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 CH_3COOH by conductometric titration.
5. Estimation of Fe^{2+} 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 - peizo 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 - H_2S - PH_3 - CO_2 - 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 - florescence 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), $NH_4N(NO_2)_2$, hydrazinium nitroformate (HNF), $N_2H_5C(NO_2)_3$ 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 C_{60} - superconductivity in $C_{60,}$ 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, TiO_2 and metallic nanotubes.
Molecular Electronics and Machines: Molecular electronics: Working of Molecular and supramolecular switches, transistors and wires. Molecular machines: Working of Molecular motors, rotors, cars, elevators and valves.

TEXTBOOKS:
1. *Charles P Poole Jr, Frank J Ovens, "Introduction to Nanotechnology", Wiley Interscience, (2003).*
2. *Alexei Nabok, "Organic and Inorganic Nanostructure", Artech House, Inc. (2005).*
3. *Peter J F Harris, "Carbon Nanotube Science: Synthesis, Properties and Applications", Cambridge University Press, (2009).*
4. *Balzani V, Credi A, Venturi M, "Molecular devices and machines - A journey in to the Nanoworld", Wiley VCH, (2003).*
REFERENCES:
1. *Rao C N R, Muller A, Cheetham A K (Eds.), "The Chemistry of Nanomaterials: Synthesis, Properties and Applications", WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, (2004).*
2. *Zhong Lin Wang, "Characterization of nanophase materials", Wiley VCH, (2000).*
3. *Massimiliano Di Ventra, Stephane Evoy, James R Heflin, "Introduction to nanoscale science and technology", Kluwer Academic Publishers, (2004).*
4. *William A Goddard, III, Donald W Brenner, Sergey Edward Lyshevski and Gerald J. lafrate, "Handbook of Nanoscience, Engineering, and Technology", CRC Press, (2003).*
5. *Balzani V, Credi A, Venturi M, "Molecular devices and machines- A journey in to the Nanoworld" Wiley VCH (2003).*
6. *Bharat Bhushan, "Hand book of Nanotechnology", Springer, (2004).*

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

REFERENCES:

1. Jonathan Black, "Biological Performance of Materials: Fundamentals of Biocompatibility", 4th edition, CRC Press, (2006).

2. John D. Enderle, Susan M. Blanchard, Joseph D. Bronzino, "Introduction to Biomedical Engineering", 2nd edition, Elsevier Academic Press, 2005.

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:

1. Gary W.VanLoon and Stephen J.Duffy, "Environmental Chemistry", Oxford University Press, (2000).

2. Ajay Kumar Bhagi and G.R.Chatwal, "Environmental Chemistry", Himalaya Publishing House, (2003).

REFERENCES:

1. John Wright, "Environmental Chemistry", Routledge, (2003).

2. A K De, "Environmental Chemistry", New Age International, (2003).

3. Fritz Helmet, "Environmental Chemistry", Sarup and sons (Delhi), (2003).

4. *Clair N Sawyer, Perry L McCarty and Gene F Parkin, "Chemistry for Environmental Engineering", McGraw Hill, (1994).*

5. *Jack Barrett, "Chemistry in your Environment", Albion Publishing Ltd., (1994).*

6. *Thomas G Spiro and William M Stigliani, "Chemistry of the Environment", Prentice Hall, (2002).*

7. *Kudisia 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 spetrophotometry - 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 I.L, "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 elecrophilic 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 sulphaonation 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 internationals (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", 7thedition, J.B.Lippincott company, Philadelphia, (1977).*
2. *Burger A, "Medicinal Chemistry", 3rdedition, Wiley Interscience, Newyork, (1970).*
3. *Graham L P, "An Introduction to Medicinal Chemistry", 3rdedition, 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 eletrophiles: Carbocations - formation

and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carbonyl compounds - hydrolysis of carbocyclic acid derivatives - electrophilic aromatic substitution - carbenes and benzynes - Baeyer-Villeger 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-Loffler-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 CO_2, 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 CO_2 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 3 0 0 3
AND MOLECULAR MODELLING

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 Philips, "Introduction to Quantum mechanics", Wiley, (2003).*
3. *Wolfram Koch, Max C. Holthausen, "A Chemist's guide to Density Functional Theory", Wiley, VCH, 2ⁿᵈ edition, (2001).*

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 peizoelectric 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

## CSE210	COMPUTER ORGANIZATION AND ARCHITECTURE	3 1 0 4
(Pre-requisite: ECE210)

Unit 1

Computer abstractions and technology: introduction, classes of computing applications and their characteristics, classic components of a computer, memory system, moore's law, various technologies used for building processors and memories. Instructions, representation of instructions in the computer, instruction format, logical operations, instructions for making decisions, loops, addressing modes. Design principles of instruction sets. Comparison of RISC and CISC architectures.

Unit 2

Arithmetic for computers: signed and unsigned numbers addition and subtraction, multiplication, division, floating point numbers. Assessing and understanding performance: CPU performance and its factors, evaluating performance, SPEC

benchmarks, Amdahl's law. The processor: data path and control: basic implementation, clocking methodology, building a datapath, ALU control, designing the main control unit, performance of single cycle implementation, a multicycle implementation, instruction execution cycle, exceptions, types of control unit. Microprogramming.

Unit 3
Pipeline and vector processing: an overview of pipelining, pipelined data path, pipeline control, data hazards and forwarding, data hazards and stalls, branch hazards. Memory hierarchy: introduction, the basics of cache memory, measuring and improving cache performance, virtual memory, Pentium P4 and AMD Opteron memory hierarchies. Storage, networks and other peripherals: disk storage and dependability, networks, buses and other connections between processors, memory and I/O devices, I/O performance measures.

TEXTBOOK:

Patterson D A and Hennessy J L, "Computer Organization and Design", Third Edition, Morgan Kaufmann Publishers, 2007.

REFERENCES:

1. *Patterson D A and Hennessy J L, "Computer Architecture: A Quantitative Approach", Fourth Edition, Morgan Kaufmann, 2006.*
2. *Stallings W, "Computer Organization and Architecture - Designing for Performance", Seventh Edition, Prentice Hall, 2006.*
3. *Hamacher C, Vranesic Z and Zaky S, "Computer Organization", Fifth Edition, McGraw-Hill, 2002.*

CSE220   OBJECT ORIENTED PROGRAMMING   3 1 0 4

Unit 1
Comparison of various programming methodologies, OOPS concepts, C and C++, compilers for C++, structure of a C++ program, revision of data types, control statements, arrays, insertion and extraction operators, manipulators. Structures, functions within structures, access specifiers, classes and objects, array within a class, array of objects, scope resolution operator, inline functions, static class members. References and reference parameters, default arguments.

Unit 2
Pointers and dynamic memory allocation with new and delete operators. Constructors and destructors, friend functions. Objects as members of classes, Friend classes. Function overloading, overloading a constructor, this pointer. Operator overloading with member functions and friend functions, overloading stream insertion and stream, extraction operators, type conversion.

Unit 3
Inheritance, types of inheritance, function overriding, virtual base class, run time polymorphism, virtual functions, pure virtual function, abstract class. Files & file handling, templates, function templates and class templates, exception handling.

TEXTBOOK:

Lafore R,"Object Oriented Programming in C++", Fourth Edition, SAMS, 2002.

REFERENCES:

1. *Deitel H M and Deitel P J,"C++ How to Program", Pearson Education, Fourth Edition, 2002.*
2. *Nagler E,"Learning C++: A Hands on Approach", Third Edition, Jaico, 2004.*
3. *Stroustrup B,"C++ Programming Language", Special Third Edition, Addison Wesley Professional, 2000.*

CSE221   STRUCTURE AND INTERPRETATION OF   3 1 0 4
COMPUTER PROGRAMS
(Pre-requisite: CSE220)

Unit 1
Introduction to the elements of programming languages: different types of programming languages - describing the syntax and semantics – lexical and syntax analysis – bindings – type checking – scopes and different types of parameter passing methods.

Unit 2
Introduction to LISP and scheme-building abstractions with procedures - the elements of programming procedures and the process they generate – formulating abstractions with higher-order procedures. Building abstractions with data: introduction to data abstraction - hierarchical data and the closure property – symbolic data – multiple representations for abstract data – systems with generic operations.

Unit 3
Modularity, objects and state: assignment and local state – the environment model of evaluation – modeling with mutable data – concurrency - streams. Metalinguistic abstraction: the metacircular evaluator – lazy evaluation - variation on a scheme - nondeterministic computing – logic programming – Introduction to PROLOG.

TEXTBOOK:

Abelson H and Sussman G J, "Structure and Interpretation of Computer Programs", Second Edition, MIT Press, 2005.

REFERENCES:

1. *Sebesta R W, "Concepts of Programming Languages", Ninth Edition, Addison Wesley, 2009.*

2. *Pierce B C, "Types and Programming Languages", MIT Press, 2002.*
3. *Sethi R, "Programming Languages Concepts and Constructs", Second Edition, Addison Wesley, 1996.*
4. *T W Pratt and Marvin V Z, "Programming Languages: Design and Implementation", Third Edition, Prentice Hall, 1995.*

CSE230   **DATA STRUCTURES**   **3 1 0 4**
(Pre-requisite: CSE220)

Unit 1
Introduction: abstract data type – arrays - classes – templates – STL. Stacks, queues, linked list, and recursion: using recursion - linear, binary, and multiple recursions, stack - ADT, array based implementation, implementing recursion and function calls, queues - ADT, array based implementation, double-ended queue, circular queue.

Unit 2
Linked list - ADT, singly linked list, doubly linked list, circular linked list, stack and queue implementation. STL: vector – lists - sequences – iterators - hierarchical sequence of ADT's. Trees: ADT - basic tree traversals - binary tree - data structure for representing trees. Priority Queues: ADT – implementation - heaps.

Unit 3
Types of trees – binary search tree, AVL tree, (2, 4) tree, red-black tree. Graphs: ADT- data structure for graphs - basic traversal - directed graphs - weighted graphs - definition of spanning tree. Dictionaries and hashing: dictionary ADT - hash tables - skip list - complexity.

TEXTBOOKS:

1. *Drozdek A, "Data Structures and Algorithms in C++", Third Edition, Course Technology, 2004.*
2. *Goodrich M T, Tamassia R and Mount D M, "Data Structures and Algorithms in C++", Wiley publication, 2004.*

REFERENCES:

1. *Kruse R, Tondo C L and Leung B, "Data Structure and Program Design in C", Prentice Hall of India Private Ltd, 2002.*
2. *Tremblay J P and. Sorenson P G, "An Introduction to Data Structures with Applications", Second Edition, Tata McGraw-Hill, 2002.*

CSE290   **OBJECT ORIENTED PROGRAMMING LAB.**   **0 0 3 1**

1. Program to implement Input/Output Statements, Manipulators
2. Program using Structures, Functions within Structures
3. Program using Classes and Objects

4. Program using Static data member, Static functions and Functions with reference arguments
5. Program using Constructors and Destructors, Default arguments
6. Program using Friend Functions, Friend Classes
7. Program using Function Overloading, Overloading a constructor
8. Program using Operator Overloading
9. Program to implement Type Conversion
10. Program to implement Inheritance
11. Program to implement Virtual Functions
12. Program using Files
13. Program to implement Templates
14. Program to implement Exception Handling.

CSE291   **DATA STRUCTURES LAB.**   **0 0 3 1**

Note: Lab to be conducted in C++
1. Implementing sample ADT, templates.
2. Stacks and queues: array implementation, applications, using STL.
3. Linked list: implementation, linked stacks, D-queue, circular queue
4. Implementing as STL: vector, lists, sequences, iterators
5. Trees: binary search tree, priority queue, heaps, AVL, red-black tree
6. Graph traversals: BFS, DFS
7. Hashing: hash table creation.

CSE300   **OPERATING SYSTEMS**   **3 1 0 4**

Unit 1
Introduction to operating systems: overview - types of systems - computer system operations - hardware protection - operating systems services - system calls - system structure - virtual machines. Process management: process concepts - process scheduling - operations on process - cooperating process - interprocess communication - multi threading models - threading issues - thread types - CPU scheduling – scheduling algorithms.

Unit 2
Process synchronization: critical section problem - synchronization hardware – semaphores - classical problems of synchronization - critical regions – monitors – deadlocks - deadlock characterization - methods of handling deadlocks - deadlock prevention – avoidance - detection and recovery. Storage management: memory management – swapping - contiguous memory allocation.

Unit 3
Paging and segmentation - segmentation with paging - virtual memory - demand

paging - process creation – page replacement - thrashing. File systems: directory structure - directory implementation - disk scheduling.

Case study: threading concepts in operating systems, kernel structures.

TEXTBOOK:

Silberschatz and Galvin, "Operating System Concepts", Eighth Edition, John Wiley and Sons, 2009.

REFERENCES:

1. *Deitel. Deitel and Choffnes, "Operating System", Third Edition, Prentice Hall, 2003.*
2. *Tannenbaum A S, "Modern Operating Systems", Third Edition, Prentice Hall, 2007.*
3. *Stevens W R and Rago S A, "Advanced Programming in the Unix Environment", Second Edition, Addison- Wesley, 2008.*
4. *Gary Nutt, "Operating Systems", Third Edition, Addison Wesley, 2003.*

CSE310   COMPUTER NETWORKS   3 1 0 4

Unit 1

The internet: the network edge, the network core, delay, loss and throughput in packet switched networks, protocol layers and their service models. Principles of network applications: the web and HTTP, file transfer: FTP, electronic mail in the internet, DNS - the internet's directory service, peer-to-peer applications. Introduction and transport layer services: multiplexing and demultiplexing, connectionless transport - UDP, principles of reliable data transfer.

Unit 2

Transport layer: connection oriented transport - TCP, principles of congestion control, TCP congestion control. Introduction network layer: virtual circuit and datagram networks, inside a router, the Internet Protocol (IP) - forwarding and addressing in the internet, routing algorithms, routing in the internet, broadcast and multicast routing.

Unit 3

The link layer and Local Area Networks (LAN): introduction and services, error-detection and correction techniques, multiple access protocols, link-layer addressing, ethernet, link-layer switches, PPP - the point-to-point protocol. Introduction to wireless networks: wireless links and network characteristics, WiFi- 802.11 wireless LANs, mobile IP, wireless and mobility - impact on higher-layer protocols.

TEXTBOOK:

Kurose J F and Ross K W, "Computer Networking: A Top-Down Approach", Fourth Edition, Addison-Wesley, 2008.

REFERENCES:

1. *Tanenbaum A S, "Computer Networks", Third Edition, PHI, 2004.*
2. *Stallings W, "Data and Computer Communications", Seventh Edition, Pearson Education Asia, 2004.*
3. *Forouzan B A, "Data Communication and Networking ", Third Edition, Tata McGraw Hill, 2004.*

CSE320   SOFTWARE ENGINEERING   3 1 0 4

Unit 1

Software engineering concepts: a generic view of process - categories of software - process models - perspective models - waterfall model - incremental models - evolutionary models - specialized models - unified process models. Requirements engineering: tasks – initiation – elicitation - developing use cases - building the analysis model – negotiation - validation - building the analysis model.

Unit 2

Requirement analysis: approaches - data modeling concepts - OO analysis – scenario-based modelling - flow oriented modelling - class based modelling - behavioral modeling. Design engineering: design process and quality - design concept – model - creating an architectural design - Software architecture - data design - architectural styles and patterns - architectural design - mapping data flow into software architecture - modeling component level design –component – class-based components - conducting component level design - designing conventional components.

Unit 3

Performing user interface design - golden rules - user interface analysis and design - interface analysis - interface design steps - web engineering - attributes, layers, processes and best practices - initiating, analysis, design and testing of Webapp projects. Testing strategies: testing tactics - testing fundamentals - black-box and white-box testing - product metrics. Case study: SWEBOK

TEXTBOOK:

Pressman R S, "Software engineering-A Practitioner's Approach", Sixth Edition, Tata McGraw-Hill, 2005.

REFERENCES:

1. *Sommerville I., "Software Engineering", Sixth Edition, Addison Wesley, 2003.*
2. *Fairley R, "Software Engineering Concepts", Seventh Edition, Tata McGraw-Hill, 1999.*
3. *G J Myers, Corey S, Tom B, Todd M T, " The Art of Software Testing", Second Edition, Wiley, 2004.*
4. *Pankaj J, "An Integrated Approach to Software Engineering", Third Edition, Narosa Publishing House, 2005.*

CSE330   DESIGN AND ANALYSIS OF ALGORITHMS   3 1 0 4
(Pre-requisite: CSE230)

Unit 1
Introduction: growth functions - recurrence relation – methods – master method. Sorting: bubble - insertion sort – selection sort. Divide and conquer: quick sort - merge sort – bucket sort - lower bounds - heap sort - comparisons of sorting.

Unit 2
Greedy algorithm: fractional knapsack problem - task scheduling problem. Dynamic programming: matrix multiplication problem – 0-1 knapsack.

Unit 3
Graph algorithms: graph traversal (DFS, BFS with analysis) – biconnected components - strong connectivity, shortest path algorithms (along with analysis) – Dijkstra – Bellman Ford – Floyd Warshall. All pair shortest path algorithm – minimum spanning tree (with analysis) – Kruskal – Prim's – Baruvka's. NP problems: definition - P, NP, NP complete, NP hard & co-NP, examples – P, NP.

TEXTBOOK:

Goodrich M T and Tamassia R, "Algorithm Design Foundations, Analysis, and Internet Examples", John Wiley and Sons, 2002.

REFERENCES:

1. *Baase S and Gelder A V, "Computer algorithms- Introduction to Design and Analysis", Pearson Education Asia, 2002.*
2. *Cormen T H, Leiserson C E, Rivest R L and Stein C, "Introduction to Algorithms", Prentice Hall of India Private Limited, 2001.*
3. *Dasgupta S, Papadimitriou C and Vazirani U, "Algorithms", Tata McGraw-Hill, 2009.*
4. *Horowitz E, Sahni S and Rajasekaran S, "Fundamentals of Computer Algorithms", Galgotia, 1998.*

CSE331   FORMAL LANGUAGES AND AUTOMATA   3 1 0 4

Unit 1
Automata and languages: introduction finite automata - regular operations **-** **n**ondeterministic finite automata - equivalence of NFAs and DFAs - regular expressions - non-regular languages - pumping lemma for regular languages.

Unit 2
Context free languages - Chomsky normal form - push down automata - pumping lemma for context free language.

Unit 3
Computability theory: turing machines - non-deterministic turing machines - undecidability - PCP computation histories – reducibility.

TEXTBOOK:

Linz P, "An Introduction to Formal Languages and Automata", Fourth Edition, Narosa Publishing House, 2009.

REFERENCES:

1. *Michael Sipzer, "Introduction to the Theory of Computation", Second Edition, Boston, MA: Course Technology, 2005 (pumping lemma to be followed from this book).*
2. *Martin and John, "Introduction to Languages and the Theory of Computation", New York, NY: McGraw Hill, 2002.*
3. *Garey, Michael, and Johnson D S, "Computers and Intractability: A Guide to the Theory of NP-Completeness", New York, NY: W.H. Freeman and Company, 1979.*
4. *J E Hopcroft, R Motwani and J D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Third Edition, Addison-Wesley, 2007.*

CSE340   DATABASE MANAGEMENT SYSTEMS   3 1 0 4

Unit 1
Introduction and the relational model: introduction to DBMS - data models. Structure of relational databases - fundamental relational algebra operations - additional relational algebra operations. SQL: background - SQL data types and schemas - integrity constraints – data definition - basic structure of SQL queries - set operations - aggregate functions - null values. Database design: overview of the design process - the entity-relationship model – constraints - entity-relationship diagrams.

Unit 2
Entity-relationship design issues - weak entity sets - extended E-R features - reduction to relational schemas. SQL & advanced SQL: nested sub-queries - complex queries - views - join relations – authorization - functions and procedural constructs. Relational database design: features of good relational designs - atomic domains and 1NF - decomposition using functional dependencies (2NF) – 3NF, 4NF, BCNF - functional dependency theory.

Unit 3
Decomposition using functional dependencies - decomposition using multi-valued dependencies – PJNF and DKNF. Transaction management: transactions – concept – state - atomicity and durability - concurrent executions - serializability – concurrency control – lock-based protocols – deadlock handling.

TEXTBOOK:

Silberschatz A, Korth H F and Sudharshan S, "Database System Concepts", Sixth Edition, Tata McGraw-Hill Publishing Company Limited, 2010.

REFERENCES:

1. *Elmasri R and Navathe S B, "Fundamentals of Database Systems", Fifth Edition, Addison Wesley, 2006.*
2. *Date C J, "An Introduction to Database Systems", Eighth Edition, Addison Wesley, 2003. (For SQL portions).*
3. *Ramakrishnan R and Gehrke J, "Database Management Systems", Third Edition, McGraw-Hill, 2003.*

CSE351   ADVANCED DATABASES   3 0 0 3

Unit 1

Object-oriented and object-relational databases: complex data types – object-oriented data model – languages – persistent programming languages – C++/Java systems – nested relations – complex types – inheritance – reference types – querying with complex types – functions and procedures – object- oriented vs object-relational. Database system architectures: centralized and client-server/ server system architectures – parallel/distributed systems – network types. Distributed databases: homogeneous and heterogeneous databases – distributed data storage/transactions – commit protocols.

Unit 2

Introduction to concurrency control in distributed databases – introduction to availability – distributed query processing – introduction to heterogeneous distributed databases. Parallel databases: I/O, interquery, intraquery, intraoperation and interoperation parallelism – design of parallel systems. Application development and administration: performance tuning/benchmarks – standardization – legacy systems. Advanced querying and information retrieval: decision-support systems – information-retrieval systems.

Unit 3

Advanced data types and new applications: motivation – time in databases – spatial and geographic data – multimedia databases – mobility and personal databases. Advanced transaction processing: transaction - processing monitors/ workflows – main-memory databases – real-time transaction systems – long-duration transactions – transaction management in multidatabases.

TEXTBOOK:

Silberschatz A, Korth H F and Sudarshan S, "Database System Concepts", Fifth Edition, McGraw Hill, 2002.

REFERENCE:

Hector G and Jeff U, "Database Systems: The Complete Book", Prentice Hall, 2002.

CSE352   PATTERN RECOGNITION   3 0 0 3

Unit 1

Introduction: machine perception – pattern recognition systems – design cycle – learning and adaptation - Bayesian decision theory - minimum error rate classification – discriminant functions – decision surfaces – normal density based discriminant functions - maximum likelihood estimation – Bayesian estimation.

Unit 2

Bayesian parameter estimation – Gaussian case – problems of dimensionality - components analysis and discriminants – hidden Markov models. Non-parametric techniques: density estimation – parzen windows – nearest neighborhood estimation – linear discriminant functions and decision surfaces – two category linearly separable case – perception criterion function.

Unit 3

Non-metric methods: decision trees – CART methods – algorithm independent machine learning - bias and variance – regression and classification - classifiers – unsupervised learning and clustering – mixture densities and identifiably – hierarchical clustering – low dimensional representation – multidimensional scaling

TEXTBOOKS:

1. *Duda R O , Hart P E and Stork D G, "Pattern Classification", Second Edition, John Wiley & Sons, 2003.*
2. *Gose E, Johnsonbaugh R and Jost S, "Pattern Recognition and Image Analysis", Prentice Hall of India, 2002.*

REFERENCES:

1. *Bishop C M, "Pattern Recognition and Machine Learning (Information Science and Statistics)", First Edition, Springer, 2006.*
2. *Bishop C M, "Neural networks for Pattern Recognition", Oxford University Press, 1995.*

CSE353   SOFT COMPUTING   3 0 0 3

Unit 1

Introduction: soft computing concept, importance of tolerance of imprecision and uncertainty, constituent techniques – artificial neural networks, fuzzy logic, evolutionary computation. Neural network: biological and artificial neuron, neural networks, supervised and unsupervised learning. Single layer perceptron, multilayer perceptron – backpropagation learning - neural networks as associative memories - Hopfield networks, bidirectional associative memory.

Unit 2

Topologically organized neural networks – competitive learning, Kohonen maps. Fuzzy logic: fuzzy sets, properties, membership functions, fuzzy operations.

Unit 3

Fuzzy logic and fuzzy inference. Applications. Evolutionary computation: constituent algorithms. Hybrid approaches (neural networks, fuzzy logic, genetic algorithms etc.)

TEXTBOOKS:

1. *Kumar S, "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2004.*
2. *Ross T J, "Fuzzy Logic with Engineering Applications", McGraw Hill, 1997.*
3. *Eiben A E and Smith J E, "Introduction to Evolutionary Computing", Second Edition, Springer, Natural Computing Series, 2007.*

REFERENCES:

1. *Jang J S R, Sun C T, Mizutani E, "Neuro-Fuzzy and Soft Computing", PHI, 2002.*
2. *Goldberg D E, "Genetic Algorithm": Addison Wesley, 1994.*
3. *Rajashekaran S and Vijayalakshmi Pai G A, "Neural Networks, Fuzzy Logic and Genetic Algorithms ", PHI, 2003.*
4. *Fausett L, "Fundamentals of Neural Networks", Prentice Hall, 1994.*

CSE354   AGENT BASED INTELLIGENT SYSTEMS   3 0 0 3

Unit 1

Solving agents – formulating – search strategies – intelligent search – game playing as search.

Unit 2

Knowledge based agents representation - logic – first order logic – reflex agent – building a knowledge base – general ontology – inference – logical recovery. Planning agents situational calculus – representation of planning – partial order planning – practical planners – conditional planning – preplanning agents.

Unit 3

Agents and uncertainty - acting under uncertainty - probabilistic Bayes rule and use - belief networks – utility theory - decision network - value of information – decision theoretic agent design. Higher level agents learning agents – learning from observations – knowledge in learning.
Case studies on applications of AI.

TEXTBOOKS:

1. *Russell S and Norvig P "Artificial Intelligence – A modern approach", Third Edition, Prentice Hall, 2009.*
2. *Nilsson N J, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.*

REFERENCE:

1. *George J.K, Ute St. C and Bo Yuan, "Fuzzy Set Theory: Foundations and Applications", Prentice Hall, 1997*

CSE361   HIGH PERFORMANCE COMPUTING   3 0 0 3

Unit 1

Introduction to high-performance computing: defining computer architecture – trends in technology – trends in power in Integrated circuits – trends in cost – dependability – measuring performance – quantitative principles of computer design – performance and price performance, instruction level parallelism (ILP): concepts and challenges – basic compiler techniques for exposing ILP – reducing branch costs with prediction – overcoming data hazards with dynamic scheduling – dynamic scheduling, examples and algorithm – hardware-based speculation.

Unit 2

Multiprocessors and thread level parallelism: introduction – symmetric shared-memory architecture - performance of symmetric shared-memory multiprocessors – distributed shared-memory and directory-based coherence – synchronization: the basics – models of memory consistency: an introduction.

Unit 3

Memory hierarchy design: introduction – eleven advanced optimizations of cache performance – memory technology and optimizations – protection: virtual memory and virtual machines. Storage systems: introduction – advanced topics in disk storage – definitions and examples of real faults and failures – I/O performance, reliability measures and benchmarks.

TEXTBOOK:

Hennessy J L and Patterson D A, "Computer Architecture: A Quantitative Approach", Fourth Edition, Morgan Kaufmann, 2007.

REFERENCES:

1. *Grama A, Gupta A, Karypis G and Kumar V, "Introduction to Parallel Computing", Addison-Wesley, 2003.*
2. *Wadleigh K R and Crawford I L, "Software Optimization for High-Performance Computing", Prentice Hall, 2000.*

CSE362   CRYPTOGRAPHY   3 0 0 3

Unit 1

Basics of number theory: integers and operations on integers - modular arithmetic - prime numbers – primality related properties and algorithms - pseudo random

number generation. Classical cryptography: basic conventions and terminology - substitution ciphers - transposition ciphers - rotor machines -cryptanalysis.

Unit 2

Foundations of modern cryptography: perfect secrecy - information and entropy - source coding, channel coding and cryptography - product cryptosystems. Symmetric cryptosystems: substitution permutation networks - cryptanalysis through linear and differential analyses - DES and enhancements - AES and its modes. Asymmetric key cryptography: basic ideas of asymmetric key cryptography - RSA cryptosystem - primality testing - square root modulo m-factorization algorithms - attacks on RSA - Rabin cryptosystem - discrete logarithm problem and related algorithms - ElGamel cryptosystem.

Unit 3

Elliptic curve cryptography: finite fields and extended finite fields - elliptic curves - elliptic curve over finite fields - elliptic curve cryptography - typical schemes. Hash functions and message authentication: data integrity - security of hash functions - iterated hash functions - message authentication. Digital signature and authentication schemes: digital signature - digital signature schemes and their variants - digital signature standards - cryptographic identification schemes - other identification schemes.

TEXTBOOK:

Padmanabhan T R, Shyamala C K and Harini N, "Cryptography and Security", First Edition (under publication), Wiley Publications.

REFERENCES:

1. *Stallings W, "Cryptography and Network Security", Third Edition, Pearson Education Asia. Prentice Hall, 2000.*
2. *Forouzan B A, "Cryptography and Network Security", Special Indian Edition, Tata McGraw Hill, 2007.*
3. *Bruce Schneier, "Applied Cryptography", Second Edition, John Wiley & Sons, 1996.*

CSE363   REAL-TIME COMPUTING SYSTEMS   3 0 0 3

Unit 1

Basic real-time concepts: terminology – real-time system design issues – example real-time systems.

Hardware considerations: basic architecture – hardware interfacing - central processing unit – memory – input/output – enhancing performance real-time operating systems: real-time kernels – theoretical foundations of real-time operating systems – intertask communication and synchronization – memory management.

Unit 2

Software requirements engineering: requirements engineering process – types of requirements – requirements specification for real-time systems – formal methods in software specification – structured analysis and design – object oriented analysis and the Unified Modeling Language (UML) software system design: properties of software – basic software engineering principles – the design activity – procedural oriented design – object oriented design.

Unit 3

Performance analysis and optimization: theoretical preliminaries – performance analysis – application of queuing theory – I/O performance – performance optimization – results from compiler optimization – analysis of memory requirements – reducing memory utilization.

TEXTBOOK:

Laplante P A, "Real-Time Systems Design and Analysis", Third Edition, Wiley-India, 2005.

REFERENCES:

1. *Williams R, "Real-Time Systems Development", Elsevier, 2006.*
2. *Liu J W S, "Real-Time Systems", Prentice Hall, 2000.*

CSE371   VISUAL PROGRAMMING   3 0 0 3

Unit 1

Windows programming fundamentals: different paradigms of programming - event driven architecture - GUI concepts - windows programming fundamentals - message driven architecture - message processing and message loop. Data types: hungarian notation - handles - device context. Windows programs: simple window applications - handling mouse.

Unit 2

Handling keyboard - displaying text and graphics - creating and using pens. Visual C++ programming: introduction to VC++ - VC++ components – MFC: fundamentals - class hierarchy - message handling – using MFC classes: CWinApp, CWnd, CString, Clist., using controls: edit box - radio button - progress bar – slider - up down control - list view - tree view, labels, activeX.

Unit 3

Types of applications in VC++: SDI – MDI - dialog based - console based – document - view architecture. Accessing database in VC++: DAO and ODBC - synchronization classes - CSemaphore - CMutex and CEvent.

TEXTBOOKS:

1. *Petzold C, "Programming Windows", Fifth Edition, Microsoft Press,1998.*
2. *Pappas C and Murray W, "Visual C++ 6: The Complete Reference", Tata McGraw Hill.*

REFERENCES:

1. *Schildt H, "MFC Programming from the Ground Up", Second Edition, Tata McGraw Hill Publishing Company Limited, 2000.*
2. *Mueller J P, "Visual C++ 6 from the Ground Up", Tata McGraw-Hill Publishing Company Limited, 1998.*

CSE380   INFORMATION TECHNOLOGY ESSENTIALS   3 0 0 3

Unit 1

Computer hardware and system software concepts: computer architecture, system software, operating systems, computer networking. programming fundamentals: problem solving concepts, modular approach though use of functions, error handling techniques, structured programming and data structures, structured statements, string handling functions, sorting and searching, file handling functions. Object oriented concepts: managing software complexity, concepts of object oriented programming, abstraction, class, object, member data, member methods, encapsulation, data hiding, inheritance, polymorphism, binding.

Unit 2

Analysis of algorithms: principles and tools for analysis of algorithms, analysis of popular algorithms, code tuning techniques, intractable problems. Relational database management: basic RDBMS concepts, database design, SQL commands, embedded SQL concepts, OLTP concepts.

Unit 3

System development methodology: software engineering and software development life cycle (SDLC), quality concepts and quality system procedures, analysis and design methods, structured programming concepts and principles of coding, software testing. User interface design: process of user interface design, elements of user interface design, speech user interface, web design issues. Introduction to web architecture: basic architecture of a web application, security, performance of web based applications, architecture documents.

REFERENCES:

1. *Tanenbaum A. S, "Structured Computer Organisation", Fourth Edition, PHI, 1999.*
2. *Silberschatz A, Korth H F, S. Sudharshan, "Database System Concepts", Fourth Edition, Tata McGraw, 1997*
3. *Pressman R.S, "Software Engineering – A practitioner's approach", Sixth Edition, McGraw Hill Publishers, 2004*

CSE390   JAVA PROGRAMMING   0 0 3 1

Unit 1

Java - features - structure - elements of Java - array, string, string buffer, vectors - methods - object oriented features - classes – constructors – method overloading – static members - nested classes objects - package - Inheritance – overriding methods and fields - abstract class – dynamic binding – polymorphism - interface.

Unit 2

Applet programming - AWT - graphics - event handling - exception handling – user defined exceptions – debugging Java programs - utilities and collections – command line argument – collection framework – wrapper classes - I/O streams – file management – retrieving data from console - multithreaded programming – thread lifecycle – thread priority - concurrency issues.

Unit 3

Swings – model view controller – building non blocking GUI – networking – TCP/IP socket programming – UDP socket programming - RMI development lifecycle – RMI server – RMI client – security issues - database handling – types of drivers – JDBC operations.

TEXTBOOKS:

1. *Arnold, Gosling and Holmes, "The Java Programming Language", Third Edition, Addison-Wesley, 2000.*
2. *Eckel B, "Thinking in Java", Second Edition, Prentice Hall PTR, 2000.*
3. *Naughton P and Schildt H, "Java2 Complete Reference", Tata McGraw Hill, 1999.*

CSE391   DATABASE MANAGEMENT SYSTEMS LAB.   0 0 3 1

1. Working with objects using SQL for the following: data definition language: create, alter, grant, revoke, drop, truncate. Data manipulation language: select, insert, update, delete. Transaction control statements - commit, rollback, save point.
2. Constraints - queries: simple selection, projection and selection with conditions.
3. Functions: aggregate functions, group by, order by, date and conversion functions.
4. Set operators, joins, sub query: simple, nested, correlated, existence test, membership test, DDL and sub queries and DML and Sub queries.
5. Working with other schema objects: view, sequence, index, synonym, cluster, lock, BLOB, CLOB, nested table, type.
6. PL/SQL programs, cursors, functions, procedures, packages, triggers, exception handling.

7. Front end tool: forms creation, validation, triggers and report generation.
8. Mini project.

CSE392   OPERATING SYSTEMS LAB.   0 0 3 1

1. Basic Unix commands
2. Shell scripts
3. Process creation
4. Scheduling algorithms
5. Pipes-shared memory - implementation of algorithms for critical section problem for two processes.
6. Semaphores - classical problems in semaphores.
7. Implement the banker's algorithm of deadlock avoidance
8. Implementation of deadlock detection algorithm
9. Page replacement policies
10. Disk scheduling.

CSE393   SOFTWARE ENGINEERING LAB.   0 0 3 1

1. Analysis: requirement specification report.
2. Software requirement specification (SRS) preparation.
3. Data flow diagram design.
4. Use case model – identifying actors, identifying use cases, use case flow of events, data dictionary creation. Create use case realization.
5. Activity diagram – identifying activities, adding start and end states, state transitions, decisions and guard conditions.
6. Class design
7. Interaction diagrams, deployment and component diagrams.
TOOL: Rational Rose with UML/Visual Modeler, VISIO tool, Magic View.

CSE394   COMPUTER NETWORKS LAB.   0 0 3 1

1. Client server communication using basic socket communication
2. Experimental study of application protocols such as HTTP, FTP, SMTP, using network packet sniffers and analyzers such as Ethereal. Small exercises in socket programming in C/C++/Java.
3. Packet sniffers for understanding the TCP protocol.
4. File transfer between nodes in a network.
5. Introduction to ns2 (network simulator) - small simulation exercises to study TCP behavior under different scenarios.

6. Setting up a small IP network - configure interfaces, IP addresses and routing protocols to set up a small IP network. Study dynamic behavior using packet sniffers
7. Design and implementation of congestion control in TCP/IP network.

CSE400   COMPUTER GRAPHICS AND VISUALIZATION   3 1 0 4

Unit 1
Computer graphics fundamentals – overview of CG: video displays - output primitives: points, lines - line drawing algorithms - circle generation algorithm - filled area primitives - attributes of output primitives. Geometric transformations - basic two-dimensional (2D) transformations: other transformations: reflection and shearing.

Unit 2
Three-dimensional (3D) object representation: fractals - geometrical transformation for 3D objects. Viewing and clipping: two-dimensional viewing clipping operations – three-dimensional viewing: viewing pipeline, viewing coordinates - projections: parallel projections, perspective projections.

Unit 3
Visible surface detection and Illumination models: visible surface detection methods - illumination models and surface rendering - polygon rendering methods: constant intensity shading, Gouraud shading, Phong shading. GUI and color models: GUI: the user dialog - interactive picture construction techniques - color models - computer animation.

TEXTBOOK:
Hearn D and Baker P, "Computer Graphics C Version", Second Edition, Prentice Hall of India, 1996.
REFERENCES:
1. Plastock R A and Kalley G, 'Theory and Problems of Computer Graphics", Schaum's Outline Series, TMH, 1986.
2. Foley J D D, Eiener S K and Hughes J.F, "Computer Graphics Principles and Practice", Second Edition, Pearson Education, 1996.

CSE421   NET CENTRIC PROGRAMMING   3 1 0 4

Unit 1
Introduction to internet: the domain name system – client/server model – internet services of the Internet – ports – IP addresses – web architecture – parsing in browsers – web site design standards. Client side technologies: introduction to markup languages (SGML, HTML, DHTML) – introduction to scripting languages

(Javascript, VBScript, PHP). XML: comparison with HTML - DTD - XML elements - content creation - attributes - entities - XSL - XLINK - XPATH - XPOINTER - namespaces - applications - integrating XML with other applications.

Unit 2
J2EE: architecture - servlets, Java server pages – Java beans – building EJB applications.

Unit 3
Middleware architecture: CORBA, MULE, ACTIVE MQ.

TEXTBOOKS:
1. *Bates C, "Web Programming - Building Internet Application", Second Edition, Wiley- Dreamtech India Pvt. Ltd., 2002.*
2. *Pitter K, Amato S and Callahan J et al, "Every students guide to the Internet", Tata McGraw Hill, 2005.*
3. *Aaron W E, "J2EE a Professional Guide", Tata McGraw Hill, 2003.*

CSE430   COMPUTER LANGUAGE ENGINEERING   3 1 0 4
(Pre-requisite: CSE331)

Unit 1
Overview of translators and different types of programming languages: bootstrap compiler, compiler-compiler, portable compiler, tombstone representation – phases of compiler – simple straight line program interpreter - lexical analysis: regular expressions, finite automata, JLex – parsing: predictive parsing, LR parsing, error recovery.

Unit 2
Abstract syntax: semantic actions and AST – semantic analysis: symbol table, bindings and type checking – activation records, translation to IR - basic blocks and traces: canonical trees, handling conditional branches.

Unit 3
Instruction selection: maximal munch, dynamic programming, CISC machines – liveness analysis: dataflow equations – register allocation: simplification, coalescing, precoloring - putting it altogether.

TEXTBOOK:
Appel, Andrew W., "Modern Compiler Implementation in Java®, Cambridge", UK: Cambridge University Press, 1997.
REFERENCES:
1. *Aho, Alfred V., Sethi R, and Ullman J, "Compilers: Principles, Techniques and Tools", Addison-Wesley, 1986.*

2. *Muchnick, Steven, "Advanced Compiler Design and Implementation", First Edition, San Mateo, CA: Morgan Kaufman, 1997.*
3. *Cooper, Keith, and Torczon L, "Engineering a Compiler", San Mateo, CA: Morgan Kaufman, 2003.*

CSE451   COMPUTATIONAL FINANCE   3 0 0 3

Unit 1
Introduction: computational intelligence in economics and finance – fuzzy logic – rough sets – grey forecasting – artificial neural networks – support vector machines – self organizing maps - finite state automata – decision trees – k nearest neighbors – hidden markov – fourier and wavelet transforms – evolutionary computation – state space approach.

Unit 2
Fuzzy logic and rough sets**:** intelligent system to support judgmental decision forecasting – Case study: estimating hotel room demand – rough sets theory and multivariate data analysis in classification problems. Artificial neural networks and support vector machine: Case studies - forecasting the opening cash price index in integrating grey forecasting and neural networks – support vector model for currency crises determination – saliency analysis of support vector machines for feature selection.

Unit 3
Self organizing maps and wavelets**:** searching financial patterns – applications of wavelets and self organizing maps – pattern matching pattern discovery in databases – discovering hidden patterns with genetic programming – evolutionary strategies versus neural networks – business failure prediction using ants algorithm.

TEXTBOOK:
*Chen S H, Wang P P, "**Computational Intelligence in Economics and Finance" (Advanced Information Processing), Springer-Verlag Berlin Heidelberg, 2004.***
REFERENCES:
1. *Chen S H, "**Genetic Algorithms and Genetic Programming in Computational Finance",** Kluwer Academic Publishers, 2002.*
2. *Mcnelis P D, "Neural Network in Finance: Gaining Predictive Edge in the Market", Elsevier Academic Press, 2005.*

CSE452   MULTIMEDIA DATABASES   3 0 0 3
(Pre-requisite: CSE340)

Unit 1
Introduction: an introduction to object-oriented databases; multidimensional data

structures: k-d trees, point quadtrees, the MX-Quadtree, R-Trees. Image databases: raw images, compressed image representations, image processing: segmentation, similarity-based retrieval, alternative image DB paradigms, representing image DBs with relations, representing image DBs with R-Trees.

Unit 2

Text/document databases: precision and recall, stop lists, word stems and frequency tables, latent semantic indexing, TV-Trees, other retrieval techniques. Video databases: organizing content of a single video, querying content of video libraries, video segmentation, video standards.

Unit 3

Audio databases: a general model of audio data, capturing audio content through discrete transformation, indexing audio data. Multimedia databases: design and architecture of a multimedia database, organizing multimedia data based on the principle of uniformity, media abstractions, query languages for retrieving multimedia data, indexing SMDSs with enhanced inverted indices, query relaxation/expansion.

TEXTBOOK:

Subhramanian V S, "Principles of Multimedia Database Systems", Morgan Kaufmann Publisher, 2001.

REFERENCES:

1. *Khoshafian, "Multimedia and Imaging Databases", Lavoisier Publications, 1997.*
2. *Dunckley L, "Multimedia Databases: An Object Relational Approach Addison Wesley", 2002.*
3. *Shekhar S and Chawla S, "Spatial Databases A tour", Prentice Hall, 2003.*

CSE453   NATURAL COMPUTING   3 0 0 3

Unit 1

Introduction: philosophy of natural computing, three branches, conceptualization, constituent computing techniques. Evolutionary computing: problem solving as search task, standard evolutionary algorithm, constitutent algorithms - similarities and differences, applications. Swarm intelligence: social adaptation of knowledge, ant colony optimization, particle swarm optimization and other variants, applications.

Unit 2

Neural computing: biological and artificial neuron, typical neural networks and learning algorithms, applications. Immuno computing: artificial immune systems, algorithms, artificial immune networks, applications.

Unit 3

Fractal geometry of nature – cellular automata, L – systems, DNA computing, applications. Quantum computing: principles, quantum information, quantum algorithms, physical realization of quantum computers.

TEXTBOOK:

Leandro N C, "Fundamentals of Natural Computing", First Edition, Chapman & Hall/CRC, 2006.

REFERENCES:

1. *Kumar S, "Neural Networks - A Classroom Approach", TataMcGraw Hill, 2004.*
2. *Eiben A E and Smith, J E "Introduction to Evolutionary Computing", Second Edition, Springer, Natural Computing Series, 2007.*
3. *Eberhart R C, Shi Y and Kennedy J, "Swarm Intelligence", First Edition, Morgan Kauffmann, 2001.*
4. *Leandro N C and Timmis J, "Artificial Immune Systems - A New Computational Intelligence Approach", First Edition, Springer, 2002.*

CSE454   PRINCIPLES OF DIGITAL IMAGE PROCESSING   3 0 0 3

Unit 1

Mathematical background for Image processing: review of vectors and matrices, review of probability and statistics. Continuous image characterization: psychophysical vision properties - photometry - colorimetry. Fundamentals of digital image processing: image acquisition – various modalities - image sampling and quantization - mathematical representation - image interpolation.

Unit 2

Intensity transformation and spatial filtering – filtering in frequency domain.

Unit 3

Image restoration and reconstruction – color image processing. Image processing applications.

TEXTBOOK:

Gonzalez R C and Woods R E, "Digital Image Processing", Third Edition, Pearson Education, 2009.

REFERENCES:

1. *Pratt W K, "Digital Image Processing", Fourth Edition, Wiley-Interscience, 2007.*
2. *Castleman K R, "Digital Image Processing", Prentice Hall, 1996.*
3. *Gonzalez, Woods and Eddins, "Digital Image Processing Using MATLAB", Prentice Hall, 2004.*
4. *Russ J C, "The Image Processing Handbook", CRC Press, 2007.*

CSE455   DATA WAREHOUSING AND DATA MINING   3 0 0 3

(Pre-requisite: CSE340)

Unit 1

Data mining: evolution and importance - kinds of data and functionalities - classification of database system - major issues in data mining. Data preprocessing: summarization – cleaning – integration and transformation – reduction – discretization and concept hierarchy.

Unit 2

Mining frequent patterns: basic concepts – frequent item set mining methods – mining association rules – from association to correlation analysis. classification, prediction and clustering: Issues in classification and prediction – decision tree induction – Bayesian classification.

Unit 3

Rule-based classification – K-nearest neighbor classifier – prediction – accuracy and error measures – evaluating the accuracy - increasing the accuracy, overview of cluster analysis - concept – types. Data warehousing: operations - multidimensional data model – data warehouse architecture.

TEXTBOOKS:

1. *Han J and Kamber M, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Morgan Kaufmann Publishers, 2006.*
2. *Soman K P, Diwakar S and Ajay V, "Insight into Data Mining Theory and Practice", PHI of India, 2006.*

REFERENCE:

Inmon W H, "Building the Data Warehouse", Fourth Edition, Wiley Publications, 2005.

CSE456　　　INFORMATION RETRIEVAL　　　3 0 0 3

Unit 1

Boolean retrieval – the term vocabulary and postings lists – dictionaries and tolerant retrieval – index construction. Index compression – scoring, term weighting and the vector space model – computing scores in a complete search system – evaluation in information retrieval.

Unit 2

Relevance feedback and query expansion – XML retrieval – probabilistic information retrieval. Text classification and Naive Bayes – vector space classification – flat clustering – matrix decompositions and latent semantic indexing.

Unit 3

Web search basics – web crawling and indexes – link analysis.

TEXTBOOKS:

1. *Manning C D, Raghavan P and Schütze H, "Introduction to Information Retrieval", Cambridge University Press, 2008.*
2. *Belew R K, "Finding Out About: A Cognitive Perspective on Search Engine Technology and the WWW", Cambridge University Press, 2001.*

REFERENCES:

1. *Rijsbergen C J, "Information Retrieval", Second Edition, Butterworths, 1979.*
2. *Grossman D A and Frieder O, "Information Retrieval: Algorithms and Heuristics", Second Edition, Springer, 2004.*
3. *Kowalski G and Maybury M T, "Information Storage and Retrieval Systems", Second Edition, Springer, 2000.*

CSE457　　　BUSINESS INTELLIGENCE　　　3 0 0 3
(Pre-requisite: CSE340)

Unit 1

Introduction to business intelligence - introduction to OLTP and OLAP, BI definitions & concepts, business applications of BI, BI framework, role of data warehousing in BI, BI infrastructure components – BI process, BI technology, BI roles & responsibilities. Basics of data integration (extraction transformation loading) - concepts of data integration need and advantages of using data integration.

Unit 2

Introduction to common data integration approaches, introduction to ETL using SSIS, introduction to data quality, data profiling concepts and applications. Introduction to Multi-dimensional data modelling - introduction to data and dimension modeling, multidimensional data model, ER modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema.

Unit 3

Introduction to business metrics and KPIs, creating cubes using SSAS. Basics of enterprise reporting - introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS architecture, enterprise reporting using SSRS.

TEXTBOOK:

Loshin D, "Business Intelligence", First Edition, Elsevier Science (USA), 2003.

REFERENCES:

1. *Biere M, " Business intelligence for the enterprise" , Second Edition, IBM Press, 2003.*
2. *Moss L T, Atre S, "Business intelligence roadmap", First Edition, Addison-Wesley Longman Publishing Co., Inc. , 2003.*
3. *Howson C, "Successful Business Intelligence: Secrets to making Killer BI Applications", First Edition, McGraw-Hill Osborne Media, 2007.*
4. *Larson B, " Delivering business intelligence with Microsoft SQL server 2008" , Second Edition, McGraw-Hill Osborne Media,2008.*
5. *Langit L, "Foundations of SQL Server 2008 Business Intelligence", First Edition, Apress, 2007.*
6. *Few S, "Information dashboard design" , First Edition, O'Reilly Media,2006.*

CSE458   COMPUTER VISION   3 0 0 3

Unit 1

Introduction, image formation – geometric primitives and transformations, photometric image formation, digital camera, image processing – point operators, linear filtering, neighborhood operators, fourier transforms, segmentation.

Unit 2

Feature detection and matching – points and patches, edges, lines, feature-based alignment - 2D, 3D feature-based alignment, pose estimation, image stitching, dense motion estimation – optical flow - layered motion, parametric motion, structure from motion.

Unit 3

Recognition - object detection, face recognition, instance recognition, category recognition, stereo correspondence – epipolar geometry, correspondence, 3D reconstruction.

TEXTBOOK:

Szeliski R, "Computer Vision: Algorithms and Applications", Springer, 2010.

REFERENCES:

1. *Shapiro L G and Stockman G., "Computer Vision", Prentice Hall, 2001.*
2. *Forsyth D A and Ponce J, "Computer Vision – A Modern Approach", 2002.*
3. *.Davies E.R, "Machine Vision: Theory, Algorithms, Practicalities", Morgan Kaufmann, 2004.*
4. *Jain R, Kasturi R and.Shunck B G, "Machine Vision", McGraw Hill, 1995.*

CSE460   COMPUTER SYSTEMS ENGINEERING   3 0 0 3
(Pre-requisite: CSE300, CSE310)

Unit 1

Introduction to systems - complexity in computer systems - abstractions and naming - modularity with client/server - operating system structure - clients and servers within a computer - virtualizing processors: threads – performance.

Unit 2

Introduction to networks - layering and link layer - network layer, routing - end-to-end layer - congestion control - distributed naming - reliability - atomicity concepts - recoverability – isolation.

Unit 3

Multi-site atomicity - consistency and replication - security intro - authentication - cryptographic protocols - authorization and confidentiality - systems design experience – complexity.

TEXTBOOKS:

1. *Saltzer, Jerome H and Kaashoek M F, "Principles of Computer System Design: An Introduction, Part I". San Francisco, CA: Morgan Kaufmann, 2009.*
2. *Saltzer, Jerome H. and Kaashoek M F, "Principles of Computer System Design: An Introduction, Part II", from MIT Open Courseware.*

REFERENCE:

Brooks, Frederick P, Jr "The Mythical Man-Month". Reading, MA: Addison-Wesley, 1995.

CSE461   INFORMATION SECURITY   3 0 0 3

Unit 1

Authentication: overview – requirements – functions - protocols – applications – Kerberos – X.509 directory services. Electronic mail security: Email architecture – security - pretty good policy variations – operational descriptions – PGP session keys - key rings – key management – message exchange formats – trust model – effectiveness of PGP - S/MIME- RFC 822 – S/MIME message specification – S/MIME certificates – Email encryption software - applications of PGP and S/MIME.

Unit 2

IP security: introduction to IP - IP security overview - pros and cons – IP sec applications - IP security architecture – IP sec services - authentication header - encapsulating security payload – IP sec modes - combining security associations - key management – IP sec vs other layers (TLS, SSH) web security: web security requirements - secure sockets layer objectives – versions – certificates – protocols - transport level security.

Unit 3

Secure electronic transaction entities – certificates – DS verification – SET and smart cards. System level security: Intruders - types of attacks – intrusion detection – intrusion techniques – intrusion prevention – DIDS architecture – viruses – classification – origin – types – antivirus approaches – structure – digital immune system – firewalls - need for firewall – limitation – types – implementation of firewalls - trusted system – properties – trusted databases - applications.

TEXTBOOK:

Padmanabhan T R, Shyamala C K and Harini N, "Cryptography and Security", First Edition, Wiley Publications. (Under publication)

REFERENCES:

1. *Stallings W, "Cryptography and Network Security", Third Edition, Pearson Education Asia. Prentice Hall, 2000.*
2. *Forouzan B A, "Cryptography and Network Security", Special Indian Edition, Tata McGraw Hill, 2007.*

CSE462   WIRELESS AND MOBILE COMMUNICATION   3 0 0 3
(Pre-requisite: CSE310)

Unit 1

Introduction to wireless communications: evolution of mobile radio communications, paging system, cordless telephone system, cellular telephone system, Modern wireless communication systems: 2G networks, 3G networks, WLL and LMDS, bluetooth and personal area networks. Mobile radio propagation: large scale path loss - free space propagation model, basic propagation mechanisms. Small scale fading and multi path - small scale multi path propagation, UWB pulse transmission, digital cellular transmission, spread spectrum transmissions, diversity and smart transmission.

Unit 2

Local area and ad hoc networks: LAN technologies: evolution of wireless LAN, IEEE 802.11, physical, layer, MAC sub-layer, routing algorithms. Adhoc networks: characteristics – performance issues. Overview to wireless ATM, HYPERLAN, IEEE 802.15 wireless PAN, home RF and Bluetooth.

Unit 3

Cellular concepts: frequency reuse, channel assignment strategies, hand off strategies, interference and system capacity, improving coverage and capacity in cellular systems. Routing in mobile hosts. Mobile IP-DHCP-mobile transport layer – indirect TCP - snooping TCP - transmission/time-out freezing –selective retransmission – transaction oriented TCP.

TEXTBOOKS:

1. *Rappaport T S, "Wireless Communication, Principles and Practice", Second Edition, Pearson Education, 2002.*
2. *Pahlavan K and Krishnamurthy P, "Principles of Wireless Networks", Prentice –Hall, 2006.*

REFERENCES:

1. *Stallings W, "Wireless communications and networks", Pearson Education Ltd, 2002.*
2. *Jochen S, "Mobile communications", Pearson Education Ltd. 2000.*
3. *Lee W C Y, "Wireless and Cellular Communications", Third Edition, Tata McGraw Hill Publishing Company Limited, 2006.*

CSE463   INFORMATION CODING TECHNIQUES   3 0 0 3

Unit 1

Source coding: uncertainty, information and entropy; source coding theorem, Huffman coding, arithmetic coding, Lempel-Ziv algorithm. Channel model, channel capacity and channel coding; Information capacity theorem, Shannon limit.

Unit 2

Linear block codes: matrix description, equivalent codes, parity checking, decoding, syndrome decoding, hamming codes. Cyclic codes: polynomials in GF, division; cyclic codes, generator polynomial, matrix description; shortened cyclic codes, CRC codes; primitive polynomials, minimal polynomials,

Unit 3

BCH codes, generator polynomials; decoding BCH codes; Reed-Solomon codes, nested codes. Convolution codes: trellis, generating function, decoding; turbo codes and their decoding; TCM and TCM decoding

TEXTBOOK:

Ranjan B, "Information Theory, Coding, and Cryptography", Second Edition, Tata McGraw Hill, New Delhi, 2008.

REFERENCES:

1. *Stallings W, "Cryptography and Network Security", Third Edition, Pearson Education Asia. Prentice Hall, 2000.*
2. *Forouzan B A, "Cryptography and Network Security", Special Indian Edition, Tata McGraw Hill, 2007.*

CSE464   EMBEDDED PROGRAMMING   3 0 0 3

Unit 1

ARM embedded systems: the RISC design philosophy - the ARM design philosophy - embedded system hardware - embedded system software ARM processor fundamentals - registers - current program status register - pipeline - exceptions, Interrupts, and the Vector table - core extensions - architecture revisions - ARM processor families. Introduction to the ARM instruction set - data processing instructions - branch Instructions - load-store instructions - software interrupt instruction - program status register instructions - loading constants - conditional execution. Introduction to the thumb instruction: thumb register usage - ARM-thumb interworking - other branch instructions - data processing instructions - single-register load-store instructions - multiple-register load-store instructions - stack instructions - software interrupt instruction.

Unit 2

Efficient C programming: overview of C compilers and optimization - basic C data types - C looping structures - register allocation - function calls - pointer aliasing - structure arrangement - bit-fields - unaligned data and endianness - division - floating point - inline functions and inline assembly - portability issues. Writing and optimizing ARM assembly code - writing assembly code - profiling and cycle counting - instruction scheduling - register allocation - conditional execution -

looping constructs - bit manipulation - efficient switches - handling unaligned data optimized primitives: double-precision integer multiplication - integer normalization and count leading zeros - division - square roots - transcendental functions: log, exp, sin, cos - endian reversal and bit operations - saturated and rounded arithmetic - random number generation. Caches: the memory hierarchy and cache memory - cache architecture - cache policy - coprocessor and caches - flushing and cleaning cache memory - cache lockdown - caches and software performance.

Unit 3
Memory unit: memory protection units - protected regions - initializing the MPU, caches and write buffer - demonstration of an MPU system - memory management units: moving from an MPU to an MMU - how virtual memory works - details of the ARM MMU - page tables - the translation look aside buffer - domains and memory access permission - the caches and write buffer - coprocessor and MMU configuration - the fast context switch extension - demonstration: a small virtual memory system. Embedded operating systems: fundamental components - example: simple little operating system, RTOS – basic concepts. Exception and interrupt handling: exception handling – interrupts - interrupt handling schemes. Firmware: firmware and boot loader example: sandstone

TEXTBOOK:

Sloss A, Symes D and Wright C, "ARM System Developer's Guide: Designing and Optimizing System Software", Elsevier Publications, March 2004.

REFERENCES:

1. Furber S, "ARM System-on-Chip Architecture", Second Edition, Addison-Wesley, 2000.

2. Seal D, "ARM Architecture Reference Manual", Second Edition, Addison-Wesley, 2000.

CSE465   PARALLEL AND DISTRIBUTED COMPUTING   3 0 0 3
(Pre-requisite: CSE310)

Unit 1
Introduction: the reality of high performance computing - modern algorithms – compilers - scientific algorithms – history - state-of-art and perspective - things that are not traditional supercomputers parallel computing - PDC models working mechanism - scalability of PDC architectures – applications, performance metrics and Amdahl's law. Models and algorithms - PRAM algorithms, process-level parallelism, data-level parallelism, problem partitioning, divide-and-conquer, distributed algorithms – algorithm design techniques - filters, client/server, heartbeat, probe/ echo, token-passing, replicated servers.

Unit 2
Communication - interconnection network design, topological and parametric models of interconnection networks; routing mechanisms; flow control mechanisms, communication protocols. Communication primitives - point-to-point communication

primitives; group communication patterns; broadcast in distributed systems, CSP, MPI; synchronization - locks, monitors, barriers; deadlock; hardware primitives and implementation issues; clock synchronization, distributed mutual exclusion; distributed deadlock detection. Computation: threads - creation, coordination, termination; futures.

Unit 3
Shared memory - models of memory consistency; implementation of consistency protocols; transactions: serializability, concurrency - control, commit protocols; Linda. scheduling and load balancing: load distribution algorithms; task migration; co-scheduling; affinity scheduling; self-scheduling in loops.

TEXTBOOKS:

1. Wilkinson B and Allen M, "Parallel Programming Techniques and Applications using Networked Workstations and Parallel Computer", Prentice Hall, Upper Saddle River, 2004.

2. Tanenbaum A, "Distributed Operating Systems", Prentice Hall, 1999.

REFERENCE:

Nikhil R S and Arvind, "Implicit Parallel Programming in PH", Morgan Kaufman, 2001.

CSE471   FREE AND OPEN SOURCE SOFTWARE   3 0 0 3

Unit 1
Introduction: history - the rise of proprietary software and free software - "Free" versus "Open Source" - overview of development process; technical infrastructure - mailing lists - version control - bug tracker - IRC/Real-time chat systems - RSS feeds - wikis - web site - overview of funding activities, communications - packaging, releasing and daily development - licenses, copyrights and patents.

Unit 2
FOSS programming: introduction to python programming – control flow tools – data structures – modules – input and output – errors and exceptions – classes.

Unit 3
FOSS - collaborative software development: introduction to autotools (Autoconf, Automake, Libtool) – how to run configure and make – introducing Makefile – a minimal Autotools project; Integrated development environments, documentation - eclipse, LaTeX; Case studies of open source software development - Apache and Mozilla. Featuredevelopment and defect repair (FDDR) case study: a simulated environment of the collaborative development process, standards and techniques to emphasize on large-scale programming and improve the program writing, understanding and debugging skills - to work on large ongoing projects especially on feature addition/ enhancement and/or maintenance in a controlled environment.

TEXTBOOKS:

1. *Karl Fogel, "Producing Open Source Software - How to Run a Successful Free Software Project", O'Reilly Media, 2005.*
2. *Joseph Feller, "Perspectives on Free and Open Source Software", MIT Press, 2007.*

REFERENCES:

1. *Karl Fogel, "Producing Open Source Software - How to Run a Successful Free Software Project", http://producingoss.com/*
2. *Joseph Feller, "Perspectives on Free and Open Source Software", http://mitpress.mit.edu/ books/ chapters/0262562278.pdf*
3. *Guido V R, Fred L. D, "Python Tutorial", http://www.python.org/doc/current/tut/tut.html*
4. *Gary V. V, "GNU Autoconf, Automake and Libtool", http://sourceware.org/autobook/*

CSE472   DATA COMPRESSION   3 0 0 3

Unit 1

Information theory foundation: entropy, its properties, conditional entropy, mutual information, types of codes, Krafts McMillan inequality theorem, source coding theorem. Introduction to compression techniques: introduction, types of compression - Lossy, lossless. Performance measures, modeling, coding. Text compression: Huffman-static and dynamic, application in text compression, Shannon Fano Elias coding, arithmetic coding, dictionary based coding -static, adaptive, UNIX compress.

Unit 2

Scalar and vector quantization: scalar quantization – introduction, uniform and adaptive quantization. Vector quantization - introduction, advantages, LBG, tree vector quantization, trellis coded quantization.
Audio compression: distortion criteria - auditory perception, PCM, DPCM, ADPCM, predictive coding - basic algorithm, basic sub-band coding, MPEG audio coding.

Unit 3

Image compression: distortion criteria - the human visual system, transform coding - DCT, JPEG, JBIG II, GIF, wavelet-based compression - wavelets, the scaling function, Haar transforms, JPEG-2000. Video compression: motion estimation and compensation - full search and fast search algorithms, H.261, MPEG-1, MPEG-2, MPEG-4, MPEG -7.

TEXTBOOK:

Sayood and Khalid, "Introduction to Data Compression", Third Edition, Morgan Kaufmann, 2006.

REFERENCES:

1. *Richardson I E G, "Video Codec Design: Developing Image and Video Compression Techniques", John Wiley & Sons, 2002.*
2. *Salomon D, "Data Compression: The Complete Reference", Fourth Edition, Springer, 2007.*

3. *Gersho A and Kluwer R M G, "Vector Quantization and Signal Compression", Academic Press, 1992.*

CSE473   SOFTWARE QUALITY ASSURANCE   3 0 0 3
(Pre-requisite: CSE320)

Unit 1

Introduction - software quality in the business context - managing software quality in the organization - quality management systems - planning for software quality assurance - product quality and process quality.

Unit 2

Software measurement and metrics - walkthroughs and inspections - ISO 9001 - what is ISO 9001 - what is CMMI - introduction to CMMI for development - process area components - understanding capability levels - introduction to people CMM.

Unit 3

Statistical quality control and process control - software maintenance models - cyclomatic complexity - principles of coupling and cohesion - introduction to Six Sigma. **Case studies** - Indian software industry in perspective.

TEXTBOOKS:

1. *Godbole N, "Software Quality Assurance, Principles and Practice", Narosa Publications, Reprint 2007.*
2. *CMMI for development Version 1.2, CMMI website: www.sei.cmu.edu/reports/06tr008.pdf*
3. *People CMM- http://www.sei.cmu.edu/cmmi/tools/peoplecmm/*

REFERENCES:

1. *Perry W, "Effective Methods of Software Testing", Third Edition, Wiley Publication, 1995.*
2. **Pankaj Jalote, "***An Integrated Approach to Software Engineering", Third Edition, **Narosa Publishing House, 2005.**
3. *ISO: www.iso.org.*
4. *Bill Curtis, William E. H, Sally A. M, "People CMM: A Framework for Human Capital Management", Second Edition, Pearson Education.*

CSE474   COMPONENT BASED DEVELOPMENT   3 0 0 3
(Pre-requisite: CSE421)

Unit 1

Introduction to components: terms and concepts. Components – objects - components and objects – modules - white box versus black box abstractions and reuse. Interfaces. Components, interfaces and re-entrance: components and interfaces - direct and indirect interfaces – versions - interfaces as contracts.

Unit 2

Patterns, frameworks, architectures, wiring standards. The OMG way (CORBA, CCM, OMA, and MDA), Microsoft COM, .NET CLR: the first fundamental wiring model – COM, DCOM, .NET framework, common language frameworks, XML and data - enterprise services - web services with .NET.

Unit 3

Component development: the methodology - component-oriented programming - problems of asynchrony – multithreading - learning from circuit design - living without implementation inheritance - nutshell classes - language support - dynamic base objects with forwarding semantics - caller encapsulation - The environment, selecting target frameworks - the tools, selecting programming languages.

TEXTBOOK:

Szypersk C, Gruntz D and Mureri S, "Component Software Beyond Object- Oriented Programming", Second Edition, Pearson Education, 2004.

REFERENCES:

1. *George T. H, William T. C. "Component-Based Software Engineering: Putting the Pieces Together", First Edition, Addison-Wesley Professional, 2001*
2. *Sudha G S, "Component Based Development", First Edition, Wiley India, 2008*

CSE475 NATURAL LANGUAGE PROCESSING 3 0 0 3
(Pre-requisite: CSE331)

Unit 1

Introduction: words - morphology and finite state transducers - computational phonology and pronunciation modelling - probabilistic models of pronunciation and spelling - N-gram models of syntax - hidden markov models and speech recognition - word classes and part of speech tagging.

Unit 2

Context-free grammars for english – parsing with context free grammar – features and unification - lexicalized and probabilistic parsing - language and complexity. Semantics: representing meaning - semantic analysis - lexical semantics - word sense disambiguation and information retrieval.

Unit 3

Pragmatics: discourse - dialog and conversational agents - natural language generation. Statistical alignment and machine translation: text alignment – word alignment – statistical machine translation.

TEXTBOOK:

Daniel and Martin J H "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2000.

REFERENCES:

1. *Manning C D and Schutze H "Foundations of Statistical Natural Language processing", First Edition, MIT. Press, 1999.*
2. *Allen J, "Natural Language Understanding", Second Edition, Pearson Education, 2003.*

CSE476 BIOINFORMATICS 3 0 0 3

Unit 1

Introduction: the central dogma – killer application – parallel universes – Watson's definition – top down vs bottom up approach – information flow – conversance – communications. Database and networks: definition – data management – data life cycle – database technology – interfaces – implementation – networks: communication models – transmission technology – protocols – bandwidth – topology – contents – security – ownership – Implementation.

Unit 2

Search engines and data visualization: search process – technologies – searching and information theory – computational methods – knowledge management – sequence visualizations – structure visualizations – user interfaces – animation vs simulation. Statistics, data mining and pattern matching: statistical concepts – micro arrays – imperfect data – basics – quantifying – randomness – data analysis – tools selection – alignment – clustering – classification – data mining methods – technology – infrastructure pattern recognition – discovery.

Unit 3

Machine learning – text mining – pattern matching fundamentals – dot matrix analysis – substitution matrix – dynamic programming – word method – Bayesian method – multiple sequence alignment tools. Modeling simulation and collaboration: Drug discovery fundamentals – protein structure – system biology tools – collaboration and communication – standards – issues – Case study.

TEXTBOOK:

Bergeron B, "Bio Informatics Computing", Prentice Hall, 2003.

REFERENCES:

1. *Affward T K and Smith D J P, "Introduction to Bio Informatics", Pearson Education, 2001.*
2. *Baldi P and Brunak S, "Bio Informatics - The Machine Learning Approach", Second Edition, First East West Press, 2003.*

CSE481   MANAGEMENT INFORMATION SYSTEMS   3 0 0 3

Unit 1

Fundamental concepts - information systems in business: roles of IS, trends, e-business, types of IS, managerial challenges; components of IS: system concept, components, IS resources, activities, case studies. E-business applications – e-business systems: introduction, cross-functional integration, application integration, transaction processing, enterprise collaboration systems; functional business systems, IT in business, marketing systems, manufacturing systems, HR systems, accounting and financial systems, case studies; enterprise business systems: CRM, ERP, SCM, case studies.

Unit 2

Electronic commerce systems & DSS – e-commerce systems: scope, processes, payment systems, application, case studies; decision support systems: introduction, structure of decisions, trends, systems, OLAP, usage, EIS, portals, artificial intelligence and its applications in business, case studies. Strategic role of IT – competing with IT: strategic IT, uses of IT, value chain, reengineering, agility, virtual organizations, knowledge creation, case studies; Business/IT strategy: organizational planning, scenario approach, SWOT, business models, IT planning, IT strategies, application planning; implementation challenges, barriers, change management, case studies.

Unit 3

Management challenges - security and ethical challenges: IT security, ethics, computer crime, privacy Issues, ethical responsibilities, cyber laws, challenges; security management: tools, security defense in the internet, security measures, system controls and audits, case studies; enterprise and global management of IT: business and IT, managing IT, IT function in enterprises. Organizing the IT function, outsourcing, off shoring, failures; managing global IT: cultural, political, geo-economic issues, global IT applications, platforms and strategies, data access Issues, global system development, case studies.

TEXTBOOK:

O'Brien J, Marakas G M and Behl R, "Management Information Systems", Ninth Edition, Tata McGraw-Hill Special Indian Edition, 2010.

REFERENCE:

Laudon and Laudon, "Management Information Systems", Eleventh Edition, Pearson Education, 2010.

CSE482   SOFTWARE PROJECT MANAGEMENT   3 0 0 3

Unit 1

Introduction to software project management - software projects - ways of categorizing software projects – problems with software projects - project life cycle – management - setting objectives – stakeholders - project team – step wise: an overview of project planning - project evaluation - selection of appropriate project approach. Software effort estimation – function point analysis - object point – COCOMO.

Unit 2

Activity planning - project schedules - sequencing and scheduling projects - network planning models - AON and AOA - identifying critical activities - crashing and fast tracking. Risk management: categories, risk planning, management and control - evaluating risks to the schedule, PERT. Resource allocation - identifying resource requirements - scheduling resources - creating critical paths - publishing schedule - cost schedules - sequence schedule.

Unit 3

Monitoring and control – visualizing progress, earned value analysis – managing people and organizing teams – organizational structures – planning for small projects. Case study: PMBOK.

TEXTBOOK:

Hughes B and Cotterell M, "Software Project Management", Fourth Edition, Tata McGraw-Hill, 2006.

REFERENCES:

1. *Marchewka J T, "Information Technology Project Management Providing Measurable Organizational Value", Wiley Publication, 2006.*
2. *Pressman R S, "Software Engineering – A Practitioner's Approach", Sixth Edition, McGraw-Hill Publishers, 2005.*
3. *Jalote P, "Software Project Management in Practice", Second Edition, Pearson Education, 2003.*

CSE483   ELECTRONIC COMMERCE   3 0 0 3

Unit 1

E-business and e-commerce: foundations of electronic commerce - definition and content, benefits and limitations, driving forces of electronic commerce, Impact of electronic commerce, e-commerce framework, e-business models (B2C), B2B. Infrastructure for EC: internet protocols, internet security - digital signatures, digital certificates, secure socket layer, firewalls, virtual private networks.

Unit 2

Applications: SCM, CRM, ERP, WAP, virtual value chain. Search engines: working, advantages, ISP-working, types, structure, choosing an ISP, problems with ISPs, web portals. Web presence: planning, designing - design criteria, creating web pages and launching them into cyberspace. Electronic payment systems: basics of electronic payment systems, electronic cash, electronic wallets, smart cards, SET, EFT.

Unit 3

Public policy, legal issues, privacy: legal, ethical and other public policy issues, protecting privacy, protecting intellectual property, taxation. advertisement in electronic commerce - web advertisement, advertisement methods, advertisement strategies, push technology and intelligent agents, economics and effectiveness of advertisement, online catalogs.

TEXTBOOK:

Turban, Lee E J, King D and Chung H M, "Electronic Commerce: A Managerial Perspective", Prentice-Hall, 2004.

REFERENCE:

Kalakota R and Robinson M, "E-Business: Roadmap for Success", Addison-Wesley Co., 1999.

CSE490   COMPUTER GRAPHICS AND VISUALIZATION LAB.   0 0 3 1

1. Graphing mathematical function Ex: $y = ax + b$, coordinate axis display, line graph, bar graph, histogram and piechart
2. Line drawing algorithms (drawing line with different attributes: width, type - solid, dotted, dash, dot and dash)
3. Circle drawing algorithms (drawing circle with different attributes: width, type - solid, dotted, dash, dot and dash, display each dot of the circle as another circle, use random colors)
4. Translation (simple translation for basic geometric objects – (square and triangle), create an animation: moving car - in a straight line path, in   randomposition)
5. Rotation (simple rotation for basic geometric objects – (square and triangle), enhancing moving car animation - rotating the wheel of the cars, allow the user to specify the speed)
6. Scaling (simple scaling for basic geometric objects – (square and triangle), creating zoom-in and zoom-out application - description: display various geometric objects in the screen, enable the mouse. Left click on any of the object should reduce its size and right click should increase the size.)
7. Reflection (simple reflection for basic geometric objects – (square and triangle), create a rectangular photo frame and design a scene, and create the mirror image of the photo frame.)
8. Shearing (simple shearing for basic geometric objects – (square and triangle), shear an object with mouse drag operation)
9. Line clipping algorithms (implement the Cohen-Sutherland line clipping algorithm, display random number of lines with random coordinates and display a square with random coordinates. By using the square as clip window clip the lines)
10. Polygon clipping algorithms (implement the Sutherland-Hodgeman polygon clipping algorithm, draw a tree with basic drawing objects and move a window on the tree, do the clipping operation when the use presses the enter key)

CSE491   COMPUTER LANGUAGE ENGINEERING LAB.   0 0 3 1

1. Program for performing the operations on languages.
2. Program to implement the lexical analyzer using DFA.
3. Program for constructing NFA using Thompson's algorithm.
4. Program for constructing DFA from a regular expression.
5. Program to implement Shift reduce parsing algorithm.
6. Program for constructing LR parsing table.
7. Program to generate DAG for the given expression.
8. Program to simulate the storage management.
9. Program to generate a code for a given intermediate code.

CSE497   SEMINAR   0 0 3 1

Each student is to prepare a seminar paper related to Computer Science and Engineering in an approved format and present it at the end of the semester. No weekly slot to be allotted for presentation.

CSE499   PROJECT   10 cr

The project shall be focused on the synthesis of the knowledge gained over the past seven semesters, by taking up a work of relevance to the area of specialization covering – design / development / realization / application / conceptual ideas / state-of-the-art technology. A report should be submitted in approved format before final examination.

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 – Purushurthas; 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 -   1 0 2 2
AN INDIAN PERSPECTIVE

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 Ranaganathananda published by Bharatiya Vidya Bhavan, Bombay.*
6. *Personality Development – Swami Vivekananda published by Advaitha Ashram, Kolkatta.*
7. *Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay*
8. *Will Power and its Development- Swami Budhananda published by Advaitha Ashram, Kolkatta*
9. *Ultimate Success - Swami Ramakrishnananada Puri published by Mata Amritanandamayi Math, Kollam*
10. *Yoga In Daily Life - Swami Sivananda – published by Divine LIife 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 Advaitha 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:

IFIH'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 indispensible 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*

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*

ECE210   DIGITAL SYSTEMS   3 1 0 4
(Pre-requisite: ECE100)

Unit 1

Introduction to logic circuits, logic families: Variables and functions, inversion, truth tables, logic gates and networks, Boolean algebra, synthesis using AND, OR, NOT, NAND and NOR gates. Design examples. Introduction to logic families such as ECL, TTL.

Implementation technology: Transistor switches, NMOS logic gates, CMOS logic gates, Negative logic system, tri-state logic.

Optimized implementation of logic functions: Karnaugh map, strategy for minimization, minimization of product of sums forms, incompletely specified functions,

multiple–output circuits multilevel synthesis, analysis of multilevel circuits, cubical representation, a tabular method for minimization.

Number representation and arithmetic circuits: Addition of unsigned numbers, signed numbers, fast adders.

Unit 2

Combinational circuit building blocks: Multiplexers, decoders, encoders, code converters, arithmetic comparison circuits.

Flip flops, registers, counters: Basic latch, gated SR latch, gated latch, master slave and edge triggered D flip-flops, T flip-flop, JK flip-flop, registers, counters, reset synchronization, other types of counters.

Synchronous sequential circuits: Basic design steps, state assignment problem, mealy state model, serial adders example, state minimization.

Unit 3

Asynchronous sequential circuits: Asynchronous behavior, analysis of asynchronous circuits, synthesis of asynchronous circuits, state reduction, state assignment, hazards.

TEXTBOOK:

Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital logic with Verilog Design", Tata McGraw Hill Publishing Company Limited, Special Indian Edition, 2007.

REFERENCES:

1. *Morris Mano, "Digital Design", Third Edition, Pearson Education, 2006.*
2. *Donald D Givone, "Digital Principles and Design", Tata McGraw Hill Publishing Company Limited, 2003.*
3. *Allen Dewey, "Analysis and Design of Digital Systems with VHDL", PWS Publishing Company, 1999.*
4. *John F. Wakerly, "Digital Design Principles and Practices", Third Edition, Pearson Education, 2001.*

ECE212   INTRODUCTION TO EMBEDDED SYSTEMS   3 1 0 4

Unit 1

Registers: File registers - memory organization tristate logic – buses - memory address register - memory addressing - read and write operations – ROM – RAM – PROM – EPROM - E^{2}PROM. Introduction to elementary processor: Organization - data transfer unit (DTU) – operation - enhanced data transfer unit (EDTU) – opcode - machine language - assembly language - pipeline scheme and system clock.

Unit 2

Introduction to microcontrollers: PIC16FXXX architecture – operation - data and program memory organization - special function registers - addressing modes - instruction set. MPLAB IDE simulator – assembler - assembler directives - simple

programs - conditional branching – subroutines - nested subroutines – interrupts - interrupt service routines - priority.

Unit 3

PIC peripherals: Application of each peripherals and its use: Ports - IO ports - port configuration - parallel slave port - LED, LCD and keyboard interface -timers and counters - watchdog timer - analog to digital converter specification – operation - EEPROM data memory - serial communication – USART - CCP module. Introduction to 8051 microcontrollers: Architecture - instruction set – interrupts – ports - timers.

TEXTBOOK:

Padmanabhan T R, "Introduction to Microcontrollers and their Applications", First Edition, Narosa Publishing House Private Limited, 2007.

REFERENCES:

1. *Ayala K J, 'The 8051 Microcontroller", Thomas Delman Learning, 2004.*
2. *PIC Micro mid Range MCU Family Reference Manual, Micro Chip Technology Inc.*

ECE290   DIGITAL SYSTEMS LAB.   0 0 3 1

1. Realization of basic logic functions using universal logic gates.
2. Construction of simple decoder & multiplexer circuits using logic gates.
3. Design of combinational circuits for BCD to decimal conversion to drive 7- segment display using multiplexer.
4. Construction of simple arithmetic circuits–adder, subtractor using logic gates, multiplexers, decoders
5. Realization of RS-JK and D flip flops, universal register
6. Realization of synchronous and asynchronous up and down counter.
7. Adder circuit using shift register and full adder.

ECE294   EMBEDDED SYSTEMS LAB.   3 1 0 4

1. Assembly programming
2. Embedded C/Java programming
3. Programming in an RTOS platform
4. Peripheral interfacing
5. Programs for Interrupt management
6. Structured programming for embedded systems
7. Task scheduling exercises
8. Digital signal processing (DSP)
9. Writing driver software

ECE300   INTRODUCTION TO DIGITAL SIGNAL PROCESSING   3 0 0 3

Unit 1

Discrete time signals and systems: Basic sequences and sequence operations – periodicity of sequences, discrete time systems – impulse response, linearity, time variance and time invariance, causality, and stability. Convolution – properties of LTI systems, sampling of continuous signals – discrete frequency, reconstruction and aliasing.

Unit 2

Fourier transforms: Discrete fourier series for periodic sequences, discrete fourier transform and properties, circular convolution, linear convolution, and DFT relationship, DFT computation – DIT and DIF algorithm and computation, impulse response and frequency response of LTI systems.

Unit 3

Filter design techniques: Filter specifications, analog filters (Butterworth filter may be studied in detail and concept of Chebyshev filters), IIR filter design using impulse invariance and bilinear transformation, FIR filter design – linear phase – windowing (rectangular, hamming/hanning), frequency transformation, filter structures and implementation of transfer function (direct form 1 and 2).

TEXTBOOK:

Oppenheim A V, Schaffer R W, "Discrete Time Signal Processing," Second Edition, Prentice Hall, 2000.

REFERENCES:

1. *Proakis J G and Manolakis G, "Digital Signal Processing Principles, Algorithms, Applications", Fourth Edition, Prentice Hall India Private Limited, 2007.*

2. *Mitra S J, "Digital Signal Processing, a Practical Approach", Tata McGraw-Hill Publishing Company Limited, 2005.*

ECE370   INTRODUCTION TO VLSI DESIGN   3 0 0 3

Unit 1

Introduction to VHDL: Design units VHDL statements - data flow – behavioural - structural modeling – library - package - subprograms function - procedure – generics – configuration. An overview of VLSI: basic concepts of VLSI design, MOSFETs: basic physics, I-V characteristics and models, MOSFETs as switches, NMOS and CMOS physical layouts and stick diagrams.

Unit 2

Physical structure of integrated circuits: NMOS and CMOS layers, designing FET arrays, FET sizing and unit transistor, physical design of logic gates and design hierarchies. Analysis of MOS logic gates: DC switching characteristics of NMOS and CMOS inverters, DC characteristics of NAND and NOR gates, transient response, gate design for transient performance, transmission gates and pass transistors.

Unit 3

Designing high speed CMOS logic networks: Gate delays, driving large capacitive loads, logical effort, BiCMOS drivers, clocking and data flow control -advanced techniques in CMOS logic circuits: Mirror circuits, pseudo-NMOS, tristate circuits, clocked CMOS, dynamic CMOS logic circuits, dual-rail logic networks.

TEXTBOOKS:

1. *Uyemura J P, "Introduction to VLSI Circuits and Systems", Second Edition, John Wiley and Sons, 2002.*

2. *Kang S M and Leblechi Y, "CMOS Digital Integrated Circuits- Analysis and Design", Third Edition, Tata McGraw Hill Publishing Company Limited, 2003.*

REFERENCES:

Pucknell D A and Eshrghian K, "Basic VLSI Design", Third Edition, Prentice Hall India Private Limited, 1994.

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 ruminate 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 3

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. Alliyan & 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
T o 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: Emarald. 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: Model 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 – Yudhisthira's ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy – Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2

India's contribution to the world: spirituality, philosophy and sciences
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.
The arrival of Europeans, British paramountcy and colonization
What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

Unit 3

Women in Indian society

The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya's Arthasastra and Mrichchhakatikam 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, Murli 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. Arthasastra.*
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:　　　1 0 2 2
　　　　　　THE GROWTH OF MODERN INDIA

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 varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira's ramarajya; Sarasvati - Sindhu civilization and India's trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2
Classical India: 600B.C. – 1200 A.D.
The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's *Arthasastra;* 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. Arthasastra.*
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, Murli Manohar. Science, Sustainability and Indian National Resurgence. Chennai: Centre for Policy Studies, 2008.*

11. *Tripathi, Dwijendra. The Oxford History of Indian Business. New Delhi: Oxford University Press, 2004.*

12. *McGuire, John, et al, eds. Evolution of World Economy, Precious Metals and India. New Delhi: Oxford University Press, 2001.*

13. *Tripathi, Dwijendra and Jyoti Jumani. The Concise Oxford History of Indian Business. New Delhi: Oxford University Press, 2007.*

14. *Kudaisya, Medha M. The Life and Times of G.D. Birla. New Delhi: Oxford University Press, 2003.*

15. *Raychaudhuri, Tapan and Irfan Haib, eds. The Cambridge Economic History of India. Volume 1. New Delhi: Orient Longman, 2004.*

16. *Kumar, 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.*

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16. *Bajaj, Jitendra & M.D. Srinivas. Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*

17. *Joshi, Murli 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   3 1 0 4
AND ORDINARY DIFFERENTIAL EQUATIONS

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
Reviewof 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 stabilty. (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   3 1 0 4
AND PARTIAL DIFFERENTIAL EQUATIONS

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, logarthims, 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.

MAT220   DISCRETE MATHEMATICS   3 1 0 4

Unit 1

Logic, mathematical reasoning and counting: Logic, prepositional equivalence, predicate and quantifiers, functions, mathematical induction. Recursive definitions, recursive algorithms, basics of counting, pigeonhole principle, permutation and combinations. (Sections: 1.1-1.4, 2.1 - 2.6, 3.1-3.3 and 4.1)
Relations and their properties: Cartesian products and relations, pigeonhole principle, function composition and inverse functions. (Sections: 5.1 - 5.6)

Unit 2

Representing relations, closure of relations, partial ordering, equivalence relations and partitions. (Sections: 7.1-7.4)
Advanced counting techniques and relations: Recurrence relations, solving recurrence relations, generating functions, solutions of homogeneous recurrence relations, divide and conquer relations, inclusion-exclusion. (Sections: 10.1-10.6)

Unit 3

Graph theory: Introduction to graphs, graph operations, graph and matrices, graph isomorphism, connectivity, Euler and Hamilton paths, shortest path problem, planar graph, graph colorings and chromatic polynomials. (Sections: 11.1-11.6)

TEXTBOOK:

R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2007.
REFERENCES:

1. *Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw- Hill Publishing Company Limited, New Delhi, Seventh Edition, 2007.*
2. *Thomas Koshy, "Discrete Mathematics with Applications", Academic Press, 2005.*
3. *Liu, "Elements of Discrete Mathematics", TMH, 2004.*

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

MEC401   **OPERATIONS RESEARCH**   **3 0 0 3**

Unit 1

Linear programming: Formulations - graphical solutions - simplex method - duality, dual simplex method.
Transportation model: Assignment model – travelling salesman problem.
Dynamic programming: concepts, Bellman's principle – solutions to simple problems.

Unit 2

Decision theory: Decision trees. Game theory - 2 person zero sum; mixed strategies; 2 x n and m x 2 games.
Network models - project networks - CPM/PERT - project scheduling – crashing networks and cost considerations - resource leveling and smoothing - shortest route problem, minimal spanning tree problem, maximal flow problem.

Unit 3

Sequencing model – 2 machines 'n' jobs, 'm' machines 'n' jobs – n jobs 2 machines.
Inventory models: deterministic & probabilistic models. Quantity discounts. Selective inventory management.
Queuing models: Poisson arrival and exponential service times. Single server, multi-server. Queues - infinite and finite capacity queues.
Simulation **–** Monte Carlo simulation: simple problems.

TEXTBOOK:

Taha, H.A., 'Operations Research: an Introduction', 8e, Prentice Hall, New Delhi, 2008.

REFERENCES:

1. Hillier, F .S. and Lieberman, G .J, 'Operations Research', 9e, McGraw Hill, 2010.

2. Ravindran, A., Phillips, D.J., and Solberg, J.J., 'Operations Research- Principles and Practice', John Wiley & Sons, 2005.

3. Wagner, H.M., 'Principles of Operations Research', Prentice Hall, New Delhi, 1998.

4. Hardley, G., 'Linear Programming', Narosa Book Distributors Private Ltd 2002.

MEC482   **FINANCIAL MANAGEMENT**   **3 0 0 3**

Unit 1

Introduction: Financial management an overview – financial decisions in a firm – goal of FM – function of the financial system.
Fundamental valuation concepts: Time value of money – risk and return.

Unit 2

Capital budgeting: techniques of capital budgeting investment criteria – NPV – benefit cost ratio – IRR – payback period – ARR – investment appraisal in practice – estimation of project cost flows.

Unit 3

Working capital management: Current assets – financing ruling – profit criterion. Cash and liquidity management. Working capital financing.
Financial analysis and planning**:** Analyzing financial performance – break – even analysis and Leverages – financial planning and budgeting.
Mergers and takeovers - international trade.

TEXTBOOK:

Chandra, P., 'Financial Management: Theory and Practice', 5e, TMH, 2001.

REFERENCES:

1. Denzil Watson & Antony Head, 'Corporate Finance- Principles and Practice', 2e, Pearson Education Asia, 2002.

2. Terry S. Maness, 'Introduction to Corporate Finance', McGraw Hill Book Company, 1988.

3. Eugene F. Brigham & Louis C. Gapenski, 'Financial Management – Theory and Practice', 12e, 2010.

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 Kooritz & Heinz Weihrich "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 Reasons 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 Walls 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. Llewellen, "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 an 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 it's consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it's applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

TEXTBOOK:

A J Decker, "Electrical Engineering materials", PHI, New Delhi, 1957.

REFERENCES:

1. *A J Decker, "Solid State Physics", Prentice Hall, Englewood Cliffs, N J 1957.*
2. *C Kittel, "Introduction to solid state Physics", Wieley, 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).

REFRENCES:

1. David J Griffiths, "Introduction to Electrodyanamics", 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, nodulation transfer function; chemistry of lithographic processes: organic and polymeric photoresists, developing and exposure, contrast; principles of non-optical lithography: electron beam, X-ray lithography, resists, sources; etching: Chemistry of wet etching, plasma physics, chemistry of plasma etching and reactive ion etching; chemical mechanical polishing.

Unit 3

Vacuum science: Kinetic theory of gases, gas flow and conductance, vacuum pumps and seals; deposition of thin films: physics of sputtering and evaporation, step coverage and morphology of deposited films, chemical vapor deposition: chemical equilibrium and law of mass action, gas flow and boundary layers, types of CVD, plasma assisted CVD; thermodynamics of epitaxial growth, types molecular beam epitaxy, isolation and contact formation – LOCOS and trench, silicides, metallization with Al and Cu; process Integration: CMOS, bipolar process flow.

TEXTBOOK:

Stephen Campbell, Science and Engineering of Microelectronic Fabrication, Oxford University Press, 2001

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, peretectic 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, superconductivty 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, Birefringerence; Dielectric Properties of Materials:

Polarization and Permittivity, Mechanisms of polarization, dielectric properties-dielectric constant, dielectric loss, dielectric strength and breakdown, Piezoelectricity, Ferreoelectricity, 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 Dw 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) CO_2 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 - donar 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 - Aryabhatta, 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: Comic 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. *BradleyW.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 puncuation: 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; Cryptogrithms.

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. Aggrawal ,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 competitative 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.the grammarbook.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.the grammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.