - short circuit current, open circuit voltage, fill factor, efficiency. Optical losses, electrical losses, surface recombination velocity, quantum efficiency - external and internal, I-V characteristics of Solar cells. Fabrication and design of Solar cells. Performance enhance: Enhance absorption, Reduce series resistance, surface recombination.

Advanced Solar cell technologies (III Generation): Alternatives to conventional Si based solar cells - Thin film solar cells, Hetero junction solar cells, Tandem solar cells: material properties, fabrication and stability (includes nano scale devices). Organic solar cells.

TEXTBOOK:

Wenham S R, "Applied Photovoltaics", 2nd ed., Earthscan Publications Ltd., (2007).

REFERENCES:

1. Peter Würfel, "Physics of Solar Cells", 2nd Ed., Wiley VCH (2005).
2. S O Kasap, "Principles of Electronic Materials and Devices", McGraw-Hill, New York (2005).

15PHY248 PHYSICS OF LASERS AND APPLICATIONS 3 0 0 3

Unit 1

Review of some basic concepts and principle of laser.

Introduction to light and its properties: Reflection, refraction, interference, diffraction and polarization. Photometry – calculation of solid angle. Brewster's law. Snell's law and, its analysis.

Introduction to LASERS: Interaction of radiation with matter - induced absorption, spontaneous emission, stimulated emission. Einstein's co-efficient (derivation). Active material. Population inversion – concept and discussion about different techniques. Resonant cavity.

Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of $\Delta\omega$ FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser

and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3

Types of LASERS

Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO₂ LASER - principle, construction, working and application.

Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:

Holography: Principle, types, intensity distribution, applications. laser induced fusion. Harmonic generation. LASER spectroscopy. LASERS in industry: Drilling, cutting and welding. Lasers in medicine: Dermatology, cardiology, dentistry and ophthalmology.

REFERENCES:

1. William T Silfvast, "Laser Fundamentals", Cambridge University Press, UK (2003).
2. B B Laud, "Lasers and Non linear Optics", New Age International (P) Ltd., New Delhi.
3. Andrews, "An Introduction to Laser Spectroscopy (2e)", Ane Books India (Distributors).
4. K R Nambiar, "Lasers: Principles, Types and Applications", New Age International (P) Ltd., New Delhi.
5. T Suhara, "Semiconductor Laser Fundamentals", Marcel Dekker (2004).

15PHY250 QUANTUM PHYSICS AND APPLICATIONS 3 0 0 3

Unit 1

Review of Planck's relation, De-Broglie relation and uncertainty principle basic concepts - Schrodinger equation: probabilistic interpretation of wave function, one dimension problems – particle in a box, harmonic oscillator, potential barrier and tunneling. Hydrogen atom, electrons in a magnetic field - X-ray spectra - periodic table.

Unit 2

Bosons and Fermions - symmetric and antisymmetric wavefunctions - elements of statistical physics: density of states, fermi energy, Bose condensation - solid state physics: Free electron model of metals, elementary discussion of band theory and applications to semiconductor devices.

Einstein coefficients and light amplification - stimulated emission - optical pumping and laser action.

Unit 3

Operation of He-Ne laser and Ruby laser - laser in science and Industry - Raman effect and applications.

Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces – fission - principle of nuclear reactor - elementary particles - leptons, hadrons, quarks, field bosons - the standard model of elementary particles.

TEXTBOOK:

A Beiser, Perspectives in Modern Physics, McGraw Hill

REFERENCES;

1. Arthur Beiser, *Concepts of Modern Physics, 6th Edition Tata McGraw Hill*
2. S H Patil, *Elements of Modern Physics, Tata Mc Graw Hill, 1989*
3. K Krane, *Modern Physics, John Weiley, 1998.*
4. K Thyagarajan, A K Ghatak, *Lasers-Theory and Applications, Macmillan, 1991*

15PHY251**THIN FILM PHYSICS****3 0 0 3****Unit 1**

Introduction and preparation of thin film: Difference between thin and thick film. Appreciation of thin film technology in modern era. Deposition technology: Physical methods, chemical methods, other new techniques, vacuum technology: Vacuum pumps & pressure gauges.

Defects in thin film: General concepts, nature of defect, microscopic defect and dislocation. Boundary defects. Defect and energy states - donor acceptor levels, trap and recombination centers, excitons, phonons.

Unit 2

Thin film analysis: Structural studies: XRD and electron diffraction. Surface studies: electron microscopy studies on film (SEM, TEM, AFM) Film composition: X-ray photoelectron spectroscopy (XPS), Rutherford Back Scattering spectroscopy (RBS) and Secondary Ion Mass Spectroscopy (SIMS).

Properties of thin film: Optical behaviors: transmission, reflection, refractive index, photoconductivity, and photoluminescence.

Unit 3

Electrical behaviors: sheet resistivity, electron mobility and concentration, Hall effect, conduction in MIS structure.

Mechanical behaviors: stress, adhesion, hardness, stiffness.

Applications of thin films in various fields: Antireflection coating, FET, TFT, resistor, thermistor, capacitor, solar cell, and MEMs fabrication of silicon wafer: Introduction. preparation of the silicon wafer media, silicon wafer processing steps.

TEXTBOOK:

K. L. Chopra, "Thin Film Phenomena", McGraw Hill, New York, 1969

REFERENCES:

1. L. T. Meissel and R. Glang, *"Hand book of thin film technology", McGraw Hill, 1978.*
1. A. Goswami, *"Thin Film Fundamentals", New Age International, Pvt Ltd, New Delhi, 1996.*
2. O. S. Heavens *"optical Properties of Thin Films" by, Dover Publications, Newyork 1991.*
3. Milton Ohring *"Materials science of thin films deposition and structures", Academic press, 2006.*
4. Donald L. Smith *"Thin Film deposition principle and Practice", McGraw Hill international Edition, 1995.*

15PHY331**ASTRONOMY****3 0 0 3****Unit 1**

Astronomy, an Observational Science: Introduction - Indian and Western Astronomy – Aryabhata - Tycho Brahe's observations of the heavens - The laws of planetary motion - Measuring the astronomical unit - Isaac Newton and his Universal Law of Gravity - Derivation of Kepler's third law - The Sun - The formation of the solar system - Overall properties of the Sun - The Sun's total energy output - Black body radiation and the sun's surface temperature - The Fraunhofer lines in the solar spectrum and the composition of the sun - Nuclear fusion - The proton-proton cycle - The solar neutrino problem - The solar atmosphere: photosphere, chromosphere and corona - Coronium - The solar wind- The sunspot cycle - Solar The Planets - Planetary orbits - Orbital inclination - Secondary atmospheres - The evolution of the earth's atmosphere.

Unit 2

Observational Astronomy

Observing the Universe - The classic Newtonian telescope - The Cassegrain telescope - Catadioptric telescopes - The Schmidt camera - The Schmidt-Cassegrain telescope - The Maksutov-Cassegrain telescope - Active and adaptive optics -

Some significant optical telescopes - Gemini North and South telescopes - The Keck telescopes - The South Africa Large Telescope (SALT) - The Very Large Telescope (VLT) - The Hubble Space Telescope (HST) - The future of optical astronomy - Radio telescopes - The feed and low noise amplifier system - Radio receivers - Telescope designs - Large fixed dishes - Telescope arrays - Very Long Baseline Interferometry (VLBI) - The future of radio astronomy - Observing in other wavebands – Infrared – Sub-millimetre wavelengths - The Spitzer space telescope - Ultraviolet, X-ray and gamma-ray observatories - Observing the universe without using electromagnetic radiation - Cosmic rays - Gravitational waves.

Unit 3

The Properties of Stars: Stellar luminosity - Stellar distances - The hydrogen spectrum - Spectral types - Spectroscopic parallax - The Hertzsprung–Russell Diagram - The main sequence - The giant region - The white dwarf region - The stellar mass – luminosity relationship - Stellar lifetimes - Stellar Evolution – White dwarfs - The evolution of a sun-like star - Evolution in close binary systems – Neutron stars and black holes - The discovery of pulsars - Black holes: The Milky Way - Open star clusters - Globular clusters - Size, shape and structure of the Milky Way – observations of the hydrogen line - Other galaxies - Elliptical galaxies - Spiral galaxies - The Hubble classification of galaxies - The universe - The Cepheid variable distance scale - Starburst galaxies - Active galaxies - Groups and clusters of galaxies – Superclusters - The structure of the universe - Cosmology – the Origin and Evolution of the Universe - The expansion of the universe - The cosmic microwave background - The hidden universe: dark matter and dark energy - The Drake equation - The Search for Extra Terrestrial Intelligence (SETI) - The future of the universe.

TEXTBOOK:

Introduction to Astronomy and Cosmology, Ian Morison, Wiley (UK), 2008

REFERENCE BOOK:

Astronomy: Principles and Practice, 4th Edition (Paperback), D. C. Clarke, A. E. Roy, Institute of Physics Publishing

15PHY333**CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY****3 0 0 3****Unit 1**

Introduction

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement
Basic concepts – excitons, effective mass, free electron theory and its features, band structure of solids. Bulk to nano transition – density of states, potential well - quantum confinement effect – weak and strong confinement regime. Electron confinement in infinitely deep square well, confinement in two and three dimension. Blue shift of band gap - effective mass approximation. Vibrational properties of solids - phonon confinement effect and presence of surface modes.

Unit 2

Tools for characterization:

Structural – X-ray diffraction, transmission electron microscope, scanning tunneling microscope, atomic force microscope. Optical - UV – visible absorption and photoluminescence techniques, Raman spectroscopy.

Nanoscale materials – properties and applications:

Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

Unit 3

Field emission and shielding – computers – fuel cells – chemical sensors – catalysis – mechanical reinforcement. Quantum dots and Magnetic nanomaterials – applications.

Nanoelectronics and nanodevices:

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

TEXTBOOKS:

1. Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, *Nanoscale Science and Technology*, John Wiley and Sons Ltd 2004.
2. W. R. Fahrner (Ed.), *Nanotechnology and Nanoelectronics*, Springer 2006.

15PHY335**MEDICAL PHYSICS****3 0 0 3****Unit 1**

Ultrasonics - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiography – resolution – speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.

X-rays – production – intensity - hard and soft X-rays - characteristic and continuous X-ray spectrum - attenuation of x-rays by hard and soft tissues –

resolution – contrast X-ray imaging - fluoroscopy modes of operation - image quality - fluoroscopy suites - radiation dose – computed-aided tomography (CAT).

Unit 2

Nuclear medicine - principles of nuclear physics – natural radioactivity, decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Nuclear Isomerism, internal conversion - ideal energy for radiotherapy based on interactions. Radionuclide used in medicine - radioisotope production – dosimetry – safety - radiation hazards – PET.

Nuclear magnetic resonance physics - magnetic moment – magnetization – relaxation - nuclear magnetic resonance spectroscopy.

Unit 3

Nuclear magnetic resonance imaging (MRI) – principle - chemical shift - magnetic resonance signal induction and relaxation - pulse sequencing and spatial encoding.

Laser physics – characteristics of laser radiation, mode locking - power of laser radiation - lasers as diagnostic tool - lasers in surgery - laser speckle, biological effects, laser safety management.

TEXTBOOK:

Hendee W R and Rittenour E E, "Medical Imaging Physics", John Wiley & Sons, Chicago, 2001.

REFERENCE BOOKS:

1. Glasser. O. Medical Physics Vol.1, 2, 3 Book Publisher Inc Chicago, 1980
2. Jerraold T Bush Berg et al, The essentials physics of medical imaging, Lippincott Williams and Wilkins (2002)

15PHY338 PHYSICS OF SEMICONDUCTOR DEVICES 3 0 0 3

Unit 1

Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects.

Electrical conductivity: Classical free electron theory – assumptions, drift velocity, mobility and conductivity, drawbacks. quantum free electron theory – Fermi energy, Fermi factor, carrier concentration. Band theory of solids – origin of energy bands, effective mass, distinction between metals, insulators and semiconductors.

Unit 2

Theory of semiconductors: Intrinsic and extrinsic semiconductors, band structure of semiconductors, carrier concentration in intrinsic and extrinsic semiconductors,

electrical conductivity and conduction mechanism in semiconductors, Fermi level in intrinsic and extrinsic semiconductors and its dependence on temperature and carrier concentration. Carrier generation - recombination, mobility, drift-diffusion current. Hall effect.

Theory of p-n junctions – diode and transistor: p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

Unit 3

Bipolar junction transistor, p-n-p and n-p-n transistors: principle and modes of operation, current relations. V-I characteristics. Fundamentals of MOSFET, JFET. Heterojunctions – quantum wells.

Semiconducting devices: Optical devices: optical absorption in a semiconductor, e-hole generation. Solar cells – p-n junction, conversion efficiency, heterojunction solar cells. Photo detectors – photo conductors, photodiode, p-i-n diode. Light emitting diode (LED) – generation of light, internal and external quantum efficiency.

Modern semiconducting devices: CCD - introduction to nano devices, fundamentals of tunneling devices, design considerations, physics of tunneling devices.

TEXTBOOKS:

1. C Kittel, "Introduction to Solid State Physics", Wiley, 7th Edn., 1995.
2. D A Neamen, "Semiconductor Physics and Devices", TMH, 3rd Edn., 2007.

REFERENCES:

1. S M Sze, "Physics of Semiconductor Devices", Wiley, 1996.
2. P Bhattacharya, "Semiconductor Opto- Electronic Devices", Prentice Hall, 1996.
3. M K Achuthan & K N Bhat, "Fundamentals of Semiconductor Devices", TMH, 2007.
4. J Allison, "Electronic Engineering Materials and Devices", TMH, 1990.

15PHY532 ASTROPHYSICS 3 0 0 3

Unit 1

Historical introduction: Old Indian and western – astronomy - Aryabhata, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system – satellites, planets, comets, meteorites, asteroids.

Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler's laws - and derivations from Newton's laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2

Stellar astronomy: H-R diagram, color-magnitude diagram - main sequence - stellar evolution – red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwarzschild radius - stellar masses Saha–Boltzman equation - derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3

Galactic astronomy: Distance measurement - red shifts and Hubble's law – age of the universe, galaxies – morphology - Hubble's classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.

Relativity: Special theory of relativity - super-luminal velocity - Minkowski space - introduction to general theory of relativity – space - time metric, geodesics, space-time curvature. Advance of perihelion of Mercury, gravitational lens.

Cosmology: Cosmic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

REFERENCES:

1. "Textbook of Astronomy and Astrophysics with elements of Cosmology", V. B. Bhatia, Narosa publishing 2001.
2. William Marshall Smart, Robin Michael Green "On Spherical Astronomy", (Editor) Carroll, Bradley W Cambridge University Press ,1977
3. Bradley W.Carroll and Dale A. Ostlie. "Introduction to modern Astrophysics" Addison-Wesley, 1996.
4. Bradley W.Carroll and Dale A. Ostlie, "An Introduction to Modern Astrophysics" Addison-Wesley Publishing Company,1996
5. 'Stellar Astronomy' by K. D Abhayankar.
6. 'Solar Physics' by K. D Abhayankar.

15PHY535

EARTH'S ATMOSPHERE

3 0 0 3

Unit 1

Earth's atmosphere: overview and vertical structure. Warming the earth and the atmosphere: temperature and heat transfer; absorption, emission, and equilibrium; incoming solar energy. Air temperature: daily variations, controls, data, human comfort, measurement. Humidity, condensation, and clouds: circulation of water in the atmosphere; evaporation, condensation, and saturation; dew and frost; fog.

Unit 2

Cloud development and precipitation: atmospheric stability & determining stability, cloud development and stability, precipitation processes, collision and coalescence, precipitation types, measuring precipitation. Air pressure and winds: atmospheric pressure, pressure measurement, surface and upper-air charts, surface winds, winds and vertical air motions, measuring and determining winds. Atmospheric circulations: scales of atmospheric motion, eddies, local wind systems, global winds, global wind patterns and the oceans.

Unit 3

Air masses, fronts, and mid-latitude cyclones. Weather forecasting: acquisition of weather information, forecasting methods and tools, forecasting using surface charts. Thunderstorms: ordinary (air-mass) thunderstorms, mesoscale convective complexes, floods and flash floods, distribution of thunderstorms, lightning and thunder. Tornadoes: severe weather and Doppler radar, waterspouts.

Unit 4

Hurricanes (cyclones, typhoons): tropical weather; anatomy, formation, dissipation and naming of hurricanes. Air pollution: a brief history, types and sources, factors that affect air pollution, the urban environment, acid deposition. Global climate: climatic classification; global pattern of climate.

Unit 5

Climate change: possible causes; carbon dioxide, the greenhouse effect, and recent global warming. Light, colour, and atmospheric optics: white and colours, white clouds and scattered light; blue skies and hazy days, red suns and blue moons; twinkling, twilight, and the green flash; the mirage; halos, sundogs, and sun pillars; rainbows; coronas and cloud iridescence.

TEXTBOOK:

C. Donald Ahrens: *Essentials of Meteorology: An Invitation to the Atmosphere* (6th edition), Brooks-Cole, 2010.

REFERENCE:

Frederick K. Lutgens & Edward J. Tarbuck: *The Atmosphere, An Introduction to Meteorology* (11th Edition), Prentice Hall, 19 January, 2009

15PHY536

EARTH'S STRUCTURE AND EVOLUTION

3 0 0 3

Unit 1

Introduction: geologic time; earth as a system, the rock cycle, early evolution, internal structure & face of earth, dynamic earth. Matter and minerals: atoms, isotopes and radioactive decay; physical properties & groups of minerals; silicates,

important nonsilicate minerals, resources. Igneous rocks: magma, igneous processes, compositions & textures; naming igneous rocks; origin and evolution of magma, intrusive igneous activity, mineral resources and igneous processes.

Unit 2

Volcanoes and volcanic hazards: materials extruded, structures and eruptive styles, composite cones and other volcanic landforms, plate tectonics and volcanic activity. Weathering and soils: earth's external processes; mechanical & chemical weathering, rates; soils, controls of formation, profile, classification, human impact, erosion, weathering and ore deposits. Sedimentary rocks: the importance and origins of sedimentary rocks; detrital & chemical sedimentary rocks, coal, converting sediment into sedimentary rock; classification & structures, nonmetallic mineral & energy resources. Metamorphism and metamorphic rocks: metamorphic textures, common metamorphic rocks, metamorphic environments & zones.

Unit 3

Mass wasting: gravity, mass-wasting and landform development, controls and triggers, classification of mass-wasting processes, slump, rockslide, debris flow, earthflow, slow movements. Running water: hydrologic cycle, running water, streamflow, work of running water, stream channels, base level and graded streams, shaping stream valleys, depositional landforms, drainage patterns, floods and flood control. Groundwater: importance and distribution, water table, factors influencing storage and movement, springs, wells, artesian wells, environmental problems, hot springs and geysers, geothermal energy, geologic work. Glaciers and glaciation: formation and movement, erosion & landforms, deposits, other effects, causes. Deserts and wind: distribution and causes, geologic processes, basin and range, wind transport, erosion & deposits.

Unit 4

Shorelines: coastal zone, waves & erosion, sand movement, shoreline features & stabilization; erosion problems along U.S. coasts, hurricanes, coastal classification, tides. Earthquakes and earth's interior: faults, seismology, locating the source of an earthquake, measuring intensity, belts and plate boundaries, destruction, damage east of the Rocky Mountains, earthquake prediction, earth's interior. Plate tectonics: continental drift, divergent boundaries, convergent boundaries, transform fault boundaries, testing the plate tectonics model, the breakup of Pangaea, measuring plate motion, what drives plate motions, plate tectonics in the future.

Unit 5

Origin and evolution of the ocean floor: continental margins, features of deep-ocean basins, anatomy of oceanic ridge, oceanic ridges and seafloor spreading, nature of oceanic crust, continental rifting, destruction of oceanic lithosphere. Crustal deformation and mountain building: structures formed by ductile & brittle

deformation, mountain building at subduction zones, collisional mountain belts, fault-block mountains, vertical movements of the crust. Geologic time: time scales, relative dating, correlation of rock layers; dating with radioactivity, the geologic time scale, difficulties in dating. Earth's evolution: birth of a planet, origin of the atmosphere and oceans, Precambrian (formation of continents); Phanerozoic (formation of modern continents & earth's first life); Paleozoic (life explodes); the Mesozoic (dinosaurs); Cenozoic era (mammals). Global climate change: climate & geology, climate system, detecting change; atmospheric basics & heating the atmosphere; natural & human causes; carbon dioxide, trace gases, and climate change; climate-feedback mechanisms, aerosols, some possible consequences.

TEXTBOOK:

Frederick K. Lutgens, Edward J. Tarbuck & Dennis G. Tasa: *Essentials of Geology* (11th edition), Prentice Hall, 8 March, 2012.

REFERENCE:

Graham R. Thompson & Jonathan Turk: *Introduction to Physical Geology* (2nd Edition), Brooks Cole, 23 June, 1997.

15PHY540

NON-LINEAR DYNAMICS

3 0 0 3

Unit 1

Introduction: examples of dynamical systems, driven damped pendulum, ball on oscillating floor, dripping faucet, chaotic electrical circuits.

One-dimensional maps: the logistic map, bifurcations in the logistic map, fixed points and their stability, other one-dimensional maps.

Non-chaotic multidimensional flows: the logistic differential equation, driven damped harmonic oscillator, Van der Pol equation, numerical solution of differential equations.

Dynamical systems theory: two-dimensional equilibrium and their stability, saddle points, are contraction and expansion, non-chaotic three-dimensional attractors, stability of two-dimensional maps, chaotic dissipative flows.

Unit 2

Lyapunov exponents: for one- and two-dimensional maps and flows, for three-dimensional flows, numerical calculation of largest Lyapunov exponent, Lyapunov exponent spectrum and general characteristics, Kaplan-Yorke dimension, numerical precautions.

Strange attractors: general properties, examples, search methods, probability of chaos and statistical properties of chaos, visualization methods, basins of attraction, structural stability.

Bifurcations: in one-dimensional maps and flows, Hopf bifurcations, homoclinic and heteroclinic bifurcations, crises.

Hamiltonian chaos: Hamilton's equations and properties of Hamiltonian systems, examples, three-dimensional conservative flows, symplectic maps.

Unit 3

Time-series properties: examples, conventional linear methods, a case study, time-delay embeddings.

Nonlinear prediction and noise-reduction: linear predictors, state-space prediction, noise reduction, Lyapunov exponents from experimental data, false nearest neighbours.

Fractals: Cantor sets, curves, trees, gaskets, sponges, landscapes.

Calculations of fractal dimension: similarity, capacity and correlation dimensions, entropy, BDS statistic, minimum mutual information, practical considerations.

Fractal measure and multifractals: convergence of the correlation dimension, multifractals, examples and numerical calculation of generalized dimensions.

Non-chaotic fractal sets: affine transformations, iterated functions systems, Mandelbrot and Julia sets.

Spatiotemporal chaos and complexity: examples, cellular automata, coupled map lattices, self-organized criticality.

TEXTBOOK:

Hilborn, R. C., *Chaos and Nonlinear Dynamics, Second Edition, Oxford University Press, 2000*

REFERENCES:

1. Sprott, J. C., *Chaos and Time Series Analysis, Oxford University Press, 2003*
2. Strogatz, S. H., *Nonlinear Dynamics and Chaos, Westview Press, 2001*
3. Solari, H. G., Natiello, M. A., and Mindlin, G. B., *Nonlinear Dynamics, Overseas Press (India) Private Limited, 2005*

15PHY542

OPTOELECTRONIC DEVICES

3 0 0 3

Unit 1

Properties of semiconductors: Electron and photon distribution: density of states, effective mass and band structure, effect of temperature and pressure on band gap, recombination processes.

Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence, electroluminescence, radioactive and non-radiative recombination, wave trains.

Unit 2

Semiconductor light-emitting diodes: Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency, semiconductor heterojunctions, double-heterostructure LEDs.

Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes.

Unit 3

Semiconductor light modulators: Modulating light (direct modulation of laser diodes, electro-optic modulation, acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching)

Semiconductor light detectors: I-V characteristics of a p-n diode under illumination, photovoltaic and photoconductive modes, load line, photocells and photodiodes, p-i-n photodiodes, responsivity, noise and sensitivity, photodiode materials, electric circuits with photodiodes, solar cells.

REFERENCES:

1. *Semiconductor Optoelectronics: Physics and Technology, Jasprit Singh, McGraw Hill Companies, ISBN 0070576378*
2. *Optoelectronics, E. Rosencher and B. Vinter, Cambridge Univ. Press, ISBN 052177813.*
3. *Photonic Devices, J. Liu, Cambridge Univ. Press, ISBN 0521551951.*
4. *Semiconductor Optoelectronic Devices 2nd Edition, P. Bhattacharya, Prentice Hall, ISBN 0134956567.*
5. *Physics of Semiconductor Devices, by S. M. Size (2nd Edition, Wiley, New York, 1981).*

15SAN101

SANSKRIT I

1 0 2 2

OBJECTIVES: To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1

Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns

and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit.
Practical classes in spoken Sanskrit

Unit 2

Verbs- Singular, Dual and plural – First person, Second person, Third person.

Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi - karthariprayoga

Unit 3

Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4

Selected slokas from Valmiki Ramayana, Kalidasa's works and Bhagavad Gita.

Ramayana – chapter VIII - verse 5, Mahabharata - chapter 174, verse -16,
Bhagavad Gita – chapter - IV verse 8, Kalidasa's Sakuntalam Act IV – verse 4

Unit 5

Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. Praveshaha; Publisher: Samskrita bharti, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar press

15SAN111**SANSKRIT II****1 0 2 2**

OBJECTIVES: To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1

Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2

Ktavatu Pratyaya, Upasargas, Ktvanta, Tumunnanta, Lyabanta.
Three Lakaras – brief introduction, Lot lakara.

Unit 3

Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashithas, riddles.

Unit 4

Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas - Bhagavad Gita – chapter - II verse 47, chapter - IV verse 7, chapter - VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa's Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5

Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. Praveshaha; Publisher: Samskrita bharti, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar Press.

15SSK221**SOFT SKILLS I****1 0 2 2**

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work - environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words. Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level II: Time speed and distance; work time problems;

Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.

Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptogrihms.

TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. *Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Quantitative Aptitude by R. S. Aggarwal, S. Chand*
6. *Quantitative Aptitude – Abijith Guha, TMH.*
7. *Quantitative Aptitude for Cat - Arun Sharma. TMH.*

REFERENCES:

1. *Books on GRE by publishers like R. S. Aggrawal, Barrons, Kaplan, The Big Book, and Nova.*
 2. *More Games Teams Play, by Leslie Bendaly, McGraw Hill Ryerson.*
 3. *The BBC and British Council online resources*
 4. *Owl Purdue University online teaching resources*
- www.the-grammarbook.com - online teaching resources
www.englishpage.com- online teaching resources and other useful websites.

15SSK321

SOFT SKILLS II

1 0 2 2

Professional grooming and practices: Basics of corporate culture, key pillars of business etiquette. Basics of etiquette: Etiquette – socially acceptable ways of

behaviour, personal hygiene, professional attire, cultural adaptability. Introductions and greetings: Rules of the handshake, earning respect, business manners. Telephone etiquette: activities during the conversation, conclude the call, to take a message. Body Language: Components, undesirable body language, desirable body language. Adapting to corporate life: Dealing with people.

Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.

Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.

Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.

Spacial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. *Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Quick Maths – Tyra.*
6. *Quicker Arithmetic – Ashish Aggarwal*
7. *Test of reasoning for competitive examinations by Thorpe.E. TMH*
8. *Non-verbal reasoning by R. S. Aggarwal, S. Chand*

REFERENCES:

1. Books on GRE by publishers like R. S. Aggarwal, Barrons, Kaplan, The Big Book, and Nova
 2. More Games Teams Play, by Leslie Bendaly, McGraw Hill Ryerson.
 3. The BBC and British Council online resources
 4. Owl Purdue University online teaching resources
- www.thegrammarbook.com - online teaching resources
www.englishpage.com- online teaching resources and other useful websites.

15SSK331**SOFT SKILLS III****1 0 2 2**

Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation / knowledge about the company, professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, critical reasoning: A course on verbal reasoning. Listening comprehension advanced: An exercise on improving listening skills.

Reading comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Problem solving level IV: Geometry; Trigonometry; Heights and distances; Co-ordinate geometry; Mensuration.

Specific training: Solving campus recruitment papers, national level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In mathematics). Lateral thinking problems. Quick checking of answers techniques; Techniques on elimination of options, estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

TEXTBOOKS:

1. A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.
2. Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
3. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
4. The Hard Truth about Soft Skills, by Amazone Publication.
5. Data Interpretation by R. S. Aggarwal, S. Chand
6. Logical Reasoning and Data Interpretation – Niskit K Sinkha
7. Puzzles – Shakuntala Devi
8. Puzzles – George J. Summers.

REFERENCES:

1. Books on GRE by publishers like R. S. Aggarwal, Barrons, Kaplan, The Big Book, and Nova.
 2. More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.
 3. The BBC and British Council online resources
 4. Owl Purdue University online teaching resources
- www.thegrammarbook.com - online teaching resources
www.englishpage.com- online teaching resources and other useful websites.

15SWK230**CORPORATE SOCIAL RESPONSIBILITY****2 0 0 2****Unit 1**

Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2

CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3

Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

REFERENCES:

1. Corporate Governance, Ethics and Social Responsibility, V Bala Chandran and V Chandrasekaran, PHI Learning Private Limited, New Delhi 2011.
2. White H. (2005) Challenges in evaluating development effectiveness: Working paper 242, Institute of Development Studies, Brighton.

3. UNDP (nd) *Governance indicators: A users guide*. Oslo: UNDP
4. Rao, Subbha (1996) *Essentials of Human Resource Management and Industrial Relations*, Mumbai, Himalaya
5. Rao, V. S. L. (2009) *Human Resource Management*, New Delhi, Excel Books,

15SWK231**WORKPLACE MENTAL HEALTH****2 0 0 2****Unit 1**

Mental Health – concepts, definition, Bio-psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person. Work place – definition, concept, prevalence of mental health issues in the work place, why invest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

Unit 2

Mental Health Issues in the Workplace: Emotions, Common emotions at the workplace, Mental Health issues - Anger, Anxiety, Stress & Burnout, Depression, Addictions – Substance and Behavioural, Psychotic Disorders - Schizophrenia, Bipolar Disorder, Personality disorders. Crisis Situations - Suicidal behavior, panic attacks, reactions to traumatic events. Stigma and exclusion of affected employees. Other issues –work-life balance, Presenteeism, Harassment, Bullying, Mobbing. Mental Health First Aid - Meaning. Case Study, Activity.

Unit 3

Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being - corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals-talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case Study, Activity.

REFERENCES:

1. American Psychiatric Association. "Diagnostic and statistical manual of mental disorders: DSM-IV 4th ed." www.terapiacognitiva.eu/dwl/dsm5/DSM-IV.pdf
2. American Psychiatric Association. (2000) www.ccsa.ca/Eng/KnowledgeCentre/OurDatabases/Glossary/Pages/index.aspx.
3. Canadian Mental Health Association, Ontario "Workplace mental health promotion, A how to guide" wmhp.cmhaontario.ca/

4. Alberta Health Services *Mental Health Promotion*. (2012). *Minding the Workplace: Tips for employees and managers together*. Calgary: Alberta Health Services. <http://www.mentalhealthpromotion.net/resources/minding-the-workplace-tips-for-employees-and-managers-together.pdf>
5. Government of Western Australia, Mental Health Commission. (2014) "Supporting good mental health in the work place." http://www.mentalhealth.wa.gov.au/Libraries/pdf_docs/supporting_good_mental_health_in_the_workplace_1.sflb.ashx
6. Mental Health Act 1987 (India) www.tnhealth.org/mha.htm
7. Persons with disabilities Act 1995 (India) socialjustice.nic.in
8. The Factories Act 1948 (India) www.caaa.in/Image/19ulabourlawshb.pdf

15TAM101**TAMIL I****1 0 2 2**

Objectivs : To introduce the students to different literature - Sangam literature, Epics, Bhakthi literature and modern literature. To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

Unit 1

Sangam literature : Kuṟuntokai; (2, 6,8,40 pāṭalkaḷ) – puṛaṇāṅṁṟu (74,112,184,192 pāṭalkaḷ) – tirukkuraḷ (iṟaimāṭci, amaiccu)

Unit 2

Epic literature: cilappatikāram maturaik kāṇṭam (vaḷakkuṛaikkātai 50-55)

Spiritual Literature: tiruppāvai(3,4) – tēvāram (mācilvīṇaiyum)

Medieval Literature: bāratīyar kaṇṇaṇ pāṭṭu (eṇ viḷaiyāṭṭu piḷḷai) – bāratitacaṇ kuṭumpaviḷakku (tāyiṇ tālāṭṭu).

Unit 3

Novel: Jeyakāntaṇ "kuru piṭam"

Essay: Aṇṇā "ē tāḷnta tamiḷakamē"

Unit4

Tiruñāṇa campantar – ūruṇāvukkaracar – cuntarar – māṇikka vācakar – āṇṭāḷ – tirumūlar – kulacēkara āḷvār – cīttalaic cāttaṇṇār toṭarpāṇa ceytikal, mēṟkōḷkaḷ marṟrum ciṟappu peyarkaḷ

Unit 5

Tamil Grammar: Col vakaikaḷ - vēṛṛumai urupukaḷ - vallinam mikumiṭam

mikāyiṭam - canti(puṇarcci) - ilakkaṇakkuṛippu.

Practical skills: Listening, speaking, writing and reading

Textbooks:

- அறநா “ē tāḷnta tamilaḷakamē” nakkīraṇ paḷḷikēṣaṇs.
- Caktitācaṇ cupramaṇiyāṇ “nalla kuṟuntokai mūlamumuraiyum” mullai patippakam, 2008.
- <http://www.Tamilvu.Org/libirary/libindex.Htm>.
- jeyakāntaṇ “kuru pīṭam” mīṇāṭci puttaka nilaiyam, 1971.
- Nā.Pārttacāraṇi “puṟṇāṇṇūṟṟuc ciṟukataikaḷ” tamilaḷ puttakālayam, 1978, 2001
- Poṇ maṇimāṟaṇ “aṭṭōṇ tamilaḷ ilakkaṇam “aṭṭōṇ paḷḷiṣiṇ kurūp, vaṇciyūr, tīruvaṇantapuram, 2007.
- puliyūrḷ kēcikaṇ “kuṟuntokai mūlamum uraiyum” cārāta patippakam, 2010.
- Puliyūrḷ kēcikaṇ “puṟṇāṇṇūṟṟu” srīceṇṇakā patippakam, 2010

15TAM111

TAMIL I I

1 0 2 2

Objectives: To learn the history of Tamil literature. To analyze different styles, language training, to strengthen the creativity in communication, Tamil basic grammar, Computer and its use in Tamil language.

Unit 1

The history of Tamil literature: Nāṭṭupuraṇ pāṭalkaḷ, kataikkaḷ, paḷamoḷikaḷ -

ciṟukataikaḷ tōṟṟamum vaḷarcciyum,

ciṟṟilakkiyaṇkaḷ: Kaliṇkattup paraṇi (pōṟpāṭiyatu) - mukḷūṭaṟ paḷḷu 35.

Kāppiyaṇkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiṇciṟuṇ kāppiyaṇkaḷ toṭarpāṇa ceytikaḷ.

Unit 2

tīṇai ilakkiyamum nīṭiyilakkiyamum - patiṇeṇkīḷkkaṇakku nūḷkaḷ toṭarpāṇa pīra ceytikaḷ - tirukkuṟaḷ (aṇṟu, paṇṟu, kalvi, oḷukkam, naṭṟu, vāymai, kēḷvi, ceynaṇṟi, periyaraituṇakkoṭal, viḷippuṇarvu peṇṟa atikarattil uḷḷa ceytikaḷ.

Aṟaṇūḷkaḷ: Ulakanṭi (1-5) – ēḷāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittaṟ pāṭalkaḷ (āṇantak kaḷippu –1,4,6,7,8), maṟṟum akappēy cittaṟ pāṭalkaḷ(1-5).

Unit 3

tamilaḷ ilakkaṇam: Vākkiya vakaikaḷ – taṇviṇai piṟaviṇai – nēṟkkūṟṟu ayaṟḷkūṟṟu

Unit 4

tamilaḷa aṟiṇarkaḷiṇ tamilaḷ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṇ,

paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṇ,

na.Piccaimūrtti, akilaṇ, kalki, jī.Yū.Pōp, vīramāmuṇivar, aṇṇā, paritīmāṟ kalaiṇar,

maṟaimalaiyaṭikaḷ.

Unit 5

tamilaḷ moḷi āyvil kaṇiṇi payaṇpāṭu. - Karuttu parimāṟram - viḷampara

moliyamaippu – pēccu - nāṭakam paṭaiṟṟu - ciṟukatai, katai, putiṇam paṭaiṟṟu.

Textbooks:

- <http://www.tamilvu.trg/libirary/libindex.htm>.
- http://www.tunathamizh.com/2013/07/blog0post_24.html
- Mu.Varatarācaṇ “tamilaḷ ilakkiya varalāṟu” cāhitya akāṭemi paḷḷikēṣaṇs, 2012
- na.Vāṇamamalai “paḷaṇkatakāḷum, paḷamoḷikaḷum” niyu ceṇcūri puttaka veliyiṭṭakam, 1980,2008
- nā.Vāṇamamalai, “tamilaḷar nāṭṭupāṭalkaḷ” niyū ceṇcūri puttaka veliyiṭṭakam 1964,2006
- poṇ maṇimāṟaṇ “aṭṭōṇ tamilaḷ ilakkaṇam “aṭṭōṇ paḷḷiṣiṇ kurūp, vaṇciyūr, tīruvaṇantapuram, 2007.