

SYLLABI

CHY100

CHEMISTRY

3 0 0 3

Unit 1

Water Technology: Hardness – units of hardness – alkalinity - dissolved oxygen. Boiler feed water – boiler compounds – boiler problems - internal conditioning - external conditioning – zeolite and ion exchange process. Municipal water treatment – desalination by RO and electro dialysis.

Phase rule: Phase rule – statement and explanation of terms – one component system – water-vapor-ice – thermal analysis – condensed phase rule - Two component system – Ag – Pb – simple Eutectic – compound formation - Cu – Au solid solution - Ellingham diagram and its application.

Unit 2

Spectroscopy: Significance of spectroscopy as analytical tool – Electromagnetic spectrum, intensities of spectral lines and the Beer-Lamberts law. Vibration of Diatomic molecules - Energy levels - Principles of selection rules - Introduction to IR spectrum – vibrational frequency – fundamental vibrations – IR instrumentation and its applications – Electronic spectra – types of electronic transition – chromophore concept – absorption and intensity shifts – conjugated dienes - solvent effects – UV Instrumentation and its applications. Principles of H-NMR – number of signals – chemical shift – splitting of the signals.

Chemistry of corrosion and its control: Chemical and electro chemical corrosion – Pilling Bed worth ratio – forms of corrosion.

Unit 3

Electrochemical series - galvanic series - corrosion potential – corrosion current – rate of corrosion – units of corrosion - rate determination – weight loss method. Corrosion control - cathodic and anodic protection.

Advanced Engineering Materials: Introduction to Nanoscience and Technology – significance of nano materials – methods of synthesis – Carbon Nanotubes - synthesis – properties and applications. Conducting polymers - mechanism of conduction - applications. Organic LEDs - their functioning - advantages and disadvantages over conventional LEDs - their commercial uses. Liquid crystals – positional and orientation order - classification of liquid crystals - requirement for substance to exhibit liquid crystalline state - chemical constitution - identification of liquid crystals - electro-optic effect in liquid crystals, application of liquid crystals.

TEXTBOOKS:

1. Gordon M Barrow, "Physical Chemistry", 5th edition, Tata McGraw-Hill, (2007).
2. Jain P C & Monika Jain, "Engineering Chemistry", Dhanpatrai Publishing Co Ltd, New Delhi, (2005).

REFERENCES:

1. Fontana and Mars G, "Corrosion Engineering", 3rd edition, McGraw hill, (1987).
2. Robert M Silverstein and Francis X Webster, "Spectrometric Identification of Organic Compounds", 6th edition, Wiley & Sons, (2006).
3. Charles P Poole, Jr Franck J Owens, "Introduction to Nanotechnology", Wiley Interscience, (2003).
4. Chandrasekhar A, "Liquid crystals", Cambridge University Press, Cambridge, UK, (1992).
5. CNR Rao, "UV & Visible Spectroscopy – Chemical Application", Butter Worths.
6. CNR Rao, "IR Spectroscopy – Chemical Application", Academic Press

CHY181

CHEMISTRY LAB.

0 0 3 1

1. Estimation of Hardness of sample water.
 2. Estimation of alkalinity of sample water.
 3. Estimation of Kinetics of Ion Exchange reactions.
 4. Estimation of HCl and CH₃COOH by conductometric titration.
 5. Estimation of Fe²⁺ by potentiometric titration.
 6. Phase diagram of two component system.
 7. Determination of Corrosion rate and Inhibitor efficiency by weight loss method.
 8. One step preparation of simple organic/inorganic compound.
 9. Determination of molecular weight of polymer by viscosity method.
 10. Adsorption by Activated charcoal method.
- (Any 9 experiments of the above list)

Experiments for Demonstration

11. Desalination by Reverse osmosis.
12. Estimation of Dissolved oxygen of sample water.
13. Spectrophotometric analysis of trace element (Fe) in water.

CHY250

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).

CHY251 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

(Grothers - 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.

CHY252 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 - ferro magnets and ferrimagnets. One-dimensional conductors - quasi one and two-dimensional super conductor. Fullerides - paramagnetic conductors and superconductors. Electron transfer salt based ferro magnets: nitroxide, metallocene and ferric magnet-based ferro magnets - 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), NH_4NO_3 , ammonium perchlorate (AP), NH_4ClO_4 , ammonium dinitramide (AND), $\text{NH}_4\text{N}(\text{NO}_2)_2$, hydrazinium nitroformate (HNF), $\text{N}_2\text{H}_5\text{C}(\text{NO}_2)_3$ 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", Dhanpatrai & 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).

CHY253**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".

CHY254**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).

REFERENCE:

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).

CHY255**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).

CHY256**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. Iafrate, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, (2003).

- Balzani V, Credi A, Venturi M, "Molecular devices and machines- A journey in to the Nanoworld" Wiley VCH (2003).
- Bharat Bhushan, "Hand book of Nanotechnology", Springer, (2004).

CHY257 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 Rather, Allan S Hoffman, "Biomaterials Science - An introduction to materials in Medicine", Elsevier academic press, (2004).

REFERENCES:

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

CHY258 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:

- Gary W. VanLoon and Stephen J. Duffy, "Environmental Chemistry", Oxford University Press, (2000).
- 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 VP and Ritu, "Environmental Chemistry", Pragati Prakashan, Meerut, (2000).

CHY259 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.

Electro analytical 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 JR, "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).

CHY260 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.

TEXT BOOKS:

1. E. L. Eliel, "Stereochemistry of Carbon Compounds", Mc Graw-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 LL, "Organic Chemistry: Stereochemistry and the Chemistry of Natural Products", 5th edition, ELBS, (2000).

CHY261 UNIT PROCESSES IN ORGANIC SYNTHESIS 3 0 0 3

Unit 1

Application of Thermodynamics in Organic Unit Processes: free energy, bond energies and entropy. Concepts of aromaticity - Huckel's rule - anisotropy. Intermediates - carbocations, carbanions, free radicals, carbenes and nitrenes. Reagents in organic synthesis: Grignard reagents, Organolithium reagents, selenium

dioxide, chromium trioxide, lead tetraacetate, sodium borohydride, lithium borohydride, sulphur carbanions.

Unit 2

Organic reactions and mechanisms: Substitution reaction - aliphatic nucleophilic, aromatic electrophilic and nucleophilic substitution. Elimination and addition reaction - Halogenation .Nitration – aromatic nitration – mechanism – Technical nitration – mixed acid nitration. Hydrocarbon synthesis and Hydroformylation (Catalysis) Various catalysts used – technology of Fischer - Tropsch operation – methanation - Hydroformylation, Monsanto acetic acid, Wacker process and synthetic gasoline. Alkylation – types – alkylating agents – factors controlling alkylation – technical alkylation.

Unit 3

Sulphonation and sulfation: Sulphonating and sulphating agents – their principal applications – chemical and physical factors in sulphonation and sulphation – kinetic, thermodynamics and mechanism – the desulphonation reaction.

Amination: Amination by reduction – methods of reduction – catalytic, metal and acid, sulphide and electrolytic reductions – amination by ammonolysis- aminating agents – catalysts used in amination reactions – technical manufacture of amino compounds – ammonia recovery system.

Catalysis by organometallic compounds: Synthesis gas (Ruthenium and Rhodium metal catalyst).

TEXTBOOK:

P.H.Groggins, "Unit Processes in Organic synthesis", Mc Graw Hill, (Fifth edition), 1952.

REFERENCES:

1. B C Bhattacharya, C M Narayanan, "Unit Operations and Unit Processes", Mc Graw Hill, (1994).
2. Dryden, "Dryden's Outlines of Chemical Technology", East West, (1988).
3. Carey. F and Sundberg R, "Advanced Organic Chemistry, Part A & B", Kluwer, (2000).

CHY262**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, anesthetics, 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).

CHY263**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 - S_N1 and S_N2 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 benzyne - 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 - $S_{RN}1$ 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, Mc Graw Hill, (2004).

CHY264 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 behavior 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.

CHY270 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, Mc Graw-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.

CHY271 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 AJ, "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).

CHY272 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. Namboori P.K., Deepa Gopakumar and K.I. Ramachandran (In press) "Computational Chemistry and Molecular Modeling", Krishnan.
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 Forseman and Aeleen Frisch-Gaussian, "Exploring Chemistry with Electronic Structure Method", Inc., Pittsburgh, PA, 2nd edition, (2006).
2. A C Phillips, "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).

CHY273 FUEL CELLS- PRINCIPLES AND APPLICATIONS 3 0 0 3

Unit 1

Introduction: relevance, importance and classification of fuel cells.

Background Theory: Thermodynamic aspects of electrochemistry energy conversion and its efficiency - factors affecting the efficiency - electrode kinetics of electrochemical energy conversion.

Unit 2

Description, working principle, components, applications and environmental aspects of the following types of fuel cells: alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Proton Exchange Membrane Fuel cells: basic aspects - working and high temperature operation – recent development in technology.

Unit 3

Hydrogen: sources of hydrogen and preparation - clean up and storage - use as fuel in cells.

Energy and Environment - future prospects: Renewable energy and efficiency of renewable fuels - economy of hydrogen energy - life cycle assessment of fuel cell systems.

TEXTBOOK:

M.Aulice Scibioh and B.Viswanathan? "Fuel Cells – principles and applications", University Press, India, (2006).

REFERENCES:

1. F. Barbir, "PEM fuel cells: theory and practice", Elsevier, Burlington, MA, (2005).
2. J.S. Newman and K.E. Thomas-Alyea, "Electrochemical systems", 3rd edition, Wiley, Hoboken, (2004).
3. G. Hoogers, "Fuel cell handbook", CRC, Boca Raton, FL, (2003).

CHY274 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 piezoelectric 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).

CSE100**COMPUTER PROGRAMMING****3 0 0 3**

Unit 1

Introduction to problem solving - algorithm development, flowcharting. C fundamentals, datatypes, variables, constants, enumerations, operators, bitwise operators, expressions, type cast, data input and output statements - formatted & unformatted, control structures - if, if else, switch.. case, while loop, do.. while, for loop, continue, break, goto. Arrays – defining an array, processing an array, multidimensional arrays.

Unit 2

Strings, string handling functions. User defined functions - defining a function, function prototypes, calling a function, passing arguments to a function, recursion. Variable scope - auto, extern, static, register. Pointers - declarations, call by reference, functions returning pointer, pointer arithmetic. Pointer to pointer, pointers and arrays - pointer to array, array of pointers, dynamic memory allocation - malloc(), calloc(), free().

Unit 3

Structures - declaration, initialization, bitfields, operations on structures. Arrays, pointers and structures as members of structure. Array of structures, structures and functions, pointers to structures. Files - file operations for binary and text files, file I/O statements - fscanf, fprintf, fread, fwrite. Random file access - rewind, ftell, fseek. Command line arguments. Preprocessor - macros.

TEXTBOOK:

Byron S Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", Second Edition, TMH publishers, 1996.

REFERENCES:

1. Herbert Schildt, "The Complete reference, C" Fourth Edition, Tata-McGraw-Hill, 2000.
2. Kernighan Brian W and Ritchie Dennis M, "C Programming language", Second Edition, TMH, 1992.
3. Yashavant Kanetkar, "Let us C", Second Edition, TMH, 1996.
4. Cooper Herbert, "Spirit of C: Introduction to modern Programming", TMH, 1983.

CSE180**COMPUTER PROGRAMMING LAB.****0 0 3 1**

1. Programs using various input/output statements (scanf, printf, getchar, gets, puts, putchar)
2. Programs using bitwise operators and enumerated data types
3. Programs using control structures (if, if else, switch, & loops)
4. Programs using numeric one dimensional array
5. Programs using numeric multidimensional array
6. Programs using strings & string handling functions
7. Functions using static, external and auto variables
8. Programs using recursive functions
9. Programs using call by reference and pointer arithmetic
10. Pointer to array & array of pointers using dynamic memory allocation
11. Structures – arrays, structure within structure
12. Array of structures, unions
13. Programs using text files
14. Programs using binary files
15. Programs using random access of files
16. Programs using command line arguments

CUL101**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 Vedanta and Bhagavad Gita;

Unit 3

Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India (1)

TEXTBOOKS:

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

CUL102 CULTURAL EDUCATION II 2 0 0 2

Unit 1

Bhagavad Gita and Life Management; Historicity of Ramayana and Mahabharata; Overview of Patanjali's Yoga Sutras;

Unit 2

Highlights of Indian Mythology; Indian Society: Its Strengths and Weaknesses; Role & Position of Women in Indian Society;

Unit 3

Indian Models of Economy, Business and Management; Health and Lifestyle related issues; Conservation of cultural heritage; Life and work of Great Seers of India (2)

TEXTBOOKS:

1. *The Glory of India (in-house publication)*
2. *Sanatana Dharma (A compilation of Amma's teachings on Indian Culture)*

CUL151 ACHIEVING EXCELLENCE IN LIFE - AN INDIAN PERSPECTIVE 1 0 2 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 – PanchaKosas (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 'Sraddha' – 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. (Volumes 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 Ramakrishnananda 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.*

CUL152**EXPLORING SCIENCE AND
TECHNOLOGY IN ANCIENT INDIA****1 0 2 2**

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 *Aryabhatiya*: 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:

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

CUL153**EXCELLENCE IN DAILY LIFE****1 0 2 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.

CUL154**YOGA PSYCHOLOGY****1 0 2 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 Samprajnata-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

CVL200

ENGINEERING GEOLOGY

2 0 0 2

Unit 1

Introduction - the need for imparting geological training to the Civil Engineers.

General geology: weathering and soils. Geological work of wind, rivers and oceans.

Earthquakes: causes - earthquake mechanism. Earthquake phenomenon – earthquake recording instruments. Secondary effects of earth quakes. Earthquake occurrence – seismic zoning maps of India and its use – important Indian earthquakes – distribution of earth quakes.

Volcanoes: types and causes of volcanism, volcanic products, types of volcanic eruptions and their distribution.

Landslides: terminology, classification, causes & control of landslides.

Unit 2

Mineralogy: physical properties of minerals – characteristic features of mineral groups: Quartz, Feldspar, Pyroxene, Amphibole and Mica group. Other minerals and ores - Sillimanite, Kyanite, Staurolite, Asbestos, Talc, clay minerals – Kaolinite, Montmorillonite and Illite, Bauxite, Haematite, Magnetite, Calcite, Barite, Gypsum. Galena, Graphite, Coal and Petroleum.

Petrology: three-fold classification of rocks, characteristic features of igneous, sedimentary and metamorphic rocks – elementary classification, textures and structures of the three groups of rocks. Description, distribution and economic uses of the three groups of rocks. Details of special Indian rocks - Charnockite, Khondalite, deccan traps. Brief description of Granite, Basalt, Dolerite, Syenite, Sandstone, Shale, Limestone, Slate, Schists, Gneisses, Quartzite and Marble.

Unit 3

Structural geology: types and classification of structures (joints, unconformities, folds & faults) and their effect on civil engineering projects.

Hydrogeology: groundwater and occurrence, investigations, quality, artificial recharge, saline water intrusion in coastal aquifers.

Geology in Civil Engineering: tunnels, dams, reservoirs, bridges, runways, roads and buildings. Remote sensing and GIS investigations in Geology.

TEXTBOOKS:

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. Chenna Kesavulu, N., “Textbook of Engineering Geology”, Macmillan India Limited, 2009.

REFERENCE BOOKS:

1. Billing, M.P., “Structural Geology”, Prentice Hall India, 1974.
2. Juds, W. R., “Principles of Engineering Geology and Geotechniques”, Mc Graw Hill, 1957.

3. Kueffer and Lillesand, "Remote Sensing and Image Interpretation", Wiley, 2003.
4. Bangar, K.M., "Principles of Engineering Geology", Standard Publishers Distributors, 2009.
5. Legeeth, "Geology and Engineering", McGraw Hill Book co., 1998
6. Reddy.V., "Engineering Geology for Civil Engineers", Oxford & IBH, 1997

CVL201**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 - chaining and ranging – obstacles and errors in chain survey.

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

Unit 2

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

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

Levelling – 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 and its uses.

Unit 3

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.

Curves and curve setting by various methods.

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

TEXTBOOKS:

1. Kanetkar T.P.& Kulkarni S.V., "Surveying and Levelling", Vol I & II, Vidyarthi Griha Prakashan, 2006.
2. R.Agor, "Textbook of Surveying and Levelling", Khanna Publishers, 2009.

REFERENCE BOOKS:

1. Bannister, A. and Baker, R., "Solving Problems in Surveying", Longman SCV Lntific Technical, U. K, 1994.

2. Arthur R Benton and Philip J. Taety, "Elements of Plane Surveying", McGraw Hill, 2000.
3. Arora K.R., "Surveying", Vol I & II, Standard Book House, 2005.
4. S.K Duggal, "Surveying", Vol 1, Tata - McGraw Hill, 2004.
5. R.Subramanian, "Surveying and Leveling", Oxford University Press, 2008
6. Pradip Kumar Guha, "Remote Sensing for the Beginner", Affiliated East West Press, 2003.

CVL210**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 beams – 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 stress – 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., "Mechanics of Materials", Cengage Learning India Pvt. Ltd., 2006
2. Popov E.P., "Mechanics of Materials", Prentice Hall India, New Delhi, 2002

REFERENCE BOOKS:

1. Timoshenko, S.P., and Young, D.H., "Elements of Strength of Materials", East West Press, New Delhi, 2003.
2. Beer, F.P., Johnston, E.R. and De Wolf J T., "Mechanics of Materials", Tata McGraw-Hill Publishers, New Delhi, Third Edition, 2006.
3. Crandall, S.H., Dahal, N.C., and Lardener, T.J., "An Introduction to Mechanics of Solids", Mc Graw hill Books Co, 1985, 2nd Edition 2007

4. Shames, I.H., "Introduction to solid mechanics", Prentice Hall of India Ltd, 1990
5. Nash W.A. "Strength of Materials", McGraw Hill Book Company, 2006

CVL211 CONSTRUCTION MATERIALS 2 0 0 2

Unit 1

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

Natural materials - building stones, clay products, timber and wood based products - classification, properties, testing and selection criteria.

Unit 2

Lime, gypsum, cement - types, properties, tests – mortar.

Concrete – ingredients – chemical and mineral admixtures - properties in fresh and hardened state – durability - proportioning of concrete mixes – special concrete.

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, polymers and plastics, adhesives, composites and smart materials.

TEXTBOOKS:

1. Young, J.F. and Mindess, S., "The Science and Technology of Civil Engineering Materials", Prentice Hall, New Jersey, 1997.
2. Varghese, P.C., "Building Materials", Prentice Hall Publications, 2005.

REFERENCE BOOKS:

1. Mehta, P.K. and Monteiro, P.J.M., "Concrete-Microstructure, Properties and Materials", ICI Publications, 2005.
2. Rangwala S. C, "Engineering Materials", Charotar Publishing House, Anand, 2006.
3. Michael.S. Mamlouk and John P. Zaniewski, "Materials for Civil and Construction Engineers", Addison Wesley Longman Inc, USA, 1999.
4. William D. Callister, "Materials Science and Engineering- An Introduction", Third Edition, John Wiley and Sons, New York, 2005.
5. Shetty, M. S, "Concrete Technology-Theory and Practice", S. Chand & Co., New Delhi, 2005.
6. A.M. Neville, "Properties of Concrete", Pearson education, 2008.

CVL212 STRUCTURAL ANALYSIS 3 1 0 4 (Pre-requisite: CVL210)

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.

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. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2011.
2. S P Gupta & G S Pundit, "Theory of Structures", Vol I & II, Tata Mc Graw Hill, 1999

REFERENCE BOOKS:

1. Wang C.K., "Statically Indeterminate Structures" McGraw Hill, 1983.
2. Norris C.H, Wilbur J.B. & Utku.S., "Elementary Structural Analysis", Tata McGraw Hill, 1991.
3. Menon D, "Structural Analysis", Narosa Book Distributors Pvt Ltd, 2008
4. Sujit Kumar Roy & Subrata Chakrabarty, "Fundamentals of Structural Analysis", S.Chand Publishers, 2003.
5. S. B. Junnarkar and H. J. Shah, "Mechanics of Structures Vol. II", 20th Edition, Charotar Publishing House, 2008.
6. Timoshenko, S.P., and Young, D.H., "Theory of Structures", Mc Graw Hill, 1968.
7. L.S.Negi & R.S.Jangid, Structural Analysis, Tata McGraw Hill, 2003.

CVL213 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.
Superstructure - load bearing masonry - brick and stone masonry, arches, lintels, scaffolding, shoring; plastering and pointing.

Unit 2

Roofs and Floors - flat and pitched roofs, floor finishes; Doors and windows.
Damp proofing techniques.
White washing, colour washing, painting and distempering;
Concrete construction – batching, mixing, conveying, placing, compacting and curing - under water concreting - form work - prestressed concrete - prefabricated construction - recent developments in concreting.

Unit 3

Tall buildings – structural systems – steel and concrete framed construction.
Vertical transportation, plumbing systems, electrical services.
Acoustics - requirements for good acoustics - sound insulation.
Thermal insulation of buildings - natural and mechanical ventilation - air conditioning.
Principles of fire resistant construction.
Construction equipment – equipment for excavation, transport, hoisting, piling, and concrete construction.

TEXTBOOKS:

1. Arora.S.P. and Bindra.S.P., "Building Construction", Dhanpat Rai Publications, New Delhi, 2005.
2. Varghese, P.C., "Building Construction", Prentice Hall Publications, 2007.

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. Santha Kumar, A. R., "Concrete Technology", Oxford University Press, 2006.
5. Subir K Sarkar and Subhajt Saraswati, "Construction technology", Oxford University Press, 2008

CVL220

PRINCIPLES OF FLUID MECHANICS

2 1 0 3

Unit 1

Elementary concepts – density, specific weight, specific gravity, viscosity - dynamic and kinematic viscosity – surface tension, capillarity, vapour pressure, compressibility concept of gauge and absolute pressure, measurement of pressure using manometers of different types.

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

Unit 2

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.

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.

Unit 3

Boundary layer theory, boundary layer equation - Blasius solution, drags on flat plate, boundary layer separation and its control. Laminar flow through circular pipe – shear stress, pressure gradient, velocity profile, Hagen-Poiseuille 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.

TEXTBOOKS:

1. Streeter Victor L and E. Benjamin Wylie, "Fluid Mechanics", Mc Graw Hill Book Co., 1998.
2. N.N.Pillai, "Fluid Mechanics and Fluid Machines", Universities press (India), 3rd Edition 2009.

REFERENCE BOOKS:

1. Shames, I.H., "Mechanics of Fluids", Tata McGraw Hill , 2002.
2. Modi P.N. & Seth S.M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Book House, 2002.
3. Cengel and Cimbala, "Fluid Mechanics", Tata McGraw Hill Publishers, 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, 2000.
6. White, Frank.M., "Fluid Mechanics", 6th edition, McGraw Hill Publishing Co., 2007

CVL221

HYDRAULIC ENGINEERING

3 1 0 4

(Pre-requisite: CVL220)

Unit 1

Open channel flow in rigid boundary channels - comparison with pipe flow, classification of flow, uniform flow – equations for uniform flow such as Chezy's and Manning's formula, most efficient channel sections - rectangular, trapezoidal and circular shapes – circular cross section not flowing full – velocity distribution in open channels - critical depth – specific energy and specific force diagram.

Non-uniform flow – characteristics of non-uniform law – hydraulic jump, hydraulic jump equation for a rectangular channel - practical applications - back water curves - venturiflume – surges.

Unit 2

Dimensional analysis and similitude - Buckingham Pi-theorem – applications – Froude and Reynolds criteria - distorted models – limitations - fixed bed models - movable bed models.

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.

Unit 3

Turbines - classifications – velocity triangles, work done and efficiency – Pelton wheel, Francis and axial flow turbines - specific speed - synchronous speed – governing - water hammer - cavitation - model testing - selection of turbines – draft tube.

Classification of pumps – centrifugal pumps – types – velocity triangle – work done and efficiency - characteristic curves – selection of pumps – specific speed. Reciprocating pumps - types – work done – slip and coefficient of discharge – indicator diagrams - separation in suction and delivery pipes – air vessels - work saved by air vessel.

TEXTBOOKS:

1. K. Subramanya, "Flow in Open Channels", Tata McGraw Hill, 2009.
2. Modi P.N. & Seth S.M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Book House, 2002.

REFERENCE BOOKS:

1. N.N.Pillai, "Fluid Mechanics & Fluid Machines", Universities Press, Third Edition, 2009.
2. Chow V.T., "Open Channel Hydraulics", Blackburn Press, 2009.
3. M. Hanif Chaudhry, "Open Channel Flow", Prentice Hall of India, 1994.
4. K. G. Rangaraju, "Flow Through Open Channels", Tata McGraw Hill, 1984.
5. Jagdish Lal, "Hydraulic Machines including Fluidics", Metropolitan Book Co, 2003.
6. Kumar D S., "Engineering Fluid Mechanics", S.Chand & Company, 1986.

CVL230

SOIL MECHANICS

3 1 0 4

Unit 1

Introduction: soil formation – 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.

Unit 2

Seepage through soils: total, neutral and effective stresses – quick sand condition – seepage through soils – flownets: characteristics and uses.

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.

Unit 3

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

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.

TEXT BOOKS:

1. Gopal Ranjan & A.S.R. Rao, "Basic and Applied Soil Mechanics", New Age International Pvt . Ltd, 2003.
2. Das, B.M., "Principles of Geotechnical Engineering", Brooks/Cole, 2002.
3. Arora, K.R., "Soil Mechanics and Foundation Engg", Standard Publishers and Distributors, 2005.

REFERENCE BOOKS:

1. C. Venkataramiah, "Geotechnical Engineering", New Age International Pvt . Ltd, 2006.
2. T.W. Lambe and Whitman, "Soil Mechanics", Mc-Graw Hill Publishing Company, New York, 1991.
3. Purushotham Raj, "Geotechnical Engineering", Tata McGraw Hill, 1995.
4. Manoj Dutta & Gulati S.K, "Geotechnical Engineering", Tata McGraw Hill Publishers, 2005.

CVL290

CONSTRUCTION MATERIALS LAB.

0 0 3 1

1. Tests on aggregate for concrete
 - (a) Grain size distribution (b) Specific gravity (c) Density (d) Void ratio (e) Bulking (f) Aggregate crushing value (g) Aggregate impact value.
2. Tests on cement
 - (a) Fineness (b) Normal consistency (c) Setting time (d) Compressive strength.
3. Tests on tiles.
4. Tests on bricks – crushing strength, water absorption and efflorescence.
5. Workability tests – slump, compaction, V-bee and flow table tests.
6. Compression test on cubes and cylinders – determination of modulus of elasticity.
7. Split test on concrete cylinders and flexure test on concrete.

8. Tests on steel.
9. Basic tests on bitumen.
10. Demonstration of non-destructive testing equipments.

CVL291 MATERIALS TESTING AND EVALUATION LAB. 0 0 3 1

1. Tension test on metals
2. Tensile test on thin wires
3. Compression test
4. Hardness test - Rockwell hardness test - Brinell hardness test
5. Shear test
6. Deflection test on beams
7. Impact test – Izod and Charpy
8. Fatigue test
9. Static bending test
10. Test on springs

CVL292 FLUID MECHANICS AND MACHINERY LAB. 0 0 3 1

1. Verification of Bernoulli's equation.
2. Determination of coefficient of discharge for a small orifice by a constant head method.
3. Determination of coefficient of discharge for an external mouth piece by variable head method.
4. Calibration of triangular notch
5. Determination of friction factor of pipes
6. Impact of jet on vanes
7. Calibration of Venturimeter, Orificemeter, rotameter and watermeter
8. Determination of metacentric height
9. Performance test on Pelton wheel turbine and Francis turbine.
10. Efficiency test on centrifugal pump and reciprocating pump.

CVL293 SURVEY PRACTICAL 1 0 3 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 and contour surveying
5. Theodolite surveying - measurement of angles and traversing
6. Heights and distances by tacheometry and solution of triangles
7. Setting out of simple curves - angular method
8. Study and use of modern instruments – total station & GPS
9. Setting out of building plans

CVL314 ADVANCED STRUCTURAL ANALYSIS 3 1 0 4 (Pre-requisite: CVL210)

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.

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

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. Reddy C.S., "Basic Structural Analysis", Tata McGraw Hill, 2011.
2. Gupta S. P & G .S Pundit, "Theory of Structures", Vol I & II, Tata Mc Graw Hill, 1999.
3. Rajasekharan.S. and Sankarasubramanian G., "Computational Structural Mechanics", Prentice-hall of India Pvt Ltd, 2009

REFERENCE BOOKS:

1. Wang C.K., "Statically Indeterminate Structures", McGraw Hill, 1983.
2. Norris C.H., Wilbur J.B. & Utku.S., "Elementary Structural Analysis", Tata McGraw Hill, 1991
3. Timoshenko, S.P., and Young, D.H., "Theory of Structures", Mc Graw Hill, New York, 1968.
4. Menon D, "Structural Analysis", Narosa Book Distributors Pvt Ltd, 2008
5. L.S.Negi & R.S.Jangid, "Structural Analysis", Tata McGraw Hill, 2003.
6. Kanchi, M.B., "Matrix methods of Structural Analysis", Wiley Eastern Limited, 1987.
7. Sujit Kumar Roy & Subrata Chakrabarty, "Fundamentals of Structural Analysis", S.Chand Publishers, 2003.

CVL315 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 - design for bond: development length, splicing, curtailment.

Unit 2

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 - introduction to slender columns.

Unit 3

Design of isolated footing for axially loaded & eccentrically loaded columns, combined footing.

Design of staircases.

Design principles of retaining walls and water tanks.

Principles of prestressed concrete design - methods of prestressing – losses - design of simple members.

TEXTBOOKS:

1. Pillai S.U. & Menon D, "Reinforced Concrete Design", Tata McGraw Hill, 2003.
2. Varghese P.C., "Limit State Design of Reinforced Concrete", Prentice Hall India, 2003.
3. P.Dayaratnam, "Limit State Design of Reinforced Concrete Structures", Oxford & I.B.H. Publishing Company Pvt. Ltd., 2004.

REFERENCE BOOKS:

1. Park and Paulay, "Reinforced Concrete Structures", Wiley India (P) Ltd, 2010
2. Jain & Jaikrishna, "Plain & Reinforced Concrete", Vol. I, Nemchand, 2000.
3. Mallick S.K. & Gupta A.K., "Reinforced Concrete", Oxford & IBH, 1996.
4. Jain A.K., "Reinforced Concrete - Limit State Design", Nem Chand & Bros., 2002.
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", 13th edition, Tata McGraw-Hill Publications, 2002

CVL316

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 - lacings 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.

Design principles of Gantry girder.

TEXTBOOKS:

1. Duggal, S.K., "Limit State Design of Steel Structures", Tata McGraw Hill, 2010.
2. Ramchandra & Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, 2010.

REFERENCE BOOKS:

1. Subramanian N, "Design of Steel Structures", Oxford University Press, 2008.
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, IS 875-1987-Parts I, II, III, SP:6 – Part 1 to 6).
5. Lin & Breslar, "Design of Steel Structures", John Wiley & Sons, 1963
6. Emil Smith and Robert Scanlan, "Wind Effects on Structures". Wiley-Interscience, 1986.
7. Edwin Gaylord, "Design of Steel Structure", Tata McGraw Hill Publishing Company Limited, 2010.

CVL322

ENVIRONMENTAL ENGINEERING

3 1 0 4

Unit 1

Water supply engineering – quantity of water - water demand - fluctuation in demand - forecasting population – design period. Sources of water – intakes – quality of water – water quality parameters - methods of physical, chemical and bacteriological analysis of water.

Treatment of water (process details and design considerations) – aeration – coagulation – flocculation – sedimentation – filtration – disinfection – miscellaneous

and advanced treatments – iron and manganese removal - fluoridation and defluoridation - water softening - arsenic removal- desalination - membrane filtration.

Unit 2

Water supply schemes – gravitational, pumping and combined schemes – pumps pumping stations – transmission of water – design of gravity and pumping main – distribution systems – pipe network layouts – house connection from mains – different valves, meters and hydrants – storage reservoirs – balancing reservoir – detection and prevention of leaks in the distribution systems – maintenance of distribution systems.

Sanitary plumbing – sanitary fixtures – systems of piping – house drainage – connection of house drains and street sewers. Systems of sewerage – dry weather flow and wet weather flow – sewers and sewer appurtenances – sewage pumping – maintenance of sewers.

Unit 3

Waste water – characteristics – sampling – population equivalent – preliminary treatment of waste water - biological treatment (process details and design considerations) – aerobic - activated sludge process - trickling filter - oxidation ponds. Anaerobic treatment - septic tanks - soak pits. Waste water disposal methods – solid waste management - treatment and disposal. Air pollution and control – pollutants and their health effects – particulate and gaseous pollution control devices (fundamentals) - settling chambers - electrostatic precipitators – cyclones - wet collectors - gas absorption by tray and packed towers.

TEXTBOOKS:

1. Birdie G.S & Birdie J.S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2010.
2. Fair, Geyer & Okun, "Water and Waste water Engineering", John Wiley & Sons, 1966.
3. Metcalf & Eddy, "Waste Water Engineering Treatment, Disposal & Reuse", Tata McGraw Hill, 2003.

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.
3. Mark J. Hammer & Mark J. Hammer Jr., "Water and Waste Water Technology", Prentice Hall of India Pvt. Ltd., 2008.
4. Sawyer and McCarty, "Chemistry for Environmental Engineering", Tata McGraw-Hill, 2003.

CVL323 WATER RESOURCES AND IRRIGATION ENGINEERING 3 1 0 4

Unit 1

Introduction - hydrologic cycle - precipitation, rainfall variations, measurement, presentation of rainfall data, mean precipitation, frequency analysis, intensity duration frequency relationship, probable maximum precipitation. Abstractions from

precipitation - initial abstraction, evaporation, evapotranspiration, infiltration. Runoff - long term runoff, empirical formulae, short term runoff - hydrograph – concepts, assumptions and limitations of unit hydrograph. Flood - rational and empirical methods for prediction - design floods. Ground water - aquifer types - flow of ground water – aquifer characteristics - well hydraulics - types of wells - other sources of ground water.

Unit 2

Necessity of irrigation and type of irrigation systems - irrigation methods - total planning concept - water requirements of crops - command area – duty - delta. Evapo-transpiration - consumptive use of water – potential ET – Penman-Morieth method – reference crop ET - irrigation requirement of crops - irrigation efficiency. Reservoir planning - site investigation - zones of storage - reservoir yield - reservoir losses and control - life of reservoir.

Diversion head works - location – essential components of weir and barrage - weirs on permeable foundations - Bligh's and Khosla's seepage theories - design procedure. Dams - types of dams and their selection - gravity dam - analysis and design. Spillways - different types and suitability.

Unit 3

Design of lined canals - irrigation canals - Kennedy's theory and Lacey's theory - intake structures, canal outlets, canal regulation works - canal falls - canal regulators - canal escapes - surplussing arrangements in minor irrigation tanks - cross drainage works - types and selection of type of cross drainage works. Hydroelectric power: low, medium and high head plants, powerhouse components, microhydel schemes. Flood management, flood mitigation, flood damage analysis.

TEXTBOOKS:

1. Linsley.R.K., "Water Resources Engineering", Tata McGraw Hill, 1992.
2. P.N.Modi, "Irrigation, Water Resources, and Water power Engineering", Standard Book House, 2008.

REFERENCE BOOKS:

1. Ven Te Chow et.al, "Applied Hydrology", McGraw Hill Book Co, 1988.
2. K.Subramanya , "Engineering Hydrology", Tata McGraw Hill Publishers, 2008.
3. Mays.L.W. "Water Resources Handbook", McGraw Hill International Edition, 1996
4. Vijay Singh and Singh V.P, "Elementary Hydrology", Prentice Hall, Englewood Cliffs, 1997.

CVL331 FOUNDATION ENGINEERING 3 1 0 4 (Pre-requisite: CVL230)

Unit 1

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.

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 – stability of slopes of earth dams under different conditions.

Unit 2

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

Retaining walls: types of retaining walls – stability of retaining walls.

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.

Unit 3

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 – different shapes of wells – components of wells – functions and design.

Design criteria – sinking of wells – tilts and shifts.

TEXTBOOKS:

1. Gopal Ranjan & A.S.R. Rao, "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd, 2004.
2. Varghese, P.C., "Foundation Engineering", Prentice Hall of India., 2007.

REFERENCE BOOKS:

1. Das, B.M., "Principles of Foundation Engineering", Nelson Engineering (Indian edition), 2007.
2. Bowles, J.E., "Foundation Analysis and Design", 4th Edition, McGraw-Hill Publishing Company, 1988.
3. Swami Saran, "Analysis and Design of Substructures", Oxford and IBH Publishing Company Pvt Ltd, 2008 .
4. S. K.Gulhati & Manoj Datta, "Geotechnical Engineering", Tata McGraw Hill Publishing Company, 2005.
5. Teng, W.C., "Foundation Design", Prentice Hall, 1984.

CVL332

TRANSPORTATION ENGINEERING I

3 1 0 4

Unit 1

Highway engineering: introduction to transportation systems and study of system characteristics; classification of roads; highway planning; geometrical design – road cross sections, sight distance and applications, super elevation, horizontal and vertical alignment.

Airport engineering: location and spacing of airports; geometrical design – taxiways, runways and aprons; runway orientation – wind rose diagram; terminal area planning, airport drainage.

Unit 2

Pavement materials, design and construction & maintenance: pavement materials – aggregate and bitumen. Characteristics and testing, bituminous mix design; pavement design – design elements and loads, CBR and IRC methods for design of flexible and rigid pavements; pavement construction and maintenance – related equipment.

Unit 3

Traffic engineering: scope of traffic engineering, road user and vehicular characteristics; traffic studies – volume studies, speed studies, speed and delay studies – origin and distribution studies, traffic flow characteristics study, traffic capacity studies (speed, flow and density relationships), passenger car units, parking studies and accident studies – related problems to be worked out.

TEXTBOOKS:

1. Khanna SK and Justo CEG., "Highway Engineering", Nem Chand and Bros, 2009.
2. Khanna S K, Arora, M G and Jain S S., "Airport Planning and Design", Nem Chand and Bros, 1999.
3. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna, Publishers, 2008.

REFERENCE BOOKS:

1. Horanjeft, R, Mc Kelvy, F.X. and Bob Sproule, "Planning and Design of Airports", McGraw Hill, 2010.
2. Papacostas, C S, and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall, 2008.

CVL333

TRANSPORTATION ENGINEERING II

3 1 0 4

Unit 1

Traffic regulations and control: traffic signs, signals, markings, island and rotaries; traffic signals – basic concept and principles, analysis and design; types and layouts – at-grade and grade separated intersections; parking facilities; intelligent transportation systems (ITS) – components, ATMS and ATIS and applications.

Transportation planning: concept of travel demand and its' modeling based on consumer behaviour of travel choices, independent variables and travel attributes; sequential, sequential recursive and simultaneous processes; definition of study area and zoning: elements of transportation network; four stage demand modeling technique – trip generation, distribution, mode split and route split models.

Unit 2

Railway and tunnel 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; tunneling – tunnel alignment and grade, size and shape of tunnels, methods of tunneling in soft soils and hard rocks; ventilation of tunnels; lining of tunnels.

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 – design considerations; navigational facilities; inland water transport and container transportation.

TEXTBOOKS:

1. Banks J H, "Introduction to Transportation Engineering", McGraw Hill Higher Education, 2002.
2. Kadiyali;L.R, "Traffic Engineering and Transport Planning", Khanna Publishers, 2008.
3. Sathyapal Arora, "Railway Engineering", Dhanpat Rai Publishers, 1998.
4. Oza,H.P and Oza, G.H., "Dock and Harbour Engineering", Charotar Book House, 2008.

REFERENCE BOOKS:

1. Hutchinson B.G., "Principles of Urban Transportation System Planning", McGraw Hill, 1974.
2. Institute of Transportation Engineers, "Transportation and Traffic Engineering Hand Book", Prentice Hall, 1982.
3. Chandola, S.P., "A Text Book of Transportation Engineering", S. Chand & Co. Ltd. 2001

CVL390 DESIGN AND DRAWING (RCC AND STEEL STRUCTURES) 1 0 3 2

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

Continuous beams, columns and slab systems

Isolated and combined footings (axially loaded and eccentrically loaded)

Staircase

Retaining walls

Elevated water tanks

Design and detailing of steel elements/structures

Beams and beam-column joints

Built-up columns

Column bases (axially loaded and eccentrically loaded)

Roof trusses and joints including purlins

Gantry girder

REFERENCE BOOKS::

1. N. Krishna Raju, "Structural Design and Drawing – Reinforced Concrete and Steel", Universities Press, 3rd Edition 2009.
2. D.Krishnamoorthy, "Structural Design & Drawing- Vol- I & II", CBS Publishers And Distributors.

3. Karve, Shah, "Illustrated Design Of R. C. Buildings (G+3)", Standard Publishers Distributors, 2008.
4. SP:34-1987, "Handbook on Concrete Reinforcement and Detailing", BIS.

CVL391 GEOTECHNICAL ENGINEERING LAB.**0 0 3 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 by (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

CVL392 ENVIRONMENTAL ENGINEERING LAB.**0 0 3 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
11. Demonstration of Instrumental methods of pollutant analysis

REFERENCE:

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

CVL393**BUILDING DRAWING****1 0 3 2**

Part - A

Detailed drawing of components

- Doors, windows and ventilators
- 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

Building byelaws and regulations - space planning of buildings - residential, public and commercial – design process – activity areas and linkages – proximity matrix – adjacency diagram – form development with respect to site conditions and functional requirements – preparation of drawings – presentation techniques - computer aided design and drafting.

Planning, designing from given requirements of areas and specifications and preparation of drawings. (AutoCAD).

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 Drawing and Detailing", 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. IS 5533: 1969, Recommendation for Dimensions of Spaces for Human Activities.
4. IS 4963: 1987, Recommendation for Buildings and facilities for the Physically Handicapped.
5. Crosbie, M.J. and Callender, J.H., "Time-Saver Standards for Architectural Design Data", McGraw-Hill, 1997.
6. Sham Tickoo, "Autodesk revit architecture 2010 for architects and building designers", Dreamtech Press, 2010.

CVL450**CONCRETE TECHNOLOGY****3 0 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 mixed 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 - light weight 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", ICI Publications, 2005.
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.

CVL451**ADVANCED CONCRETE DESIGN****3 0 0 3**

(Pre-requisite: CVL315)

Unit 1

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.
Water tanks: Introduction - rectangular and circular with flat bottom - spherical and conical tank roofs – staging - design as per BIS.

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 – RC box culverts – T-beam bridges – concept on design of continuous bridges, balanced cantilever bridges, arch bridges and rigid frame bridges.

TEXTBOOKS:

1. Varghese P.C., "Advanced Reinforced Concrete Design", PHI, 2007
2. N. Krishnaraju, "Advanced Reinforced Concrete Design", CBS Publishers, 2008.
3. Jain and Jaikrishna, "Plain & Reinforced Concrete - Vol. I & II", Nem Chand & Bros., 2007.

REFERENCE BOOKS:

1. Purushothaman. P, "Reinforced Concrete Structural Elements", Tata Mc Graw Hill, 1986
2. G.S.Ramaswamy, "Design and Construction of Concrete Shell Roofs", CBS Publishers, 2005.
3. Ashok K Jain, "Reinforced Concrete – Limit State Design", Nem Chand & Bros., 2009.
4. Mallick & Gupta, "Reinforced Concrete", Oxford & IBH, 1997.
5. BIS codes (IS 456, IS 2210, IS 4998, IS 3370, SP 16, SP 24, SP 34).
6. IRC Codes (IRC 5, IRC 6, IRC 21)

CVL452**ADVANCED STEEL DESIGN****3 0 0 3**

(Pre-requisite: CVL316)

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.

TEXTBOOK:

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. N. Subramanian, "Design of Steel Structures", Oxford University Press, 2008.
3. P. Dayaratnam, "Design of Steel Structures", S.Chand & Co., 2003.
4. M. Raghupathi, "Design of Steel Structures", Tata McGraw Hill, 1985.
5. Lin & Breslar, "Design of Steel Structures", John Wiley & Sons, 1963
6. BIS codes (IS 800, SP 6,IS 804, IS 805,IS 6533, IS 9178, IS 801,IS 811)

CVL453**PRE-STRESSED CONCRETE DESIGN****3 0 0 3**

(Pre-requisite: CVL315)

Unit 1

High strength concrete and high tensile steel – tensioning devices – pretensioning systems – post tensioning systems.

Analysis of prestress – resultant stresses at a sector – pressure line or thrust line and internal resisting couple – concept of load balancing – losses of prestress – deflection of beams.

Unit 2

Strength of prestressed concrete sections in flexure, shear and torsion:

Types of flexural failure – strain compatibility method – IS code procedure – design for limit state of shear and torsion.

Unit 3

Design of prestressed concrete beams and slabs:

Transfer of prestress in pre tensioned and post tensioned members – design of anchorage zone reinforcement – design of simple beams – cable profiles – design of slabs.

TEXTBOOK:

N. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill, 2006

REFERENCES BOOKS:

1. T.Y. Lin, Ned H. Burns, "Design of Prestressed Concrete Structures", John Wiley & Sons, 1982.
2. P. Dayaratnam, "Prestressed Concrete", Oxford & IBH, 1996.
3. R. Rajagopalan, "Prestressed Concrete", Narosa publishers, 2005.
4. IS 1343-1980, "Code of Practice for Prestressed Concrete". BIS.

CVL454**INDUSTRIAL STRUCTURES****3 0 0 3**

(Pre-requisite: CVL316)

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.

TEXTBOOKS:

1. S.N.Manohar, "Tall Chimneys : Design and Construction", Tata Mc Graw 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, 2002.
5. Murthy and Santhakumar, "Transmission Line Structures", McGraw Hill, 1990.

REFERENCE BOOKS:

1. SP: 32–1986, "Hand Book on Functional Requirements of Industrial Buildings (Lighting and ventilation)".

2. Steel designer's manual by G.W.Owens and P.R.Knowles,
3. G.W.Owens and P.R.Knowles, "Steel Designers' Manual", ELBS Blackwell SCVLTntific Publishers, London, 1994.
4. V.Kalayanaraman (editor), "Advances in Steel Structures", Tata McGraw Hill, 1990.
5. Krishnaraju N., "Advanced Reinforced Concrete Design", CBS Publishers, 2008.
6. K.K.Mc Kelvey and Maxey Brooke, "The Industrial Cooling Tower", Elsevier Publishing Co., 1959.

CVL455**STRUCTURAL DYNAMICS AND SEISMIC DESIGN****3 0 0 3**

Unit 1

Overview of structural dynamics – types of prescribed loadings – essential characteristics of a dynamic problem – method of discretization, lumped mass procedure – generalized displacements – single degree of freedom system – components of the basic dynamic system – formulation of the equation of motion – D Alembert's principle - influence of gravitational forces - generalized SDOF system - rigid body assemblage - expression for generalized system properties. Solution of the equation of motion - undamped free vibration - damped free vibration - critical damping - under damped system - over damped system - negative damping - concept of Coulomb damping. Response to harmonic loading - undamped system - solutions – viscously damped system - resonant response - vibration isolation. Response to periodic loading.

Unit 2

Base-excited SDOF system - formulation of basic equation – concepts of pseudo acceleration, velocity and displacement - earthquake response spectra (concept) - lumped mass modelling of multi-storey shear building and modes of vibration (concepts only - demonstration with example). Performance of building and structures under earthquakes - main causes and effects - assessment of damage. Philosophy and principles of earthquake resistant design - IS specifications.

Unit 3

Equivalent static method - seismic zones and coefficients – response reduction factors - estimations of fundamental time period, base shear and its distributions using IS:1893 for multistory buildings (regular shape only). Use of codes like IS:4326, IS:13828, IS:13827, IS13920, SP:22 with reference to masonry, RCC and steel building. Detailing of reinforcement and joints. Methodologies for restoration and retrofitting

TEXTBOOKS:

1. Anil K Chopra, "Dynamics of Structures : Theory and Applications to Earthquake Engineering", Pearson Education, 2008.
2. R W Clough and J Penzien, "Dynamics of Structures", McGraw Hill, 1993.

3. Jai Krishna, Chandrasekaran and Brijesh Chandra, "Elements of Earthquake Engineering", South Asian Publishers, 2000.

REFERENCE BOOKS:

1. Pillai & Menon, "Reinforced Concrete Design", Tata McGrawHill, 2003.
2. Diggil.S.K., "Earth Quake Resistant Design of Structures", Oxford University Press, 2009.
3. Madhujit Mukhopadhyay, "Structural Dynamics : Vibrations and Systems", Ane Books, 2008.
4. IS:1893 - (Part I), Criteria for Earthquake Resistant structures-General Provisions and Buildings
5. IS:13935 – Repair and Seismic strengthening of buildings
6. IS:4326 - Earthquake Resistant Design and Constructions of buildings
7. IS:13827 – Improving Earthquake Resistance of Earthen buildings
8. IS:13828 - Improving Earthquake Resistance of Low strength Masonry buildings
9. IS:13920 – Ductile detailing of RC Structures subject to Seismic forces

CVL456**FINITE ELEMENT METHODS****3 0 0 3**

Unit 1

Boundary value problems and the need for numerical discretisation: 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.

Higher order finite element approximation: degree of polynomial in trial functions and rate of convergence, the patch test, shape functions for C^0 and C^1 continuity, one-, two- and three-dimensional shape functions.

Unit 2

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

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.

Partial discretisation and time-dependent problems: partial discretisation applied to boundary value problems, time-dependent problems via partial discretisation, analytical solution procedures, finite element solution procedures in time domain.

Unit 3

Generalised finite elements and error estimates: the generalised finite element method, the discretisation error in a numerical solution, measure of discretisation error, estimate of discretisation error.

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

TEXTBOOKS:

1. Reddy, J.N., "An Introduction to the Finite Element Method", Tata McGraw Hill, 2005.
2. Rajasekaran S., "Finite Element Analysis in Engineering Design", S.Chand & Co., 2003.
3. Rao. S.S., "Finite Element Method In Engineering", Elsevier SCVLnce (reprint Technical SCVLnce & Engineering), 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. & Belegundu A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 2007.
4. Gallagher R.H., "Finite Element Analysis: Fundamentals", Prentice Hall Inc., 1975.
5. Krishnamoorthy C. S., "Finite Element Analysis - Theory and Programming", Tata McGraw Hill, 2001.
6. Zienkiewics O.C. & Taylor R.L.and Zhu, J.Z., "The Finite Element Method: Its Basis and Fundamentals", Butterworth-Heinemann, 2005.

CVL457**SMART MATERIALS AND STRUCTURES****3 0 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 – spectrometers – fiberoptic chemical sensing systems and distributed measurement.

Unit 3

Actuator techniques – actuator and actuator materials – Piezoelectric and electrostrictive material – magnetostructure material – shape memory alloys – electro-rheological fluids – electro magnetic 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.

TEXTBOOKS:

1. Brain Culshaw, "Smart Structure and Materials", Artech House – Borton. London, 1996.
2. Srinivasan and McFarland, "Smart Structures: Analysis and Design", Cambridge University Press, 2001.

REFERENCE BOOKS:

1. L. S. Srinath, "Experimental Stress Analysis", Tata McGraw-Hill, 1998.
2. J. W. Dally and W. F. Riley, "Experimental Stress Analysis", Tata McGraw-Hill, 1998.

CVL458 MAINTENANCE AND REPAIR OF BUILDINGS 3 0 0 3
(Pre-requisite: CVL213)

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 on building materials and components - aspects of fire damage and assessment - impact of pollution on buildings.

Unit 2

Common defects in buildings and measures to prevent and control the same - maintenance philosophy - phases of maintenance – routine preventive and curative maintenance.
Building failures – causes and effects - cracks in buildings – types, classification, investigation.
Non-destructive testing methods
Materials for repair - special mortar and concretes, concrete chemicals, special cements and high grade concrete – admixtures of latest origin

Unit 3

Techniques for repair - surface repair – material selection – surface preparation - rust eliminators and polymers coating for rebars during repair – repair methods of cracks in concrete and masonry - epoxy injection. Guniting and shotcreting. Waterproofing of concrete roofs.
Strengthening measures - flexural strengthening, beam shear capacity strengthening, column strengthening, shoring, under pinning and jacketing.
Conservation movement - materials and methods for conservation work - adaptive reuse of buildings - examples.

TEXTBOOKS:

1. Champion, S., "Failure and repair of concrete structures", London, Contractors Record, Wiley, 1961.
2. Sidney M. Johnson, "Deterioration, Maintenance and Repair of Structures", McGraw Hill, 1965.

REFERENCE BOOKS:

1. Peter H. Emmons, "Concrete Repair and Maintenance", Galgotia Publications, 2001.
2. Mckaig T.M, "Building failures", McGraw Hill, 1962.
3. SP : 25 - 1984, "Causes and prevention of cracks in buildings", BIS
4. Shetty , M.S., "Concrete Technology", S. Chand & Co., 2009.
5. Philip.H.Perkins , "Concrete Structures – Repair water proofing and Protection", Applied SCV Lnce Publishers, 1976.
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.

CVL459 FUNCTIONAL DESIGN OF BUILDINGS 3 0 0 3
(Pre-requisite: CVL213)

Unit 1

Introduction to functional design – principles.

Acoustics: review of physics of sound – airborne and structure borne propagation – effect of noise on man – behavior of sound in free field and enclosures – Sabine's formula – design criteria for spaces – acoustical defects – sound reduction, sound insulation and reverberation control – acoustic materials – properties – types and fixtures.

Unit 2

Lighting and illumination engineering: types of visual tasks – principles of day lighting – day light factor – sky component – internal reflected component – external reflected component – design of windows for lighting – artificial lighting – illumination requirements for various buildings – measurement – lamps and luminaries – design of artificial lighting – coefficient of utilisation – room index – maintenance factor – room reflectance – glare.

Unit 3

Climatic elements: climate on a global scale – solar radiation - earth's thermal balance – measurement of climatic elements – climatic graph – temperature inversion – influence of topography – urban climates.
Thermal comfort: human body's thermal balance – heat loss in various environments – thermal comfort indices – ET and its use – CET – comfort zone.
Thermo-physical properties of building materials: thermal quantities – heat flow – cavities – solar radiation – absorbed, reflected and transmitted - sol- air temperature concept - solar gain factor.
Heat flow through buildings – thermal transmittance of structural elements – thermal gradients – heat gain calculation - periodic heat flow - apparent movement of sun – solar charts and its use.

Design criteria for control of climate – passive and active approaches - thermal insulation – shading devices – active systems – low energy cooling.

TEXTBOOK:

Koenigseberger, "Manual of tropical Housing and Building Part I – Climatic Design", Orient Longman, 1994.

REFERENCE BOOKS:

1. Ajitha Simha, D., "Building Environment", Tata McGraw Hill, 1985.
2. Givoni B., "Man, Climate and Architecture", Applied SCVLnce Publishers, 1969.
3. Knudsen V.O. and Harris C.M., "Acoustical Design in Architecture", John Wiley, 1978.
4. Bureau of Indian Standards, National Building Code of India 2005.
5. Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987
6. Narasimham V., "An Introduction to Building Physics", Kabeer Printing Works, Chennai, 1974.
7. Krishnan, "Climate Responsive Architecture", Tata McGraw Hill, 1999.

CVL461 GROUND WATER HYDROLOGY 3 0 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 Hydrology", Wiley Eastern Ltd., 2000.
2. Karanth, K. "Groundwater Assessment and Management", Tata McGraw Hill, 2007.

REFERENCE BOOKS:

1. Todd, D.K., "Ground Water Hydrology", John Wiley, 2000.
2. Garg S.P., Ground Water & Tube wells, Oxford & IBH, 1993.
3. Raghunath H. M., "Hydrology: Principles, Analysis and Design", New Age International (P) Limited, 2006.

CVL462 WATER RESOURCE SYSTEMS PLANNING AND DESIGN 3 0 0 3

(Pre-requisite: CVL323)

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 W.R. 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.

TEXTBOOK:

Jain, "Water Resources Systems Planning & Management: Developments in Water Science", Elsevier Science, 2006.

REFERENCE BOOKS:

1. S K Jain, V P Singh, "Water Resources Systems Planning and Management", Elsevier Science, 2003
2. M. C. Chaturvedi, "Water Resources Systems: Planning & Management", Tata McGraw Hill Publications, 1988.
3. Louks D P et al., "Water Resources System Planning & Analysis", Prentice Hall, 1981.

4. Maass. A. et.al., "Design Water Resources Systems", MacMillan, 1968.
5. Goodman. A.S. and Major. D.C., "Principles of Water Resources Planning", Prentice Hall, 1984.

CVL463 REMOTE SENSING AND GIS 3 0 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. A.M.Chandra and S.K. Gosh, "Remote Sensing and GIS", Narosa Publishing House, 2007.
2. Anji Reddy, "Remote sensing and Geographical systems", BS Publications, 2005.

REFERENCES:

1. LRA Narayana, "Remote Sensing and its applications", Universities Press, 1999
2. J.V.S.Murthy, "Watershed management", New Age International, 1998.
3. Wurbs, R.A., and James, W.P., "Water Resources Engineering". Prentice-Hall, NJ, 2002.
4. M G Srinivas (Edited by), "Remote sensing applications", Narosa Publishing House, 2001.
5. Janza F J, Blue H M and Johnston, J E., "Manual of remote sensing Vol - I", American Society of Photogrammetry, 1975.
6. Burrough P.A., "Principles of GIS for land resource assessment", Oxford SCVLnce Publication, 1990.
7. De Merse, Michael N., "Fundamentals of geographic information system", Wiley, 2002.

CVL464 ADVANCED ENVIRONMENTAL ENGINEERING 3 0 0 3 (Pre-requisite: CVL322)

Unit 1

Instrumental methods for analysis of contaminants in air, water and soil - colorimetry, chromatography, spectroscopy, electrochemical probes. Advances in settling and filtration of water and wastewater - tube settlers, dual media and multimedia filters, micro filters. Advances in waste water treatment – extended aeration – bio filtration – advances in anaerobic digestion - up flow anaerobic sludge blanket reactor

Unit 2

Tertiary treatment – disinfection of waste water - waste water recycling. Stream sanitation – kinetics of stabilization – Streeter-Phelps equation - zones of pollution in a stream – self purification of natural waters. Treatment and disposal of hazardous wastes - radioactive, nuclear and biomedical waste. Noise pollution – instruments and techniques for noise measurement.

Unit 3

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.

REFERENCE BOOKS:

1. Metcalf & Eddy, "Waste Water Engineering Treatment Disposal Reuse", Tata McGraw Hill, 2002.
2. Clarence, J.Velz, "Applied Stream Sanitation", Krieger Pub Co., 1984.
3. C.S Rao, "Environmental Pollution Control Engineering", New Age Publications, 2006.
4. Nevers, Noel De, "Air Pollution Control Engineering", McGraw-Hill, 1999.

CVL465 INDUSTRIAL WASTE TREATMENT 3 0 0 3 (Pre-requisite: CVL322)

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.
Environmental impact of textile industry – paper industry - dairy - fertilizer – thermal power plant.
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.& Sincero G.A., "Environmental Engineering - A Design Approach", Prentice Hall, 1996.
4. Rao C.S., "Environmental Pollution Control Engineering", New Age International, 1998.
5. Mahajan S.P., "Pollution Control in Process Industries", Tata McGraw Hill, 2001.
6. Babbitt H.E., "Sewerage & Sewage Treatment", Nabu Press , 2010.
7. Abbasi S.A, & Ramasami E, "Biotechnical Methods of Pollution Control", Universities Press(India) Ltd., 1999.

CVL466**COASTAL ENGINEERING****3 0 0 3**

Unit 1

Wave generation and propagation: definition - wave generation - wave classification - linear theory of waves - assumptions and derivation of relationships of wave characteristics. Pressure within a progressive wave energy - wave decay - transformation of waves - fundamentals aspects of stokes theory - reflection, refraction, diffraction of waves - breaking of waves, types, criterion; and Importance of breaking.

Unit 2

Waves forces on structures: Wave forces on structures - vertical, slopping, curved and stepped barrier - force due to non-breaking and broken waves - force on piles.
Wave forecasting: need for forecasting - SMB and PNJ methods of wave forecasting.
Tides: origin and classification of tides - Darwin's equilibrium theory of tides – effects on structures.

Unit 3

Sediment movement: types of sediment movement - types of beaches and beach profile – long shore drift and its engineering significance - causes of coastal erosion and methods of protection - dredging and artificial nourishment.
Shore protection works: description and effects of break waters - sea walls - groynes of various types - beach nourishment, break waters, tetrapod, tribar, etc.
Hudson's formula and simple design problem.

TEXTBOOKS:

1. Ippen A.T., "Estuary and Coastline Hydrodynamics", McGraw Hill Book Co., 1966.
2. Sarpkaya, T., Isaacson, M., "Mechanics of Wave Forces on Offshore Structures", Van Nostrand Reinhold Company, 1981.

REFERENCE BOOKS:

1. Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", WIT Press (Computational Mechanics) Publications, Southampton, Boston, 2003.
2. Wiegel R.L., "Oceanographical Engineering", Prentice Hall, 1969.
3. US Army Corps of Engineers, "Coastal Engg. Manual (CEM)", Parts 1 to 6, Coastal Engg Res. Centre, Washington D.C., USA, 2006.

CVL470**PAVEMENT DESIGN****3 0 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, CEG, "Highway Engineering", Nem Chand and Bros, 2009.

REFERENCE BOOKS:

1. Yoder and W Nitezak, "Principles of Pavement Design", John Wiley, 1975.
2. Yang, "Design of Functional Pavements", McGraw Hill, 2004.
3. IRC: 37 - 2001, "Guidelines for the Design of Flexible Pavements"
4. IRC: 58 - 2002, "Guidelines for the Design of Rigid Pavements"
5. David Croney, "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".

CVL471 URBAN TRANSPORTATION PLANNING 3 0 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

Trip generation analysis: definition of study area - zoning - types and sources of data - road side interviews - home interview surveys - expansion factors - accuracy checks - 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 split analysis - mode choice behaviour, completing modes, mode split curves, probabilistic models.

Route split analysis - 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.

REFERENCES BOOKS:

1. Khanna.S.K and Justo.C.E.G., "Highway Engineering", Nem Chand & Bros., 2009.
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 Prevedouros.P.D, "Transportation Engineering and Planning", Prentice Hall, 2008.
6. Dicky J.W., "Metropolitan Transportation Planning", Tata McGraw Hill, 1980.

CVL472 ADVANCED TOPICS IN TRAFFIC ENGINEERING 3 0 0 3
(Pre-requisite: CVL332)

Unit 1

Traffic stream characteristics and description using distributions: measurements, microscopic and microscopic study of traffic stream characteristics – flow, speed and concentrations, use of counting, internal and translated distributions for describing vehicle arrivals, headways, speeds, gaps and lags, fitting of distributions, goodness of fit tests.

Traffic stream models: fundamental equation of traffic flow, speed – flow - concentration relationships, normalized relationship, fluid flow analog approach, shock wave theory, platoon diffusion and Boltzman like behaviour of traffic flow, car-following theory, linear and non-linear car-following models, acceleration noise.

Unit 2

Queuing analysis: fundamentals of queuing theory, demand service characteristics, deterministic queuing models, stochastic queuing models, multiple service channels, models of delay at intersections and pedestrians crossings.

Highway capacity & level of service studies: concepts, factors affecting capacity & level of service, capacity analysis of different highway facilities, passer car units, problems in mixed traffic flow.

Unit 3

Simulation models: philosophy of simulation, modelling, formulation of simulation model, methodology of system simulation, simulation languages, generation of random numbers, generation of inputs – vehicle arrivals, vehicle characteristics, road geometrics, design of computer simulation experiments, analysis of simulation data, formulation of simulation problems & validation.

TEXTBOOKS:

1. May, A.D., "Traffic Flow Fundamentals", Prentice Hall, New Jersey, 1990.
2. Drew, D.R., "Traffic Flow Theory & Control", Mc-Graw Hill, New York 1968.

REFERENCE BOOKS:

1. TRB-Special Report No.165 – Traffic Flow Theory, TRB, Washington 1965
2. Naylor, T.H., "Computer Simulation Techniques", John Wiley, 1968.
3. Louis J Pignataro, "Traffic Engineering – Theory & Practice", Prentice Hall, New Jersey, 1973.
4. D.L. Gerlough, "Traffic Inputs for Simulation on a Digital Computer", HRB, Vol 38., 1959.

CVL473 TRANSPORTATION SYSTEM MANAGEMENT AND CONTROL 3 0 0 3

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, round-about, 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.

TEXTBOOKS:

1. Institute of Transportation Engineers, "Transportation and Traffic Engineering Hand Book", Prentice Hall, 1982.
2. Louis J. Pignataro, Edmund J. Cantilli, "Traffic Engineering – Theory and Practice", Prentice Hall, 1973.

REFERENCE BOOKS:

1. IRC- SP41-1994: Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas.
2. Salter, R.J., "Highway Traffic Analysis and Design", Macmillan Education, 1989

CVL474 GROUND IMPROVEMENT TECHNIQUES 3 0 0 3
(Pre-requisite: CVL230)

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 bio technical 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 geogrids - physical and strength properties of geotextiles and geogrids - behaviour of soils on reinforcing with geotextiles and geogrids - design aspects with geotextiles and geogrid.

TEXT BOOKS:

1. Moseley, "Text Book on Ground Improvement", Blackie Academic Professional, Chapman & Hall, 1994.
2. Purushothama Raj.P., "Ground Improvement Technique", Laxmi Publications, 2005.

REFERENCE BOOKS:

1. Shashi K. Gulhati and Manoj Dutta, "Geotechnical Engineering", Tata McGraw-Hill, 2005..
2. Boweven R., "Text Book on Grouting in Engineering Practice", John Wiley and Sons, 1981.
3. Jewell R.A., "Soil reinforcement with geotextiles – Special Publication 123", CIRIA Special Publication, Thomas Telford, 1996.
4. Donald .H. Gray & Robbin B. Sotir, "Text Book on Biotechnical & Soil Engineering Slope Stabilization", Wiley International, 1996.
5. Rao G.V. & Rao G.V.S., "Text Book on Engineering With Geotextiles", Tata McGraw Hill, 1990.
6. Korener, "Construction & Geotechnical Methods in Foundation Engineering", McGraw Hill, 1986.

CVL475 SOIL DYNAMICS AND MACHINE FOUNDATIONS 3 0 0 3

(Pre-requisite: CVL331)

Unit 1

Introduction - nature of dynamic loads - stress conditions on soil elements under earthquake loading - dynamic loads imposed by simple crank mechanism - type of machine foundations - special considerations for design of machine foundations - theory of vibration: general definitions - properties of harmonic motion - free vibrations of a mass-spring system - free vibrations with viscous damping - forced vibrations with viscous damping - frequency dependent exciting force - systems under transient forces - Raleigh's method - logarithmic decrement - determination of viscous damping - principle of vibration measuring instruments - systems with two degrees of freedom - special response.

Unit 2

Criteria for a satisfactory machine foundation - permissible amplitude of vibration for different type of machines - methods of analysis of machine foundations - methods based on linear elastic weightless springs - methods based on linear theory of elasticity (elastic half space theory) - methods based on semi graphical approach - degrees of freedom of a block foundation - definition of soil spring constants - nature of damping - geometric and internal damping - determination of soil constants - methods of determination of soil constants in laboratory and field based on IS code provisions.

Unit 3

Vertical, sliding, rocking and yawing vibrations of a block foundation - simultaneous rocking, sliding and vertical vibrations of a block foundation - foundation of reciprocating machines - design criteria - calculation of induced forces and moments - multi-cylinder engines - numerical example (IS code method).
Foundations subjected to impact loads - design criteria - analysis of vertical vibrations - computation of dynamic forces - design of hammer foundations (IS code method) - vibration isolation - active and passive isolation - transmissibility - methods of isolation in machine foundations.

TEXT BOOKS:

1. Bowles, J.E., "Foundation Analysis & Design", McGraw Hill, 1988.
2. P.C.Varghese, "Foundation Engineering", Prentice-Hall of India Private Ltd, 2007.
3. P.Srinivasulu and G.V.Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 2002.

REFERENCE BOOKS:

1. Shamsher Prakash, "Soil Dynamics", McGraw Hill, 1981.
2. Alexander Major, "Dynamics in Soil Engineering", Akademai, 1980.
3. Shashi K. Gulhati and Manoj Dutta, "Geotechnical Engineering, Tata McGraw-Hill Publishing Compay Limited, 2005.

4. IS 2974 - Part I and II, Design Considerations for Machine Foundations
5. IS 5249: Method of Test for Determination of Dynamic Properties of Soils

CVL480 CONSTRUCTION MANAGEMENT 3 0 0 3

Unit 1

Construction management environment - construction activities and sequence. Construction planning - network scheduling - resource management. Bar chart, linked bar chart, work-breakdown structures, activity-on-arrow diagrams - event based networks. Critical path method.

Unit 2

PERT network analysis - time-cost study - crashing. Construction procedure - contracts - specifications - quality control. Construction safety and engineering ethics.

Unit 3

Materials management - inventory control. Transportation model and application for distribution of materials. Management of construction equipment - selection factors - planning of equipment Introduction to project management softwares.

TEXTBOOKS:

1. R.L.Peurifoy and Schexnayder, "Construction Planning, Equipment, and Methods", Tata McGraw Hill, 2005.
2. Gahlot, P.S. and Dhir, B. M., "Construction Planning and Management", Wiley Eastern Limited, 2009.

REFERENCE BOOKS:

1. Jerome D. Wiest, Ferdinand K. Levy, "A Management guide to PERT / CPM", Prentice Hall of India, New Delhi, 1991.
2. L.S. Srinath, "PERT and CPM", Affiliated to East West Press, 2007.
3. Shrivastava.U.K., "Construction Planning and Management", Galgothia Publications Pvt. Ltd, New Delhi, 2004.
4. Chitkara, K.K. "Construction Project Management - Planning, Scheduling and Control", Tata McGraw-Hill Publishing Co., 2nd ed. 2011.

CVL481 CONSTRUCTION PLANNING AND CONTROL 3 0 0 3

Unit 1

Project planning - objectives - principles of planning - stages of planning - process of resource planning - work force, materials, equipment - scheduling - classification - methods of scheduling - bar charts, mile stone charts, network analysis, life cycle

curves - job layout - work brake down structure -- line of balance technique (LOB) - advantages, scheduling with LOB.
Project management through networks - types of networks - choice of network type.

Unit 2

CPM – advantages and disadvantages; earliest event time; latest event time; float; criticality and critical activity; illustrative numerical examples.

PERT - advantages and disadvantages; time estimates - earliest expected time, latest allowable occurrence time, slack, critical path, probability and completion time for a project - illustrative numerical examples.

Unit 3

Construction project management - objectives - project development process - project life cycle, inception stage, preparation stage, execution stage, fast track approach - project management and organizational implications - management functions - causes of project failure.

Management of construction equipment - factors affecting selection of construction equipments - planning of construction equipment.

Planning construction costs – classification - direct and indirect costs - unit rate costing - labour, equipment, materials, break even analysis - standard cost concept - S-curve chart.

TEXTBOOKS:

1. R.L.Peurifoy and Schexnayder, "Construction Planning, Equipment, and Methods", Tata McGraw Hill, 2005.
2. Gahlot, P.S. and Dhir, B. M., "Construction Planning and Management", Wiley Eastern Limited, 2009.

REFERENCES:

1. Chitkara K.K, "Construction Project Management- Planning, Scheduling and Controlling", Tata McGraw-Hill Publishing Company, 2nd ed. 2011.
2. Seetharaman S., "Construction Engineering and Management", Umesh Publications, 2003.
3. Chitale A. K. and Gupta R. C., "Materials Management- Text and cases", Prentice-Hall of India Private Limited, 2006.
4. Gopalakrishnan P and Sundaresan M, "Materials Management an integrated approach", PHI Learning Private Limited, 2009.

CVL491 DESIGN AND DRAWING (WATER RESOURCES ENGG.) 1 0 3 2

Part A

Design and detailed drawing of the following irrigation works:

1. Tank sluice - wing type
2. Tank sluice - weir type

3. Canal regulator (head regulator)
4. Canal drop
5. Syphon aqueducts

Part B:

Design and detailed drawing of the following environmental engineering works:

1. General layout of water supply scheme
2. Mixing basin, flocculation and sedimentation tanks
3. Slow and rapid filters - service and clear water reservoirs
4. Manholes, pumping station, septic tank and imhoff tank
5. Primary and secondary settling tanks- trickling filter and storm water separator.

REFERENCE BOOKS:

1. Sathyarayanan Murthy.C., "Water Resources Engineering – Principles and Practices", New-age International, 2nd ed., 2009.
2. Santhosh Kumar Garg, Irrigation Engineering, 2000.
3. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987
4. Metcalf & Eddy, "Waste Water Engineering Treatment, Disposal & Reuse", Tata McGraw Hill, 2003.

CVL493 QUANTITY SURVEYING AND VALUATION 1 0 2 2

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 for buildings - centre line method and 'long wall - short wall' method.

Preparation detailed estimate for sanitary and water supply works - roads - irrigation works - R.C.C and steel structures.

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. 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. Glenn M. Harde, "Construction Estimating Techniques" – Prentice Hill Inc. Englewood Cliffs New Jersey, 1986.

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.*

CVL497 SEMINAR 0 0 3 1

Individual students will be asked to choose a topic in any field of Civil Engineering, preferably from outside the B.Tech syllabus and give seminar on the topic for about thirty minutes. A committee, will assess the presentation of the seminars.

CVL499 PROJECT 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.

ECE100 ELECTRONICS ENGINEERING 3 0 0 3

Objective: To understand the working of basic electronic devices such as diodes, BJTs and FETs; Introduce the student to the operation and design of fundamental building blocks of electronic systems like power supplies, amplifiers and oscillators; Develop skills to analyze specifications of simple electronic circuits and carry out their design.

Unit 1

Physics of conductors and semiconductors: conductors, semiconductors, silicon crystals, intrinsic semiconductors, two types of flow, doping a semiconductor, two types of extrinsic semiconductors, unbiased diode, forward bias, reverse bias, breakdown, barrier potential and temperature, reverse biased diode, diode approximations.

Rectifiers and diodes: half wave, full wave and Bridge rectifiers. Filters, choke input filter, capacitor input filter, PIV and surge current, Zener diode, loaded Zener regulator, LED, photo diodes, Schottky diode, Varactor diode.

Unit 2

Basics of amplifiers: Introduction to BJT and FET, BJT characteristic curves and regions of operation, emitter and voltage divider bias of BJT, BJT as a switch, LED drivers, JFET characteristics, JFET biasing in Ohmic and active regions, transconductance, JFET amplifiers, depletion mode and enhancement mode MOSFET, CMOS.

Unit 3

Operational amplifiers and linear ICs: differential amplifier, introduction to Opamps, inverting and non-inverting amplifier, comparators, instrumentation amplifier, summing amplifier, voltage follower.

Oscillators: Theory of sinusoidal oscillations, Wein Bridge oscillator, Colpitts oscillator, Quartz Crystal oscillator, introduction to 555 Timer, astable and monostable operation.

TEXTBOOK:

A.P Malvino, "Electronic Principles", Seventh Edition, TMH, 2007

REFERENCES:

1. J. Millman and C C Halkias, "Electronics Devices & Circuits", TMH Edition, 2005
2. David. A. Bell, "Electronics Devices and Circuits", Fifth Edition, Oxford University Press, 2008
3. I. J. Nagrath, "Electronic Devices and Circuits", Prentice-Hall of India, 2007

EEE100 ELECTRICAL ENGINEERING 3 0 0 3

Unit 1

Introduction to electrical engineering. System of units. Electric current, Coulomb's law, Ohm's law, Faraday's law of electromagnetic induction, Kirchoff's laws, Ampere's law.

Ideal independent current and voltage-sources; Reference directions and symbols, energy and power; R, L and C- parameters; Series and parallel combination of resistances, capacitances and inductances, series-parallel circuits, superposition theorem, conversion of a voltage source to current source and vice versa, voltage divider and current divider rule. Network reduction by star–delta transformation, analysis of dc circuits by Mesh-current and nodal methods.

Unit 2

Transient analysis with energy storage elements (for RC-, RL- circuits with DC excitations): Writing differential equations for first order circuits, steady state solution of circuits containing inductors and capacitors, initial and final conditions, transient response of RL and RC circuits (rise and decay).

Sinusoidal steady state analysis: Generation of sinusoidal functions, average and effective values of periodic functions, instantaneous and average power, power factor, phasor representation of sinusoids, response of single elements (R, L and C) for sinusoidal excitation; phasor concept and phasor diagram; Impedance and Admittance concepts; The series RL, series RC and series RLC circuits, complex power and power triangle. Introduction to 3-phase systems; Balanced 3-phase systems (STAR and DELTA connections).

Unit 3

Magnetic circuits: MMF, magnetic flux, reluctance, flux density, analogy with electric

circuits, analysis of magnetic circuits, self and mutual induced emfs, energy stored in a magnetic circuit.

Transformers; construction and principle of operation of transformers, Emf equation. Three phase Induction motor: Types, construction, rotating magnetic field, principle of operation, slip, rotor induced emf.

Measuring instruments, Different types of instruments to measure voltage, current power and energy.

TEXTBOOK:

Vincent Del Toro, 'Electrical Engineering Fundamentals', Second Edition, Prentice Hall of India Private Limited, 2003.

REFERENCES:

1. Giorgio Rizzoni, 'Principles and Applications of Electrical Engineering', Fourth Edition, Tata McGraw-Hill Publishing Company Limited, 2003.
2. Hughes, 'Electrical Technology' Seventh edition, Pearson Education Asia, 2000.

EEE180**WORKSHOP B****1 0 2 2****Electrical workshop:**

Study of safety devices such as fuse, MCB, ELCB & earthing – electrical power distribution in domestic installations, study of tools and accessories used in electrical wiring – wiring practice for staircase circuit, fluorescent lamp, hospital wiring and godown lighting – study of domestic appliances like Mixie, fan, Electric iron, Air conditioner, Refrigerator – study of different types of electric lamps like Incandescent lamp, Fluorescent, CFL, Metal halide, Mercury vapour, Sodium vapour and halogen lamp.

Personal computer hardware workshop:

Study of basic components in a computer - study of basic components in a network – study of diagnostic tools for system and study of floppy disk controller – study of hard disk controller – drivers for different components – trouble shooting in printer – communication between two computers with null modem – transferring characters from PC to LCD.

Electronics and basic microprocessor workshop:

Identification of electronic components and study of measuring instruments – PCB fabrication and soldering practice – study of intel 8085 microprocessor trainer kit concepts.

PIC microcontroller workshop:

Introduction to MP lab simulator. Simulating and burning simple programmes on PIC 16F877A.

ENG111**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 ruminare on human values

Unit 1

Reading: Different styles of communication – reading comprehension - critical thinking and analysis – note-making.

Unit 2

Writing: Prewriting techniques - kinds of paragraphs - basics of continuous writing; Grammar and usage – topics including spelling and number rules (Workbook).

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.

Activities: Short speeches, seminars, quizzes, language games, debates, discussions and book reviews, etc.

TEXTBOOKS:

1. Language through Reading: Anthology compiled by Amrita;

2. Language through practice: Work book compiled by Amrita

REFERENCES:

1. Raymond Murphy. "Murphy's English Grammar", Cambridge Univ. Press, 2004.

2. Michael Swan. "Practical English Usage", Oxford Univ. Press, 2000.

3. Daniel Jones. "Cambridge English Pronouncing Dictionary" Ed. Peter Roach, Jane Setter and James Hartman, Cambridge Univ Press, 2006.

ENG112**TECHNICAL COMMUNICATION****2 0 2 3****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 2

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

Practice in oral communication: Group discussion, interviews and technical presentations.

REFERENCES:

1. Hirish, 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. EB. "The Elements of Style" New York. Alliyon & Bacon, 1999.
4. Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.

ENG250 PROFESSIONAL COMMUNICATION 1 0 2 2

Unit 1

Reading Comprehension: Focus will be on understanding of the given information, vocabulary, inference, logical thinking, and decision - making.

Unit 2

Work place Communication: Writing suggestions, recommendations - reports like, incident report, progress report, trip report, feasibility report – resume writing - formal and business letters – memos, circulars, notices - agenda, meetings, minutes.

Unit 3

Practical: Telephonic conversations, interviews, group and panel discussions, and oral presentations.

REFERENCES:

1. Davis Homer & Peter Strutt. "Words at Work", CUP, 1996.
2. Simon Sweeney. "Communicating in Business", CUP, 2000.

3. Leo Jones & Richard Alexander. "New International Business English" CUP, 2003.

4. Raymond V Lesikar & Marie E. Flatley. "Basic Business Communication", Tata McGraw-Hill Pub. Co. New Delhi, 2005. Tenth Ed.

ENG251 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

Writing – English grammar & business vocabulary - drafting – notice – agenda – minutes – reports – proposals – memos – letters - writing press releases.

Unit 2

Reading – scanning – comprehension – inference - error detection - listening – pronunciation – information & reporting.

Unit 3

Speaking – conversational practice – telephonic conversations – addressing a gathering – conducting meetings - 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. Owen, Roger. BBC Business English. BBC. 1996.
4. Henderson, Greta Lafollette & Price R Voiles. Business English Essentials. 7th Edition. Glencoe / McGraw Hill.
5. Sweeney, Simon. Communicating in Business. CUP. 2000.

ENG252 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

Unit 1

Poems: Toru Dutt – The Casuarina Tree; Sri Aurobindo – The Tiger and the Deer;

Nissim Ezekiel – Farewell Party to Miss Pushpa T S;
Rabindranath Tagore – Upagupta.

Unit 2

Essays and short stories: Jawaharlal Nehru – at Harrow; Swami Vivekananda – The Ideal of a Universal Religion; Dr. S. Radhakrishnan – Philosophy of life; Gita Hariharan – The Remains of the Feast; Anita Desai – The Winterscape; R.K Narayan – The Blind Dog; Jim Corbett – Lalaji; Ruskin Bond – The Night Train at Deoli; Tagore – The Postmaster.

Unit 3

Drama and Speech: Rabindranath Tagore – Chandalika; Mahashwetadevi – Bayen; Swami Vivekananda – Chicago Address; J.Krishnamurthy / C.N.R Rao - Audio speech.

Short Story:**REFERENCES:**

1. "The Golden Treasury of Indo-Anglian Poetry", Ed. V.K. Gokak (1923-1965)
2. "Ten Twentieth Century Indian Poets", by R. Parthasarathy, OUP, 1976.
3. "The Remains of the Feast" by Gita Haiharan from *In Other Words; New Writing by Indian Women*, ed. Urvashi Butalia and Ritu Menon, The Women's Press Limited, 34, Great Sutton Street, London.
4. "Three Plays of Rabindranath Tagore", OUP, Madras, 1979.
5. "An anthology of Popular Essays and Poems". Ed. A.G. Xavier, Macmillan India Ltd., 1988.
6. "Hymns of Darkness", 1976.
7. "Letters from a Father to His Daughter", Allahabad Law Journal Co. Ltd., Allahabad.
8. Vidya, intranet, Amrita Vishwa Vidyapeetham.
9. "Mashi" and Other Stories, Rupa and Co. Paperback – 2002.
10. "My India", Oxford University Press, New Delhi – 2000- paperback.
11. "Prison and Chocolate Cake", Victor Gollencz, London. Indian Edition, Jaico Publishing, Bombay
12. "Twelve Modern Short Stories", Macmillan Publication.
13. "Malgudi Days", R.K. Narayan, Indian Thought Publications, 1996, 23rd reprint 2007.
14. *Diamond Dust and Other Stories*, Anita Desai, Published by Vintage, 2001.
15. *The Complete Works of Swami Vivekananda*, Advaita Ashram, Calcutta.

ENG253 INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE 1 0 2 2

(Pre-requisite: Nil;Equivalent course in 2007 curriculum: Nil)

Objectives -

- to expose the students to different genres of Literature
- to inculcate reading skills
- to provide deeper critical and literary insights

- to enhance creative thinking
- to help the student develop critical and analytical skills
- to promote the aesthetic sense

Unit 1

Poetry

Seamus Heaney – Digging; Philip Larkin – Ambulances; W.B.Yeats - Prayer for my daughter; W. H Auden - Miss Gee; Peter Porter - Your Attention Please; Rabindranath Tagore 's poems "Defamation" and "Playthings".

Unit 2

Drama

Oscar Wilde - Importance of Being Earnest; Anton Chekov – Proposal; Scenes from the great tragedies of Shakespeare.

Unit 3

Essays

Bibhuti Mishra "When I took over from her"; R.K.Narayan "Junk"; M K Naik " The Postman's Knock",

Practical:

Reviews of novels and short stories; Presentations, Review of Literature, Discussions, Role plays.

REFERENCES:

1. Gupta, Balram. G. S. Srinath. C. S. ed. *Indian Humorous Essays*. Chennai: Emerald. 2008. Print.
2. Indira . C T. ed. *The Pleasures of Poetry*. Madras: 2001. Print.
3. Rabindranath Tagore et al. *Collected Poems and Plays of Rabindranath Tagore*. Macmillan India Ltd. 1999. Print.
4. Sachithanandan , V. ed. *Six English Poets*. Madras: Macmillan . 1994. Print.
5. Vishwanathan, R. ed . *ViewlessWings*. Calicut: CU. 1991. Print.
6. Wilde, Oscar. *The Importance of Being Earnest*. Ed. Dr S Sreenivasan. Kollam: Century.2005. Print.

ENV200**ENVIRONMENTAL STUDIES****3 1 0 4**

Unit 1

Overview of the global environmental crisis; Biogeochemical cycles; Climate change and related international conventions and treaties and regulations; Ozone hole and related international conventions and treaties and regulations; Overpopulation; Energy crisis; Water crisis, groundwater hydrogeology, surface water resource development .

Unit 2

Ecology, biodiversity loss and related international conventions, treaties and regulations; Deforestation and land degradation; Food crisis; Water pollution and related international and local conventions, treaties and regulations; Sewage domestic and industrial and effluent treatment; Air pollution and related international and local conventions, treaties and regulations; Other pollution (land, thermal, noise).

Unit 3

Solid waste management (municipal, medical, e-waste, nuclear, household hazardous wastes); Environmental management, environmental accounting, green businesses, eco-labeling, environmental ethics, environmental impact assessment; Constitutional, legal and regulatory provisions; Sustainable development;

TEXTBOOK:

"Environmental Studies - From Crisis to Cure" by R. Rajagopalan, Oxford University Press.2005,ISBN 0-19-567393-X.

REFERENCE BOOKS:

1. G.T. Miller Jr., "Environmental Science", 11th Edition, Cenage Learning India Pvt. Ltd., 2008.
2. Benny Joseph "Environmental Studies", Tata McGraw-Hill Publishing Company Limited, 2006.

FRE201 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

FRE202 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

GER201 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.

GER202 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.

GER211 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

Number 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.

GER212 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.

HUM250 INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY 1 0 2 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

HUM251 INTRODUCTION TO INDIA STUDIES 1 0 2 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.*

HUM252

GLIMPSES OF ETERNAL INDIA

1 0 2 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 – Yudhishthira'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 paramourty – 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 paramourty 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 Arthasastra and Mrichhakatikam 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)*

HUM253**GLIMPSES INTO THE INDIAN MIND -
THE GROWTH OF MODERN INDIA****1 0 2 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.*

HUM254 GLIMPSES OF INDIAN ECONOMY AND POLITY 1 0 2 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 varnashramadharm – socio-political structure of the various institutions based on the four purusharthas; 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) – Yudhishthira'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: dharma-vijaya, lobha-vijaya and asura-vijaya; 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).*
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9. Bajaj, Jitendra & M.D. Srinivas. *Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*
10. Joshi, Murlidhar 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.
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16. Kumar, Dharma, 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.

HUM255 SCIENCE AND SOCIETY – AN INDIAN PERSPECTIVE 1 0 2 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; *Annamahatmyam 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.

JAP201 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.

JAP202 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.

MAT111 CALCULUS, MATRIX ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS 3 1 0 4

Unit 1

Linear systems of equations, Gauss elimination, rank of a matrix, linear dependence. Solutions of linear systems: existence, uniqueness, general form, eigen values, eigen vectors, some applications of eigen value problems, symmetric, skew-symmetric and orthogonal matrices, complex matrices: Hermitian, Skew Hermitian, unitary, similarity of matrices, basis of eigen vectors, diagonalization. (Sections: 6.3, 6.4, 6.5, 7.1, 7.2, 7.3, 7.4, and 7.5)

Limits and continuity. (Sections (in textbook 1): 2.2, 2.3, 2.4, 2.5, 2.6)

Unit 2

Derivatives, curve sketching, improper integral. (Sections (in textbook 1): 3.1, 4.1, 4.3, 4.4, 8.8)

Basic concepts and ideas, exact differential equations, integrating factors, orthogonal trajectories of curves. (Sections: 1.1, 1.5, 1.8)

Unit 3

Review of linear differential equations and Bernoulli equation, modelling: mixing

problem, electric circuits. Review of homogeneous linear equations of second order, Euler-Cauchy equations, solution by undetermined coefficients, solution by variation of parameters. System of linear equation, basic concepts and theory, homogeneous systems with constant coefficients, phase plane, critical points. Criterion for critical points and stability. (Sections: 1.6, 1.7, 2.1, 2.2, 2.3, 2.6, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4)

TEXTBOOKS:

1. 'Calculus', G.B. Thomas Pearson Education, 2009, Eleventh Edition.
2. 'Advanced Engineering Mathematics', E Kreyszig, John Wiley and Sons, 2002, Eighth Edition.

MAT112 VECTOR CALCULUS, FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4

Unit 1

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: 8.4, 8.5, 8.6, 8.9, 8.10, 8.11)

Line integral, line integrals independent of path (Sections: 9.1, 9.2)

Unit 2

Green's theorem in the plane, surfaces for surface integrals, surface integrals, triple integrals – Gauss divergence theorem, Stoke's theorem. (Sections: 9.4, 9.5, 9.6, 9.7, 9.9)

Unit 3

Periodic functions, trigonometric series, Fourier series, functions of any period $p = 2L$, even and odd functions, half range expansions (theorem statement only), complex Fourier series, applications of Parseval's identity. (Sections: 10.1 to 10.5) Basic concepts, modeling; vibrating string, wave equation, separation of variables, use of Fourier series, d'Alembert's solution of the wave equation, heat equation; solution by Fourier series. (Sections: 11.1 to 11.5)

TEXTBOOK:

'Advanced Engineering Mathematics', E Kreyszig, John Wiley and Sons, 2002, Eighth Edition.

MAT211 INTEGRAL TRANSFORMS AND COMPLEX ANALYSIS 3 1 0 4

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. (Sections: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9)

Unit 2

Complex line integral, Cauchy integral theorem, Cauchy integral formula, derivatives of analytic functions. (Sections: 13.1, 13.2, 13.3, 13.4.)

Power series, Taylor series and Maclaurin series. Laurent series, zeros and singularities, residues, Cauchy residue theorem, evaluation of real integrals using residue theorem. (Sections: 14.4, 15.1, 15.2, 15.3, 15.4)

Unit 3

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. Convolution, integral equations, partial fractions, differential equations, systems of differential equations. (Sections: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)

Fourier integrals (Fourier integral theorem statement only), Fourier cosine and sine transforms, Fourier transforms. (Sections: 10.8 to 10.10)

TEXTBOOK:

'Advanced Engineering Mathematics', E Kreyszig, John Wiley and Sons, 2002, Eighth Edition.

MAT212 MATHEMATICAL STATISTICS AND NUMERICAL METHODS 3 1 0 4

Unit 1

Probability, random variables, probability distributions (continuous and discrete), mean and variance of a distribution, expectation and moment generating functions, binomial, poisson and normal distributions, random sampling, estimation of parameters. (Sections: 22.3, 22.5, 22.6, 22.7, 22.8, 23.1, 23.2)

Unit 2

Confidence interval and central limit theorem, testing of hypothesis. (Sections: 23.3, 23.4)

Solution of equations by iterative methods, interpolation. (Sections: 17.2, 17.3)

Unit 3

Numerical integration and differentiation, solution of linear systems by iterative methods, Eigen values of matrices by iterative methods. Numerical solutions for ordinary differential equations and partial differential equations. (Sections: 17.5, 18.3, 18.8, 19.1, 19.4)

TEXTBOOK:

'Advanced Engineering Mathematics', E Kreyszig, John Wiley and Sons, 2002, Eighth Edition.

MEC100**ENGINEERING MECHANICS****3 1 0 4**

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 – ladder friction – wedge friction - analysis of trusses – method of joints – method of sections.

Centroid and centre of gravity: Centroids of lines, areas and volumes – composite bodies.

Second moment of area – polar moment of inertia - mass moment of inertia - radius of gyration.

Unit 3

Dynamics of particles: Kinematics of particles – rectilinear motion – relative motion - position, velocity and acceleration calculations in cylindrical coordinates.

Dynamics of rigid bodies: General plane motion - translation and rotation of rigid bodies – Chasle's theorem – velocity and acceleration calculations in moving frames of references – Coriolis acceleration.

TEXTBOOKS:

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

REFERENCES:

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

MEC180**WORKSHOP A****1 0 2 2**

Product detailing workshop: (Study of simple mechanical and electromechanical system)

Disassemble the product or sub assembly – measure various dimensions using measuring instruments – free hand rough sketch of the assembly and components – name 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.

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.

Sheet metal workshop:

Study of tools and equipment – 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.

Welding workshop:

Study of tools and equipment – study of various welding methods – arc welding practice and demonstration of gas welding and cutting.

Demo and practice workshop:

Fitting: Study of tools, practice in chipping, filing and making joints.

Carpentry: Study of tools, planning practice and making joints.

REFERENCES:

Concerned Workshop Manual

MEC181 ENGINEERING DRAWING 1 0 3 2

Use of drawing instruments – drawing practice – lettering – dimensioning – sketching.

Orthographic projections – projection of points; projection of lines; projection of planes; projection of solids.

Section of solids; Intersection of solids; development of surfaces.

Orthographic views of three-dimensional solids.

Isometric projection.

TEXTBOOK:

John, K. C., Engineering Graphics for Degree, PHI Learning, 2010.

REFERENCES:

1. *Bhat N.D. and Panchal V.M. – Engineering Drawing – Plane and solid Geometry, 42e, Charoatar Publishing House, 2000*
2. *James D. Bethune, Engineering Graphics with AutoCAD, 2002, Pearson Education, First reprint, 2003*
3. *Narayana K.L. & Kannaiah P, Engineering Graphics, SciTech publications, Chennai, 2003*
4. *Waran J Luzadder and John M Duff, Fundamentals of Engineering Drawing, 11e, Prentice Hall of India, New Delhi, 1995*
5. *K. R. Gopalakrishna, Engineering Drawing, 2003, Subhas Publications*

MEC182 COMPUTER AIDED DRAWING 1 0 3 2

Introduction to CAD

Preparation of drawings using CAD Tools

Introduction to VBA / LISP

Introduction to 3D modeling and Surface Modeling

TEXTBOOKS:

1. *Sham Tickoo, AutoCAD 2011 – a Problem solving approach, Autodesk Press, 2011.*

2. *John, K. C., Engineering Graphics for Degree, PHI Learning, 2010.*

REFERENCES:

CADian Manual

MNG400 PRINCIPLES OF MANAGEMENT 3 0 0 3

Unit 1

HISTORICAL DEVELOPMENT: definition of management – science or art – management and administration – development of management thought – contribution of Taylor and Fayol – functions of management – types of business organisations.

PLANNING: nature & purpose – steps involved in planning – objectives – setting objectives – process of managing by objectives – strategies, policies & planning premises - forecasting – decision-making.

Unit 2

ORGANISING: nature and purpose – formal and informal organization – organization chart – structure and process – departmentation by difference strategies – line and staff authority – benefits and limitations – de-centralization and delegation of authority – staffing – selection process - techniques – HRD – managerial effectiveness.

DIRECTING: scope – human factors – creativity and innovation – harmonizing objectives – leadership – types of leadership motivation – hierarchy of needs – motivation theories – motivational techniques – job enrichment.

Unit 3

Communication: process of communication – barriers and breakdown – effective communication – electronic media in communication.

CONTROLLING: system and process of controlling – requirements for effective control – the budget as control technique – information technology in controlling – use of computers in handling the information – productivity – problems and management – control of overall performance – direct and preventive control – reporting – the global environment – globalization and liberalization – international management and global theory of management.

TEXTBOOKS:

1. Harold Koortz & Heinz Wehrich "Essentials of Management", Tata McGraw-Hill, 1998
2. Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCES BOOKS:

1. Tripathy P C and Reddy P N, "Principles of Management", Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, "Personnel and Human Resources Management", Prentice Hall of India, 1996
3. JAF Stomer, Freeman R. E and Daniel R Gilbert, "Management", Pearson Education, Sixth Edition, 2004.
4. Fraidoon Mazda, "Engineering Management", Addison Wesley, 2000.

PHY100**PHYSICS****3 0 0 3**

Unit 1

Special theory of relativity: Frames of reference, postulates of special theory of relativity, time dilation, length contraction, relativistic mass, relativistic momentum, mass and energy, Lorentz transformation, velocity addition, Doppler effect.

Physical background for quantum mechanics: Black body radiation, photoelectric effect, Compton effect, X-ray diffraction, pair production, de-Broglie waves, uncertainty principle.

Unit 2

Quantum mechanics: Wave function, wave equation, Schrodinger equation (time dependent), expectation values-operators, eigen functions and eigen values, Schrodinger equation(steady state), particle in a box-finite potential, tunneling effect, quantum theory of hydrogen atom.

Unit 3

Classical and quantum statistics: Statistical distribution, Maxwell Boltzmann's statistics, molecular energies in an ideal gas, quantum statistics, Rayleigh Jean's formula, Planck's radiation law, free electron in a metal, electron energy distribution, specific heat of solids, evolution of stars.

Solid state physics: Crystalline and amorphous solids - ionic crystals - covalent crystals - Van der Waals bond - metallic bond - Band theory of solids - semiconductor devices.

TEXTBOOK:

Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill, 2003 (6 th edition).

REFERENCES:

1. T.Thornton and A.Rex, "Modern Physics for Scientists and Engineers", Fort Worth: Saunders, 2000 (2 nd edition).
2. P.A.Tipler and R. A. Llewellyn, "Modern Physics", New York: Freeman, 1999 (3 rd edition).

3. S.H.Patil, "Elements of Modern Physics", Tata Mc Graw Hill, 1989.
4. F.K.Richtmyer, H.Kennard, John N.Copper, "Modern Physics", Tata Mc Graw Hill, 1995.

PHY181**PHYSICS LAB.****0 0 3 1****Experiments on mechanics**

1. Torsional pendulum.
2. Co-efficient of viscosity of liquid.
3. Young's modulus - non-uniform bending.

Experiments on optics

1. Determination of lycopodium powder particle size using laser.
2. Dispersive power of prism.
3. Newton's ring.

Experiments on electricity

1. Meter bridge / energy gap.
2. Frequency of AC current.
3. Temperature co-efficient of resistance.

TEXTBOOK:

The manual for experiments prepared by the Department of Physics, AVVP. Experiments will be renewed as and when feasible.

REFERENCE:

D.P.Khandelwal, "A Laboratory Manual of Physics", Vikas Publishing House Pvt Ltd., New Delhi, 1985.

PHY250**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 its 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", Wiley, New York, 1956 (2 nd 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 (5 th edition).

PHY251

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. electro luminescence, 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).

PHY252

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. DA Neamen, "Semiconductor Physics and Devices", TMH, 3rd Edn., 2007.

REFERENCES:

1. SM Sze, "Physics of Semiconductor Devices", Wiley, 1996.
2. P Bhattacharya, "Semiconductor Opto- Electronic Devices", Prentice Hall, 1996.
3. MK achuthan & KN Bhat, "Fundamentals of Semiconductor Devices", TMH, 2007.
4. J Allison, "Electronic Engineering Materials and Devices", TMH, 1990.

PHY253 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", Weiley Eastern, 2004 (2nd edition).
3. B.Chakraborty, "Principles of Electrodynamics", Books and Allied Publishers, 2002

PHY254 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, modulation 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

REFERENCE:

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.

PHY255 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.

PHY260 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 $\Delta\nu$ 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. BB 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. KR Nambiar, "Lasers: Principles, Types and Applications", New Age International (P) Ltd., New Delhi.
5. T Suhara, "Semiconductor Laser Fundamentals", Marcel Dekker (2004).

PHY261**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, WM, *Laser Material Processing (3rd Edition)*, Springer Verlag, 2003, ISBN 1852336986.
2. Silvast, WT, *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.*

PHY262**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 neighbors.

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*

PHY263 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.*

PHY264**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.*

PHY270**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 etal, The essentials physics of medical imaging, Lippincott Williams and wilkins(2002)

PHY271**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, Mc Graw Hill.

REFERENCE BOOKS:

1. D. A. Walls, Lagrangian mechanics, Schaum Series, McGrawHill, 1967.
2. J. B. Marion and S. T. Thornton, Classical dynamics of particles and systems, Ft. Worth, TX: Saunders, 1995.

PHY272 QUANTUM PHYSICS AND ITS 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, Mc Graw 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*

PHY273**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:

1. Suresh Chandra, "Computer Applications in Physics", Narosa Publishing House, New Delhi
1. M Hijroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

PHY274**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 - Schwartzchild 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.

SSK111**SOFT SKILLS I****0 0 3 1**

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; Cryptogritthms.

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.

SSK112**SOFT SKILLS II****0 0 3 1**

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. 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.thegrammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.

SSK113**SOFT SKILLS III****0 0 3 1**

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. 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.thegrammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.