SYLLABI

B. Tech. - Electrical & Electronics Engg.  
2010 admissions onwards

SYLLABI

CHY100  
CHEMISTRY  3 0 0 3

Unit 1


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

Unit 2


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.

TEXTBOOKS:

EXPERIMENTS:
1. Estimation of Hardness of sample water.
2. Estimation of alkalinity of sample water.
3. Estimation of Fe²⁺ by potentiometric titration.
5. Adsorption by Activated charcoal method.
6. Adsorption by Reverse osmosis.
8. Spectrophotometric analysis of trace element (Fe) in water.

CHY181  
CHEMISTRY LAB.  0 0 3 1

Experiments for Demonstration
1. Estimation of Hardness of sample water.
2. Estimation of alkalinity of sample water.
3. Estimation of Fe²⁺ by potentiometric titration.
4. Estimation of HCl and CH₃COOH by conductometric titration.
5. Determination of Corrosion rate and Inhibitor efficiency by weight loss method.
7. Determination of molecular weight of polymer by viscosity method.

(Any 9 experiments of the above list)

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:**

**REFERENCES:**

**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**

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

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

Unit 3
Florescence and Phosphorescence - chemiluminescence - photo sensitization.

**Chemistry of Toxic Materials and Toxicology:** Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H₂S - PH₃ - CO₂ - NO - Heavy metals - lead, arsenic, mercury, antimony, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

**TEXTBOOK:**

**REFERENCE:**

**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**

**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 chroic materials.

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

TEXTBOOKS:

REFERENCES:

Unit 1

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

TEXTBOOK:

REFERENCE:
SYLLABI

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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:

TEXTBOOK:

REFERENCES:

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: Classication, 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:

REFERENCES:
B. Tech. - Electrical & Electronics Engg.


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:

REFERENCES:

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.


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:
REFERENCES:

CHY259 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3

Unit 1

Separation Techniques: Brief outline 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

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

TEXTBOOKS:

REFERENCES:

CHY260 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3

Unit 1
Nomencalture 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

TEXTBOOKS:

REFERENCES:

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 - Hückel’s rule - anisotropy. Intermediates - carbocations, carbanions, free radicals, carbenes and nitrenes. Reagents in organic synthesis: Grignard reagents, Organolithium reagents, selenium...
Unit 2


Unit 3

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

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

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

TEXTBOOK:

REFERENCES:

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:

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 - S1 and S2 reactions, nucleophilic substitution at aliphatic sp2 carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of Grignard and organolithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.
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Unit 2
Michael and 1,4-addition reaction - Favorskii rearrangement - benzilic acid rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

Reaction involving acids and other electrophiles: Carbocations - formation and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carbonyl compounds - hydrolysis of carboxylic 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, reacation with and without cyclisation - fragmentation reaction - rearrangement of radicals - S Sn1 reaction - radical ions - Birch reduction - Hofmann-Loffler-Freytag reaction - Barton reaction - McMurry reaction.


TEXTBOOK:

REFERENCES:

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.

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Unit 2
Greener strategies of the synthesis of ibuprofen synthesis, teriphallic acid etc. phase behavior and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

Unit 3
Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity, Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:
1. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

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.

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TEXTBOOKS:

REFERENCES:

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 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:

REFERENCES:

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.


**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 – Gamesess - 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:**

**REFERENCES:**

**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:**

**REFERENCES:**

**CHY274 SOLID STATE CHEMISTRY 3 0 0 3**

Unit 1

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

Unit 2

**Electrical and Magnetic Properties:** Development of free electron theory to band theory of solids - metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; Insulators - dielectric, ferroelectric, pyroelectric and piezoelectric properties and the relationship between them. Dia, para, ferro, ferr, 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.
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Unit 3

REFERENCES:

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
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:

CUL101 CULTURAL EDUCATION I 2 0 0 2

Unit 1
Introduction to Indian Culture; Introduction to Amma’s life and Teachings; Symbols of Indian Culture;

Unit 2
Science and Technology in Ancient India; Education in Ancient India; Goals of Life – Purusharthas; Introduction to Vedanta and Bhagavad Gita;

Unit 3
Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India (1)

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

CUL102 CULTURAL EDUCATION II 2 0 0 2

Unit 1
Bhagavad Gita and Life Management; Historicity of Ramayana and Mahabharata; Overview of Patanjali’s Yoga Sutras;

Unit 2
Highlights of Indian Mythology; Indian Society: Its Strengths and Weaknesses; Role & Position of Women in Indian Society;

Unit 3
Indian Models of Economy, Business and Management; Health and Lifestyle related issues; Conservation of cultural heritage; Life and work of Great Seers of India (2)

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

CUL151 ACHIEVING EXCELLENCE IN LIFE - AN INDIAN PERSPECTIVE 1 0 2 2

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

Unit 1
Goals of Life – Purusharthas
What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life; & Professional life; Followed by a Goal setting workshop;
Yogic way of Achieving Life Goals – (Stress Free & Focused Life)
Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);
Experiencing life through its Various Stages
Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2
Personality Development
What is Personality – Five Dimensions – PanchaKosas (Physical/ Energy/Mental/ Intellectual/ Bliss); Stress Management &Personality; Self Control & personality; Fundamental Indian Values & Personality;
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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)
7. Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
8. Will Power and its Development- Swami Budhananda published by Advaitha Ashram, Kolkata
10. Yoga In Daily Life - Swami Sivananda – published by Divine Life Society
12. All about Hinduism – Swami Sivananda - Published by Divine Life Society
13. The Mind and its Control by Swami Budhananda published by Advaitha Ashram, Kolkata
15. Valmiki Ramayana – Four volumes - published by Parimal Publications, Delhi
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 ANTIQUE INDIA

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

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.
To work towards excellence, one must know where he is. Our present state.. An introspective analysis. Our faculties within.

Unit 2
4 The play of the mind. Emotions – convert weakness into strength.
5 The indispensable role of the intellect. How to achieve and apply clear thinking?
6 The quagmire of thought.. the doctrine of Karma – Law of Deservance.
7 Increase Productivity, reduce stress.. work patterning.

Unit 3
8 The art of right contact with the world.. assessment, expectations.
9 Myths and Realities on key issues like richness, wisdom, spirituality.
10 Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:
The Bhaja Govindam and the Bhagavad Gita.

CUL154
YOGA PSYCHOLOGY

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

Patanjali Yoga Sutra – 2

Unit 2
Patanjali Yoga Sutra – 3
Two formulae - Necessity of Abhyasah and Vairagya - Foundation of Abhyasah - Foundation of Vairagya.

Patanjali Yoga Sutra – 4

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

Patanjali Yoga Sutra – 7

Patanjali Yoga Sutra – 8

Patanjali Yoga Sutra – 9

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, Uttaranal.
- ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

ECE100
ELECTRONICS ENGINEERING

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:
REFERENCES:

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.

TEXTBOOK:
REFERENCES:

ECE220 SIGNALS AND SYSTEMS 3 1 0 4

Unit 1

Introduction: Integrated approach for continuous-, discrete-time cases.

Signals: Classification of signals, continuous - discrete time; even/odd signals, periodic/nonperiodic signals, deterministic/random signals, energy/power signals; Basic operations on signals: Basic (continuous/discrete) signals - unit step, unit impulse, sinusoidal and complex exponential signals etc.

Systems (continuous/discrete): Representation, classification - linear/nonlinear, causal/
noncausal, time invariant/time variant, with/without memory; BIBO stability, feedback system. LTI system – response of LTI system, convolution, properties (continuous/discrete); LTI systems – differential/difference equation representation and solution.

Unit 2
Fourier analysis of continuous time signals and systems: Fourier series for periodic signals; Fourier transform - properties of continuous time FT; Frequency response of continuous time LTI systems.

Fourier analysis of discrete time signals and systems: Discrete time Fourier series - discrete time Fourier transform - properties of DTFT; Frequency response of discrete time LTI systems.

Laplace transform analysis of systems: ROC, inverse LT, unilateral LT, solving differential equation with initial conditions.

Unit 3
Sampling: Sampling theorem, reconstruction of signal, aliasing, sampling of discrete time signals; Introduction to DFT.

z-Transform: Definition, ROC, inverse z-transform, properties, transform analysis of LTI Systems.

Interrelationship amongst different representation and transforms.

TEXTBOOK:

REFERENCES:

ECE221  DIGITAL SIGNAL PROCESSING  3 1 0  4
(Pre-requisite: ECE220)

Unit 1
The Discrete Fourier transforms: Review of main concepts form signals and systems course - frequency domain sampling and reconstruction of discrete time signals - the DFT as a linear transformation - relationship of the DFT to other transforms - properties of DFT - linear filtering methods based on DFT- efficient computation of the DFT-FFT algorithms. Efficient computation of DFT of two real sequences - efficient computation of the DFT of a 2N-point real sequences - use of FFT in linear filtering and correlation - introduction to DCT.
Unit 2

Unit 3


TEXTBOOK:

REFERENCES:
TEXTBOOK:  

REFERENCES:  

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:**  

**PIC microcontroller workshop:**  
Introduction to MP lab simulator. Simulating and burning simple programmes on PIC 16F877A.

EEE212 ELECTRIC CIRCUITS 3 1 0 4  
(Pre-requisite: EEE100)

Unit 1  
Introduction: Brief idea about transition from field model to circuit model, electrical components, reference directions, brief review of mesh and nodal analysis for DC circuits with dependent and independent sources.  
Network theorems (dc): Thevenin’s theorem, Norton’s theorem, maximum power transfer theorem, Tellegen’s theorem, Reciprocity theorem.  
Transient analysis: Transient analysis of first order and second order circuits for dc and ac excitations using time domain equations, series and parallel circuits, RLC circuits, resonance, representation of circuit in the Laplace domain - transform impedance and admittance, application of Laplace transform in solving circuit equations.

Unit 2  
Sinusoidal steady state analysis: Concept of phasor domain, representation of circuits in phasor domain and solution of circuits using mesh and nodal analysis, magnetically coupled circuit analysis with dot convention.  
Network theorems (ac): Superposition theorem, Thevenin’s theorem, Norton’s theorem, maximum power transfer theorem.

**Graph theoretic approach for circuit analysis:**  
Introductory definitions: tree, twigs, co-tree, links, loops, cutsets. Graph matrices: Incidence matrix (A), cut-set matrix (Q), loop matrix (B), orthogonality, AB^T = 0 and QB^T = 0; relations between sub-matrices of A, B and Q. KCL and KVL in terms of A, B, Q matrices. Formation of equations for different methods of circuit analysis. Development of algorithms for computer aided analysis.

Unit 3  
Three phase circuit. Complex power, power factor correction, power measurement, three phase circuit, power measurements in balanced and unbalanced systems, symmetrical components for solving unbalanced circuits.  

TEXTBOOK:  

REFERENCE:  
DC and AC bridges: Wheatstone bridge, Kelvin’s bridge, inductance and capacitance measurements - Maxwell’s bridge, De-sauty’s bridge, Schering bridge, Wein bridge and Anderson bridge.


Unit 2
Instrument transformers: Current transformer, ratio and phase angle error, potential transformer.
Measurement of power and energy: EDM type wattmeter and power factor meters, LPF wattmeter, errors in wattmeters. Induction type energy meter, errors in energy meter, calibration of meters.
Oscilloscope: Basic principle, CRT features, block diagram of oscilloscope, vertical and horizontal amplifier, triggering pulse circuit, dual beam and dual trace CRO, sampling, storage oscilloscopes, Digital storage oscilloscope, applications of CRO.
Transducers: Electrical transducers, selecting a transducers, resistive transducers, strain gauge, thermistor, RTD, inductive transducers, LVDT, capacitive transducer, piezo electric, photo voltaic cell, photo diode, photo transistors.

Unit 3
Digital voltmeters: Ramp and dual slope integrating type DVM, successive approximation type analog to digital conversion techniques, resolution and sensitivity of digital meters, digital frequency, time and phase measurements.
Instrumentation systems: Block diagram, signal conditioning systems, instrumentation amplifier.
Data acquisition and data transmission: Objectives of DAS, single/multichannel DAS, digital to analog converters, data loggers, data transmission systems, advantages of digital transmission, time division multiplexing.

TEXTBOOKS:

REFERENCES:
systems - scalar and vector fields.
Electric and magnetic fields: line, surface and volume integrals - Coulomb's law - Gauss's law - Biot-Savart's law - Ampere's circuit law - applications - boundary conditions for electric and magnetic fields - Lorentz force equation.

Unit 2
Electric potential - Poisson’s and Laplace’s equations – capacitance - energy stored - magnetic scalar and vector potentials - magnetic circuits – inductance - energy stored - conductance.

Unit 3
Uniform plane waves and sinusoidally varying waves in time domain and in free space – polarization - power flow and Poynting vector - wave parameters - plane waves in material media - skin effect - reflection and transmission of uniform plane waves - normal and oblique incidence in conductor and dielectric interfaces.

TEXTBOOK:

REFERENCE:

EEE291 SIMULATION LAB. AND ELECTRICAL WORKSHOP 1 0 3 2
Experiments in electrical workshop and familiarization with simulation software. In theory classes, simulation of electric and electronics circuits using ORCAD, Matlab will be covered. Students are encouraged to come with their own laptop in simulation classes.

EEE292 ELECTRIC CIRCUITS LAB. 0 0 3 1
Familiarization of electrical measuring Instruments, verification of network theorems, series – parallel circuits, resonance circuits, separation of resistance and reactance, power factor improvement, three phase power measurement in balanced and unbalanced circuits. Characteristics of semiconductor devices, half wave and full wave rectifiers.

EEE293 ELECTRICAL MACHINES LAB. I 0 0 3 1
DC MACHINES:
Performance characteristics, dc shunt, series and compound generators, study of starters, predetermination of efficiency of dc machines, load test, speed control of dc shunt and series motors.
TRANSFORMERS: No load and load test on single phase and three phase transformers, predetermination of efficiency and regulation, three phase transformer connections, phase conversion, parallel operation of transformers.

EEE294 MEASUREMENTS AND DIGITAL CIRCUITS LAB. 0 0 3 1
Electrical measurements, calibration of voltmeter, ammeter, wattmeter and energy meter. Extension of instrument range using instrument transformers. AC and DC bridges, study of transducer, application of transducer. Logic gates, verification of truth tables, adder, subtractor, flip flop, multiplexer, demultiplexer, assembly of shift registers, counters, ring counter.

EEE311 ELECTRONIC CIRCUITS 3 1 0 4
(Pre-requisite: ECE100)
Unit 1
Diodes and its applications: Review of diode characteristics, design of clipper, clamer circuit and nonlinear wave shaping circuits.
BJT and FET: Structures, operation, V-I characteristics of BJT and MOSFET. Biasing circuits, small signal operation and models of BJT and MOSFET, analysis of BJT and MOSFET amplifiers, frequency response of CE and CS amplifiers, BJT and MOSFET differential amplifier, Darlington pair, emitter follower.

Unit 2

Unit 3
Feedback: Introduction, properties of negative feedback, basic topologies, analysis of ideal and practical voltage shunt and voltage-series configuration.
Oscillators and filters: Principle, op-amp RC oscillators. Filters: Filter transmission, types and specifications, transfer function, passive and active filters, Design of first and second order low-pass and high-pass Butterworth filters. Introduction to band-pass and band reject filters, all-pass filter.

Power amplifier: Analysis of power amplifiers.
Voltage references and regulators: Characteristics of voltage regulators, analysis of series and shunt regulator. Shunt regulators.

"Only review - need not spend much time as this portion will be covered in EC-100 Electronics Engineering"

**TEXTBOOKS:**

**REFERENCES:**

**EEE321 ELECTRICAL MACHINES II 3 1 0 4**

(Pre-requisite: EEE221)

**Unit 1**
Induction machines - construction, time and space harmonics, starting and speed control, testing, circle diagram, equivalent circuit, performance curves, torque speed characteristics, slip ring induction motors.

**Unit 2**
Synchronous machines - construction, generators and motors, salient pole and non-salient pole synchronous machines, characteristics, regulation, parallel operation, operation on infinite bus, real and reactive power control, power angle curve, stability analysis, transient and sub transient reactance.

**Unit 3**
The fractional horse power motors, types, single phase Induction motor, construction, starting, equivalent circuit, performance curves, shaded pole motors, hysteresis motors etc.

**TEXTBOOK:**

**REFERENCES:**

**EEE331 ELECTRICAL ENERGY SYSTEMS I 3 1 0 4**

**Unit 1**
Structure of electric power system - methods of electric power generation - hydro, thermal, nuclear power generations, grid systems advantages - necessity of EHV transmission - EHV AC and HVDC transmission - variable load on power stations - load curve and load duration curve - three phase systems - balanced and unbalanced systems - power factor improvement – tariff - transmission line parameters - skin effect and proximity effect - inductance of single phase transmission line.

**Unit 2**
Inductance of three phase transmission line - single circuit and double circuit lines - symmetrical and unsymmetrical spacing - bundled conductors - self GMD and mutual GMD - capacitance of single phase, three phase single circuit and double circuit transmission lines - symmetrical and unsymmetrical spacing - performance of transmission lines - efficiency and regulation - short, medium and long lines - ABCD constants - ferranti effect - surge impedance - real and reactive power flow in transmission lines - shunt and series compensation - corona loss.

**Unit 3**
Cables - construction and characteristics of single core and three core cables - insulation resistance and capacitance of a single core cable, dielectric stress and most economical conductor size - grading of cables - capacitance and inter sheath grading - insulators - types - voltage distribution in suspension type insulators - string efficiency - grading of insulators - mechanical design of transmission lines - sag and span - supports at same level and different levels - sag template and stringing chart – substations - neutral grounding - circuit breakers - principle of operation and types - circuit breaker ratings.

**TEXTBOOK:**
REFERENCES:

EEE332 ELECTRICAL ENERGY SYSTEMS II 3 1 0 4
(Pre-requisite: EEE331)

Unit 1
Single line diagram and per unit representation of power system. Power system modeling - bus admittance matrix and bus impedance matrix - load flow analysis - Gauss siedel, Newton Raphson and fast decoupled load flow methods - comparison of methods - control of voltage profile.

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

EEE341 POWER ELECTRONCS 3 1 0 4

Unit 1
Characteristics of power semiconductor switches - power diodes, power transistors and thyristors, two transistor model of SCR, diode rectifiers, gating and protection circuit. Turn on circuits for SCR – triggering with single pulse and train of pulses – synchronizing with supply – triggering with microprocessor – forced commutation – different techniques.

Unit 2
Phase controlled converters: Single phase semi and full converters, three phase semi and full converters, power factor improvement by PWM control, effects of source inductance. Dual converter. AC and DC choppers – DC to DC converters – buck, boost and buck – boost.

Unit 3
Inverters: Voltage and current source inverters, resonant, series inverter, PWM inverter.

TEXTBOOK:

REFERENCES:

EEE342 CONTROL ENGINEERING 3 1 0 4
(Pre-requisite: ECE220)

Unit 1
Introduction to control systems, mathematical models of physical systems, block diagram, signal flow graph, feedback control system characteristics, reduction of parameter variations, control over system dynamics and disturbance signals, use of software tools to analyze and design of control system, performance of feedback control systems, test input signals, transient and steady state response of second and higher order systems, performance indices.

Unit 2
Concept of stability, Routh-Hurwitz stability criterion, root locus method, concept,
procedure, frequency response analysis, bode plots, polar plots, stability in the frequency domain, Nyquist criterion, Nichol's chart.

Unit 3
Introduction to design of feedback systems, lead-lag compensation networks, PID controllers, introduction to state variable approach, design of state variable feedback systems, controllability, observability. Control system design case studies - cruise missile altitude controller, turbine governor, robotic hand design, ship steering control system. **Self study topics.

TEXTBOOK:

REFERENCES:

EEE351 DESIGN OF ELECTRICAL APPARATUS

Unit 1
Introduction: Design factors, limitations in design, thermal design aspects, standard specification.
DC machines: Specific loadings, output equation, design of main dimensions. Design of armature windings, design of field system, design of interpole and commutator. Transformers: Output equation - volt per turn, main dimensions for three phase and single phase transformers, window dimensions & yoke design and coil design. Design of tank with tubes.

Unit 2
Induction motor: Specific loadings, output equation, main dimensions, stator design, number of slots, shape and area of slots, rotor design for squirrel cage and slip ring types. Synchronous machines: Output equation, main dimensions for salient pole and cylindrical rotor alternators, stator design, rotor, pole design for salient pole generators, pole winding calculations, design of cylindrical rotor.

EEE352 DESIGN OF ELECTRICAL SYSTEMS

Unit 1
General introduction, gathering specific data, adoption of design-parameters for the particular project, selection of basic design philosophies, detailing the electrical system, preparation of as-erected drawings and design - manuals. Maximum-demand-estimation, demand factors for HV motors, calculation of MD on the MCCs, MD, estimation for an entire load-centre substation and MSS, statutory inspector’s approach to MD-estimation.

Unit 2
Sizing of transformer capacity on basis of md-calculations, consideration and constraints in the sizing of transformers CB ratings, split bus arrangements, sizing of power-transformer capacity, sizing of distribution transformer, capacity at ICSS, techno-economic studies on selection of transformer sizes, sizing the transformer to meet HV motor, starts and voltage dips. Short-circuit calculations, SC analysis, standards for the SC analysis, passive and dynamic reactance to be considered for SC analysis, reactance multipliers for first cycle diagram for SC analysis of 415V system, the computation of AC components of fault currents, determination of DC component of the fault current and the total fault current, IEC equations, the impact of CB status on fault levels.

Unit 3
Selection of cable sizes, continuous rating of cables (standard rating and net-
rating), thermal ampacity of cables, short time short circuit rating of cables, Mechanical withstand of short circuit forces, techno economic consideration in selection of cables, SC-withstand capacity of 1.1 kV cable, voltage drops in 415V motor, feeders and voltage drop based ampacity, The use of copper cables for motors of rating less than 7.5 kW.

**TEXTBOOK:**

**REFERENCES:**
1. TNEB Hand book
2. IEEE Hand book

EEE353 ILLUMINATION ENGINEERING 3 0 0 3

Unit 1
Radiant energy and visible spectrum, energy conversion to light, colour, eye and vision; different entities of illuminating systems.
Light sources: daylight, incandescent, electric discharge, fluorescent, arc lamps and lasers; Energy efficient lamps; Luminaries, wiring, switching and control circuits.

Unit 2
Laws of illumination; illumination from point, line and surface sources. Photometry and spectrophotometry; photocells. Environment and glare. General illumination design. Illumination levels, loss factors, lamp selection and maintenance.
Interior lighting – industrial, residential, office departmental stores, indoor stadium, theater and hospitals.

Unit 3
Exterior lighting - flood, street, aviation and transport lighting, lighting for displays and signaling - neon signs, LED-LCD displays beacons and lighting for surveillance. Energy conservation codes for lighting; lighting controls – daylight sensors and occupancy sensors; controller design.

**TEXTBOOK:**

**REFERENCES:**

EEE354 ELECTROMAGNETIC COMPATIBILITY 3 0 0 3

Unit 1
Introduction to finite element method, introduction to electromagnetic compatibility, sources of EMI, transient EMI, basic definitions of EMC.

Unit 2
EMI coupling principles, conducted, radiated and transient coupling, common impedance ground coupling, radiated common mode and ground loop coupling, EMI specifications, units, civilian & military standards.

Unit 3
EMI test instruments, various test methods and calibration procedures, EMI control techniques, shielding, grounding, bonding, isolation transformer, transient suppressors, cable routing, signal control, component selection and mounting.

**TEXTBOOK:**

**REFERENCES:**
3. Course Material on electromagnetic Compatibility, Rajeev Thottappillil, Professor, Division for Electricity and Lightning Research, Angström Laboratory, Uppsala University

EEE355 INDUSTRIAL ELECTRONICS 3 0 0 3
(Pre-requisite: EEE311)

Unit 1
Input transducers and sensors: Position, displacement, velocity, acceleration, force, flow pressure, level temperature, humidity. Telemetry 0-10V and 4-20mA systems. Thermocouples, RTD, LVDT, servo-pots, strain gauges, P, PI, PID converters, average to rms converters.
Actuators, DC and AC stepper motors, dosing equipment weigh feeders, dosing pumps, extrusion – bulk and film electronic components. Medical equipments.

Unit 2
Programmable controllers and PLCs. rotary encoders, digipots.
Automation: Transfer machines, robotics basics, application of PLCs, Industrial heating;
Arc furnace, high frequency heating, high frequency source for induction heating, dielectric heating and microwave heating, ultrasonic - generation and applications.

Unit 3
High voltage equipments: voltage multipliers, electrostatic charging, precipitation, and painting. Plasma torches, particle accelerators electron beam welding, ion implantation, thrusters and gas lasers. Case studies of industrial applications.

TEXTBOOK:

REFERENCES:

EEE361 POWER PLANT INSTRUMENTATION 3 0 0 3

Unit 1
Introduction to unit operation and unit process: Material and energy balance. Significance of Instrumentation and layout of thermal, hydroelectric, nuclear, gas turbine, solar, wind power plants.

Instrumentation and equipments of various unit operations: Evaporation, distillation, leaching, gas absorption, heat exchangers, humidification and dehumidification, drying, size reduction, crystallization, mixing.

Unit 2
Boiler instrumentation and optimization: Combustion control, 3 element drum level control, steam pressure, oxygen/CO/CO₂ – flue gases control, furnace draft, boiler interlocks, SCADA controls - boiler inspection and safety procedures.

Turbine instrumentation and control: Valve actuation, auto-start up, start up and shut down, thermal stress control, condition monitoring and power distribution instrumentation. Auxiliary control of water treatment plant, electrostatic precipitator and oil automation system.

Unit 3

EEE371 ADVANCED MICROCONTROLLERS 3 0 0 3

(Pre-requisite: ECE310)

Unit 1
dsPIC 30F series: Introduction to 16 bit microcontrollers - dsPIC 30F – CPU, data memory, program memory - instruction set - programming in assembly and C - Interrupt structure.

Unit 2
Peripherals of dsPIC 30F: I/O ports, timers, input capture, output compare, motor control PWM, QEI,10 bit A/D converter, UART, CAN module, application development.

Unit 3
MSP430 and peripherals: MSP430f2274 - MSP430X22X2 device pin out, DA package, functional block diagram description, inputs, outputs, timers, ADC. application development.

TEXTBOOKS:

REFERENCES:

EEE372 COMMUNICATION ENGINEERING 3 0 0 3

Unit 1
Introduction: Communication, communication systems - block diagram description of analog and digital systems; Review of fourier representation, waveform spectra, bandwidth; Noise - sources of noise and their manifestations into communication systems, noise figure, significance of SNR considerations in communication systems. Modulation: Necessity, introduction to analog and digital modulation.
SYLLABI

B. Tech. - Electrical & Electronics Engg. 2010 admissions onwards

Unit 2
Amplitude modulation: Theory, modulation index, spectral representation of modulated waves, power and bandwidth considerations, carrier and side bands, modulation schemes: DSBFC, suppressed carrier, SSB techniques – filter systems, phase shift method, carrier reinsertion system, VSB, applications.
Frequency modulation: Introduction, theory of FM and phase modulation, frequency spectrum of FM wave, applications.
Pulse communication: Introduction, PWM, PPM, PCM.

Unit 3
Introduction to digital communications: Fundamentals of data communication systems, FSK, PSK and QAM.
Applications in power systems: Power line carrier, elements of carrier channel, transmitter, line traps, carrier communication, carrier relaying, power system communication, telemetry, tele control.

TEXTBOOKS:

REFERENCES:

EEE373 INTRODUCTION TO COMPUTER NETWORKS 3 0 0 3

Unit 1
Introduction to computer networks
Uses of computer networks, network hardware, network software, network reference models, example networks - the internet, connection-oriented networks: X.25, frame relay, ATM, ethernet, Physical layer
Guided transmission media, wireless transmission, public switched telephone network - structure of the telephone system, local loop: Modems, ADSL, multiplexing, switching.

SYLLABI

B. Tech. - Electrical & Electronics Engg. 2010 admissions onwards

Data link layer (Logical link layer)
Data link layer design issues: Framing, error control, flow control.
Error detection and correction, error-correcting codes, error-detecting codes, data link protocols: Stop-and-wait protocol, sliding window protocols.

Unit 2
Data link layer (MAC Layer)
Multiple access control protocols – Aloha, carrier sense multiple access protocols, collision-free protocols, limited-contention protocols, ethernet, repeaters, hubs, bridges, switches, routers, and gateways.
Network layer - network layer design issues, IP addressing, routing algorithms, ARP, RARP.

Unit 3
Transport layer
Transport service, elements of transport protocols, internet transport protocols - TCP, UDP, application layer: DNS, electronic mail.
Security in computer networks
Principles of cryptography, Symmetric-Key Algorithms, Public-Key Algorithms

TEXTBOOKS:

REFERENCES:

EEE391 ELECTRICAL MACHINES LAB. II 0 0 3 1

No load and load characteristics of three phase alternators - regulation by different methods and efficiency calculation - no load, blocked rotor and load tests on single phase and three phase induction machines - characteristics of synchronous induction motor and induction generator - speed control and starting methods of AC machines - synchronization to infinite bus bars - V curves and inverted V curves of synchronous motor.

EEE392 MEASUREMENTS AND ANALOG CIRCUIT LAB. 0 0 3 1

EEE393 ELECTRONIC CIRCUITS LAB. 0 0 3 1

Linear power supply, A/D converter, D/A converter, operational amplifier circuits, 555 timer, wave form generation using op-amp. Instrumentation amplifier, IC power amplifier, high power amplifier, phase locked loop applications. Precision rectifier. Familiarization with simulation software.

EEE394 MICROPROCESSOR AND MICROCONTROLLER LAB. 0 0 3 1

Programming 8085 using simulator - Programming using kit. /*Optional*/ Programming exercises which includes interfacing, using PIC micro controller.

TEXTBOOKS:

REFERENCE:

EEE397 SEMINAR 0 0 2 1

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

EEE431 POWER SYSTEM PROTECTION AND SWITCHGEAR 3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOK:
Ravindra P. Singh, "Switchgear and power system protection", Prentice Hall of India, 2009

REFERENCES:
1. A. S. Ingole, "Switchgear and protection" Umesh publication, 2006

EEE441 ELECTRIC DRIVES AND CONTROL 3 1 0 4

(Pre-requisite: EEE341)

Unit 1
Introduction: Concepts and classification of electric drives. Dynamics of electric drives: Types of loads, multi quadrant operations, motor dynamics steady state stability and transient stability. Rating and heating of motors: Heating effects, heating and cooling curves, classes of duty, load equalization, environmental factors. DC motor drives: Basic characteristics, operating modes, Ward-Leornard system, single phase and three phase controlled rectifier fed DC drives, dual converters drives, chopper drives, rheostatic and regenerative braking, effects of changes in supply voltage and load torque, closed loop control schemes.

Unit 2
AC motor drives: Induction motor drives, stator voltage control, stator impedance control, rotor voltage control - slip power recovery, static Kramer drives and static Scherbius drive, V/f control, current control method. Closed loop control. Introduction to vector control scheme.

Unit 3
Synchronous motors: Speed torque characteristics and torque angle characteristics. Fixed and variable frequency operation modes, self control modes. Special machines: Brushless DC motor, switched reluctance motor, introduction to the relevant converter circuits.
SYLLABI

B. Tech. - Electrical & Electronics Engg. 2010 admissions onwards

EEE450

OPTIMIZATION TECHNIQUES 3 0 0 3

Unit 1


Unit 2
Non-linear programming II: Unconstrained optimization techniques.


Non-linear programming III: Constrained optimization techniques.


Unit 3

TEXTBOOKS:

REFERENCE:

EEE451

POWER SYSTEM STABILITY 3 0 0 3

Unit 1

Unit 2

Unit 3
Sub synchronous oscillations – introduction - torsional interaction with power system - voltage stability - basic concepts - voltage collapse - prevention of voltage collapse - midterm and long term stability - nature of system response severe upsets - case studies.


TEXTBOOK:

REFERENCES:

EEE452

RENEWABLE ENERGY AND ENERGY CONSERVATION 3 0 0 3

Unit 1


Concentrated PV cell.
Module, panel and array – series and parallel connections. Maximum power point
tracking. SPV applications - battery charging, pumping and lighting, power plant.
PV system design.
Small hydro power - resource assessment, environmental restrictions, SHP schemes –
types, construction and equipment selection, load frequency control.

Unit 2
Wind energy: Atmospheric circulations. Wind shear and turbulence. Wind monitoring
and resource assessment; Weibull parameters. Classification of wind regimes.
Aerodynamic principles - lift and drag forces. Power coefficient and Betz limit.
Types and characteristics of wind turbines.
Wind electric generation systems – grid-connected systems: WT-IG, WT-DWIG,
WT-DOIG, WT-PMG and WT-VS1G. Comparison of performance. Economic
performance.
Development of windfarms, site selection, wake effect, performance indices.
Small WEGs – stand-alone and hybrid systems.

Unit 3
Biomass energy – Gasifiers and dual fuel engines; Ocean-thermal energy
conversion; Tidal energy conversion; Wave energy conversion; Geothermal energy
conversion; MHD; Hydrogen and fuel cells.
Energy conservation in electrical equipment: Energy efficient lighting – luminous
efficiency of lamps, efficient lamps, energy conservation codes and lighting design.
Energy conservation in motors – estimation of operating efficiency of industrial
motors, right selection of motor ratings, energy efficient motors; auto-stop control,
delta-star operation, voltage control; Energy conservation in variable speed operation
of pumps and fans – demerits of mechanical resistance control, advantages of
variable speed drives, specific energy consumption, system design using VSD.

TEXTBOOKS / REFERENCES:
Delhi, 1997
New Delhi,1998
John Wiley & Sons, 2004
company Ltd,1987

EEE453 FLEXIBLE AC TRANSMISSION SYSTEMS 3 0 0 3

Unit 1
FACTS concept and general system considerations - transmission interconnections,
flow of power in an AC system, loading capability, power flow and dynamic
stability considerations of a transmission interconnection, basic types of FACTS
controllers, IEEE definitions, FACTS devices in India and abroad.
Shunt compensation and shunt FACTS devices - concept of shunt compensation,
objectives of shunt compensation, variable impedance type shunt compensators
(TCR, TSC, FC-TCR, TSC-TCR) - circuit diagram, principle of operation, working,
waveforms/characteristics.

Unit 2
Switched converter type shunt compensator (STATCOM) - circuit diagram, principle
of operation, working, waveforms/characteristics, control schemes for shunt
compensators.
Series compensation and series FACTS devices - concept of series compensation,
objectives of series compensation, variable impedance type series compensators
(GCSC, TSSC, TCSC), switching converter type series compensators - circuit
diagram, principle of operation, working, waveforms/characteristics, control
schemes for series compensators.

Unit 3
Static voltage and phase angle regulators - objectives of voltage and phase angle
regulators, power flow control, improvement of transient stability, power oscillation
damping, thyristor-controlled voltage and phase angle regulators.
Combined FACTS compensators and other special purpose FACTS devices - unified
power flow controller (UPFC) - objectives and need, principle of operation, interline
power flow controller (IPFC) - objectives and need, principle of operation. NGH-
SSR damper, thyristor-controlled braking resistor (TCBR).
Case studies of practical applications of various FACTS devices.

TEXTBOOK:
Narain G. Hingorani and Laszlo Gyugyi, “Understanding FACTS – Concepts and technology

REFERENCES:
1. T. J. E. Miller, “ Reactive power control in Electric systems”, Wiley- Interscience
2. R. Mohan Mathur and Rajiv K. Varma, “ Thyristor based FACTS controller for electrical
3. Padiyar, K.R, “FACTS controllers in power transmission and distribution”, New Age Publishers,
India, 2007.
Unit 1
Introduction: System load variation: System load characteristics, Load curve -
daily, weekly and annual, load duration curve, load factor, diversity factor. Overview
of system control: Governor control, LFC, EDC, AVR, system voltage control,
security control.
Real power – frequency control: Need for voltage and frequency regulation in
power system, basic P-I and Q-V control loops. Fundamentals of speed governing
mechanisms and modeling, regulation of two synchronous machines in parallel,
LFC control of a single area and two area systems, static analysis.

Unit 2
Multi area systems, tie-line with frequency bias control of two-area and multi-area
systems, state variable model.
Reactive power – voltage control: Typical excitation system, static and dynamic
analysis, effect of generator loading, static shunt capacitor/reactor VAR
compensator, synchronous condenser, tap-changing transformer, static VAR
system, modeling, system level voltage control.

Unit 3
Economic dispatch: Incremental cost curve, co-ordination equations with loss and
without losses, solution by iteration method. (No derivation of loss coefficients).
Base point and participation factors. Economic controller added to LFC control.
Computer control of power systems: Energy control centers - system states and
their transition, plant level and system level controls, recent trends of real-time
control of power systems.

TEXTBOOK:

REFERENCES:
1. Allen J. Wood and Bruce F. Wollenberg, “Power Generation, Operation and Control”, John
EEE456 SPECIAL ELECTRIC MACHINES 3 0 0 3

Unit 1
Introduction: Stepper motor, permanent magnet electrical motors: Permanent magnet materials, permanent magnet AC machine drives, permanent magnet DC motors, permanent magnet synchronous motors.

Unit 2
Brushless DC motor, construction, operating principle, EMF equation, torque equation, phasor diagram and torque & speed characteristics. Reluctance Motors: Synchronous reluctance motors.

Unit 3
Switched reluctance motors with sinusoidal excitation, reluctance motors with rectangular excitation. Linear electric machines: Linear induction motors, linear synchronous motors.

TEXTBOOK:

REFERENCES:

EEE457 UTILISATION OF ELECTRIC ENERGY 3 0 0 3

Unit 1
Electric lighting - definition of terms; Types of lamps and characteristics; Lighting requirements; Illumination standards; Design of lighting.
Electric heating – comparison with other heating methods; Resistance heating, induction heating, arc furnace, dielectric heating; Electric welding – types, equipment and modern techniques.

Unit 2
Electrochemical processes - electrolysis. Electroplating, Electrodeposition. Extraction of metals. Electric drives - selection of motors in various applications; Electric drive systems in various industries; Speed control of motors; Variable speed drives.

EEE458 POWER CONVERTERS 3 0 0 3
(Pre-requisite: EEE341)

Unit 1
DC-DC switched mode converters: Operating principles, steady state analysis for continuous and discontinuous current operations, performance calculations of buck converter, boost converter, buck-boost converter, cuk converter & full bridge converter - comparison of DC-DC converters.

Unit 2
Switched mode DC power supplies: Overview of linear and switched mode power supplies, other types of converters: Flyback converter, forward converter, push pull converter, half bridge converter & full bridge converter.

Unit 3
Design of snubbers, drive circuits, magnetics, voltage feed forward PWM control and current mode control, feedback compensators, unity power factor rectifiers. Introduction to resonant converters - classification of resonant converters - basic resonant circuit concepts. Zero current and Zero voltage switching. Simulation of DC-DC converters and complete SMPS systems.

TEXTBOOK:

REFERENCES:

EEE459 NETWORK SYNTHESIS 3 0 0 3

Unit 1
Network functions, two port parameters, interconnection of two ports, incidental dissipation, analysis of ladder networks.
Elements of realizability theory, causality and stability, Hurwitz polynomial, positive real functions, synthesis procedure.

Unit 2
Synthesis of one port network with two kind of elements, properties of LC immitance function, synthesis of LC driving point immitance, properties of RC driving point impedance, synthesis of RC and RL admittance, properties of RL impedance and RC admittance, synthesis of RLC function.

Unit 3
Elements of transfer function synthesis, properties of transfer function, zero of transfer function, synthesis of $Y_{21}$ and $Z_{21}$ with 1© termination, synthesis of constant resistive network.
Filter design, filter design principles, approximate problem, transient response of low pass filter, synthesis of low pass filter, magnitude and frequency normalization, frequency transformation.

TEXTBOOKS:

EEE461 ADVANCED CONTROL THEORY 3 0 0 3  
(Pre-requisite: EEE342)

Unit 1
State variable analysis and design: State models – solution of state equations – controllability and observability - pole assignment by state feedback – full and reduced order observers.

Unit 2

Unit 3
Output regulator and tracking problems – Pontryagin’s minimum principles – time optimal control problem.
Adaptive control: Classification – model reference adaptive control (MRAC) systems – different configuration, classification, mathematical description – direct and indirect MRAC – self tuning regulator (STR) – different approach to self tuning, recursive parameter estimation, implicit and explicit STR.

TEXTBOOK:

REFERENCES:

EEE462 DIGITAL CONTROL SYSTEMS 3 0 0 3  
(Pre-requisite: EEE342)

Unit 1
Sampled data - signal reconstruction, discrete transfer functions, discrete system stability frequency response analysis, models for sampled continuous systems, state space analysis of discrete time systems, errors and non-linearity due to quantization in ADC.

Unit 2
Discrete time sensitivity functions, internal model, principle for digital control, design by pole assignment. System identification, RLS method, minimum variance control, self tuning methods, dead beat control, state estimation, Luenberger observer,

Unit 3
Kalman filter DSP based digital control SCADA, architecture and design, introduction to control system tool box. Design of state variables feedback systems, controllability and observability.
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EEE463 PROCESS CONTROL AND INSTRUMENTATION 3 0 0 3

Unit 1
Introduction to process control, process variables, degree of freedom, industrial
measurement systems – different types of industrial variables and measurement
systems elements – sensors and transducers for different industrial variables like
pressure, torque, speed, temperature etc. - sensor principles – examples of sensors
– sensor scaling – industrial signal conditioning systems - amplifiers – filters – A/D
converters for industrial measurements systems – review of general industrial
instruments - I/P and P/I converters, pneumatic and electric actuators, valve positioned,
control valves - characteristics of control valves, inherent and installed characteristics,
valve body, globe, butterfly, diaphragm, ball valves, control valve sizing, cavitations
and flashing, selection criterion, servo drives, stepper motor drives.

Unit 2
Process modeling, characteristics of liquid systems, gas systems, thermal systems,
mathematical model of first order level, pressure and thermal process - higher
order process, interacting non-interacting systems.
Basic control actions, characteristics of ON-OFF, P, I and D control, PI, PD and PID
control modes, response of controllers for different types of test inputs, pneumatic
and electronic controllers to realize various control actions, selection of control
mode for different processes, optimum controller settings, tuning of controllers -
process reaction curve method, continuous cycling method, damped oscillation
method, Ziegler Nichols methods.
1/4 decay ratio, feed forward control, ratio control, cascade control, averaging
control, multivariable control, hybrid control, expert systems.
Distillation column, control of top and bottom product compositions, reflux ratios,
control of chemical reactors, control of heat exchanger, steam boiler, drum level
control and combustion control, P&I diagrams.

Unit 3
Model predictive control - batch process control - plant-wide control & monitoring
- plant wide control design - instrumentation for process monitoring - statistical
process control - introduction to Fuzzy logic in process control - introduction to
OPC - introduction to environmental issues and sustainable development relating to
process industries.

REFERENCES:
2. Web resources
3. Selected papers from journals

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EEE464 OPTO-ELECTRONICS AND LASER INSTRUMENTATION 3 0 0 3

Unit 1
Introduction - characteristics of optical radiation, luminescence, irradiance - optical
sources - photo detectors - opto-couplers and their application in analog and
digital devices. Optical fiber fundamentals - modes, types of optical fibers - fiber
coupling - fiber optic sensors for common industrial parameters - V, I, pressure,
temperature - IR sources and detectors - fiber optic gyroscope.

Unit 2
Characteristics of LASERS - Einstein’s equations - population inversion two, three
and four level system laser rate equation, properties – modes - resonator
configurations - Q switching and mode locking, cavity dumping, single frequency
operation - types of lasers. Applications - lasers for measurement of distance and
length, velocity, acceleration, atmospheric effects, pollutants.

Unit 3
Material processing applications - laser heating, melting, scribing, splicing, welding
and trimming of materials, removal and vaporization. Holographic Interferometry
and applications – holography for non-destructive testing – medical applications
- lasers and tissue interaction – surgery - dermatology.

TEXTBOOKS:
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REFERENCES:

EEE471 EMBEDDED SYSTEMS DESIGN 3 0 0 3
(Pre-requisite: ECE310)

Unit 1

Unit 2

Unit 3

TEXTBOOKS / REFERENCES:
5. NXP LPC 17xx datasheet. (www.nxp.com)

EEE472 FUNDAMENTALS OF SOFT COMPUTING 3 0 0 3

UNIT 1
Basic concepts: Single layer perception, multi layer perception, supervised and unsupervised learning, back propagation networks, Kohonen’s self organizing networks, Hopfield networks, distance measures.

Unit 2
Fuzzy sets: properties, membership functions, fuzzy operations, applications, classification and regression tree, data clustering algorithms, rule based structure identification and regression trees, neuro fuzzy systems.

Unit 3
Simulated annealing: Evolutionary computing, survival of the fittest, fitness computation, cross over, mutation, reproduction, rank method, rank space methods, case studies on applications of soft computing.

TEXTBOOKS:

EEE473 DIGITAL SIGNAL PROCESSORS 3 0 0 3

Unit 1

Unit 2
Blackfin processor: Blackfin 5xx DSP – architecture - instruction set – addressing modes.

Unit 3
Programming using TMS320C67xx and Blackfin DSPs: Assembly language and C programming – integrated development environment - code composer studio and visual DSP++ - application development.

TEXTBOOK:

REFERENCES:
**EEE474**  
**DIGITAL IMAGE PROCESSING**  
3 0 0 3

**Unit 1**
Introduction: Introduction & applications, elements of visual perception, image sensing and acquisition, simple image formation, image sampling and quantization, representing digital epixels, image quality, introduction to colour image.  
Image enhancement in spatial domain: Introduction to image enhancement, basic grey level transforms, histogram, histogram-processing equalization, matching & colour histogram, enhancement using arithmetic/logic operations, spatial filtering, smoothing spatial filtering, sharpening spatial filtering.

**Unit 2**
Image transform: Fourier transform, SHFT, DFT, FFT, DCT, Hadamard transform, wavelets transform (CWT, DWT), applications, other transforms.  
Image enhancement in frequency domain: Smoothing frequency domain filtering, sharpening frequency domain filtering, a model for Image degradation/ restoration process, noise model, mean filtering and filtering, estimating degradation function, inverse filtering, minimum mean square error (wiener filter), color image smoothing, sharpening.

**Unit 3**
Segmentation & morphological operations: segmentation and threshold function, different algorithms in thresholding, line detection, edge detection, edge linking by graph search method, Hough transform, region based segmentation, matching, color segmentation, morphological-dilation and erosion, opening and closing, hit/miss transforms, representation boundary descriptors, regional descriptors.

**TEXTBOOK:**
R. C. Gonzalez, R. E. Wood “Digital image processing”, Addison-wiley, 2002

**REFERENCES:**

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**EEE480**  
**POWER SYSTEM MANAGEMENT**  
3 0 0 3

**Unit 1**
Introduction: Energy security, future of electricity, electricity acts and regulations.  
Demand forecasting: Forecasting techniques and forecasting modelling.  
Utility planning: Generation mix, conventional and non conventional generation, cogeneration, wheeling and banking, power pooling and trading, energy storage schemes. Concepts of smart grid.
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TEXTBOOKS / REFERENCES:


EEE482 MANAGEMENT OF POWER DISTRIBUTION 3 0 0 3

Unit 1
Power sector in the country: Acts and policies, distribution reform, quality of supply and benchmarking.

Unit 2
Change management in power distribution: Change management: Concepts and processes, change requirement, emerging developments.
Communication skills and motivation: Communication issues and aspects, motivation issues and aspects, developing communication skills.

Unit 3
Financial management: Accounting principles, financial statements, financial analysis, cost management.

TEXTBOOKS/REFERENCES


EEE491 POWER SYSTEM SIMULATION LAB. 0 0 3 1

Development of software packages to calculate line parameters, load flow analysis, short circuit analysis, transient stability analysis, power system transients, load frequency dynamics and economic dispatch.
Mini projects using standard simulation software.

EEE492 POWER ELECTRONICS LAB. 0 0 3 1

SCR characteristics, MOSFET switching characteristics, AC phase control using SCR, Triac and Diac, single phase half controlled bridge converter, UJT relaxation oscillator for SCR triggering application, series inverter, single phase transistorized inverter, speed control of DC motor using chopper drive, simulation of full bridge converter, single phase single pulse width modulated MOSFET inverter, sinusoidal unipolar pulse width modulation.

EEE499 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.

EIE 413 BIOMEDICAL INSTRUMENTATION 3 0 0 3

Unit 1
Human anatomy and physiology: Systems of the body - cell resting potential and action potential - origin and characteristics of ECG, EEG, EMG, EOG, and ERG.

Unit 2
Signal processing: Introduction, sampling, A/D conversion and signal to noise ratio and signal conditioning.
Recorders & monitors: Preamplifiers, sources of noise, amplifiers for ECG, EEG & EMG - design considerations - evoked potential systems - biomedical recorders.
Medical imaging techniques: Principle of X-ray machine, digital radiography, CT, MRI, ultrasonic imaging, PET and SPECT scanners, gamma camera.

Unit 3
Electrical safety: Physiological effects of electricity, micro & macro shock hazards - electrical safety codes & standards - protection of patients, power distribution and equipment design.

TEXTBOOK:

ENG111 COMMUNICATIVE ENGLISH

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:
Schools of Engineering

Amrita Vishwa Vidyapeetham

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Unit 3

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

**REFERENCES:**


**ENG251**

**BUSINESS COMMUNICATION**

**OBJECTIVES:**

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

**Unit 1**


**Unit 2**


**Unit 3**


**Activities** - case studies & role-plays

**BOOKS RECOMMENDED:**


**SYLLABI**

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**ENG252**

**INDIAN THOUGHT THROUGH ENGLISH**

**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 Hararan – 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:**

8. Vidya, intranet, Amrita Vishwa Vidyapeetham.
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

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

REFERENCES:

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:

REFERENCE BOOKS:

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

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

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 Chinnmayananda

HUM251 INTRODUCTION TO INDIA STUDIES

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.
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
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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 - Indhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanyata 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 wreaked 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, Brhadaranyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya's Arthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women vis-à-vis Islam and European cultures; The great

REFERENCES:
17. Aurobindo, Sri. The Indian Renaissance / India's Rebirth / On Nationalism.
34. Dharmpal. Archival Compilations (unpublished)

HUM253 GLIMPSES INTO THE INDIAN MIND: 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 Bharataravisha / On Nationalism / Greater India.


HUM254 GLIMPSES OF INDIAN ECONOMY AND POLITY

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 purusharthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – 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 Talats 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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAP201</td>
<td>PROFICIENCY IN JAPANESE LANGUAGE (LOWER)</td>
<td>1022</td>
</tr>
<tr>
<td>JAP202</td>
<td>PROFICIENCY IN JAPANESE LANGUAGE (HIGHER)</td>
<td>1022</td>
</tr>
</tbody>
</table>

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)

Students will be taught the third and the most commonly used Japanese script, KANJI. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

### MAT111 CALCULUS, MATRIX ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

**Unit 1**
Linear systems of equations, Gauss elimination, rank of a matrix, linear dependence. Solutions of linear systems: existence, uniqueness, general form, eigen values, eigen vectors, some applications of eigen value problems, symmetric, skew-symmetric and orthogonal matrices, complex matrices: Hermitian, Skew Hermitian, unitary, similarity of matrices, basis of eigen vectors, diagonalization. (Sections: 6.3, 6.4, 6.5, 7.1, 7.2, 7.3, 7.4, and 7.5)
Limits and continuity. (Sections in textbook 1): 2.2, 2.3, 2.4, 2.5, 2.6)

**Unit 2**
Derivatives, curve sketching, improper integral. (Sections in textbook 1): 3.1, 4.1, 4.3, 4.4, 8.8
Basic concepts and ideas, exact differential equations, integrating factors, orthogonal trajectories of curves. (Sections: 1.1, 1.5, 1.8)

**Unit 3**
Review of linear differential equations and Bernoulli equation, modelling: mixing problem, electric circuits. Review of homogeneous linear equations of second order, Euler-Cauchy equations, solution by undetermined coefficients, solution by variation of parameters. System of linear equation, basic concepts and theory, homogeneous systems with constant coefficients, phase plane, critical points. Criterion for critical points and stability. (Sections: 1.6, 1.7, 2.1, 2.2, 2.3, 2.6, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4)
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TEXTBOOKS:

MAT112 VECTOR CALCULUS, FOURIER SERIES 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:

MAT211 INTEGRAL TRANSFORMS AND COMPLEX ANALYSIS

Unit 1
Complex numbers, complex plane, polar form of complex numbers. Powers and roots, derivative. Analytic functions, Cauchy-Riemann equations, Laplace equation, conformal mapping, exponential function, trigonometric functions, hyperbolic functions, logarithms, general power, linear fractional transformation. (Sections: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8,12.9)

Unit 2
Complex line integral, Cauchy integral theorem, Cauchy integral formula, derivatives of analytic functions. (Sections: 13.1, 13.2, 13.3, 13.4.)
Power series, Taylor series and Maclaurin series. Laurent series, zeros and

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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:

MAT212 MATHEMATICAL STATISTICS AND NUMERICAL METHODS

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

TEXTBOOK:

MEC100 ENGINEERING MECHANICS

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
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:

REFERENCES:

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:

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.
Sheet metal workshop:
Study of tools and equipment – study of various welding methods – arc welding practice and demonstration of gas welding and cutting.
Welding workshop:
Study of tools and equipment – study of various welding methods – arc welding practice and demonstration of gas welding and cutting.

MEC181 ENGINEERING DRAWING 1 0 3 2

Section of solids; Intersection of solids; development of surfaces. Orthographic views of three-dimensional solids.
Isometric projection.

TEXTBOOK:

REFERENCES:

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:

REFERENCES:
CADian Manual

MEC209 MECHANICAL ENGINEERING 4 0 0 4

Unit 1
Thermodynamics: Concepts of thermodynamic system, properties – specific volume, pressure, temperature - Zeroth law of thermodynamics, energy forms – work and heat. First law of thermodynamics – for a closed system undergoing a cycle, for a process, energy as a property, specific heats, first law applied to steady flow devices - second law of thermodynamics – concept of heat engines and refrigerators, Kelvin Planck and Clausius statements, irreversibilities, Carnot cycle.

Unit 2
I.C. engines: Classification, I.C. engines parts, 2/4 – stroke petrol and 4-stroke diesel engines. P-V diagrams of Otto and diesel cycles (no derivation for thermal efficiency). Simple problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency and specific fuel consumption.
Refrigeration and air conditioning: Refrigerants, properties of refrigerants, list of commonly used refrigerants. Refrigeration definitions - refrigerating effect, ton of refrigeration, ice making capacity, COP, relative COP, unit of refrigeration. Principle and working of vapor compression refrigeration. Principles and applications of air conditioners, room air conditioner
Water turbines: Classification, principles and operations of Pelton wheel, Francis turbine and Kaplan turbine
Mechanical power transmission systems: Belt, rope and gear drives – types, comparison and fields of application.

Unit 3
Computer numerical control: Introduction to NC, CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

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TEXTBOOKS:

REFERENCES:

MNG400 PRINCIPLES OF MANAGEMENT 3 0 0 3

Unit 1

Unit 2

Unit 3
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

**TEXTBOOKS:**

**REFERENCES BOOKS:**

**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:**
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 its applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneou 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:

REFERENCES:

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, radioative and non-radioactive 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:

TEXTBOOKS:

REFERENCES:

PHY253 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3

Unit 1
Electrostatics: Coulomb's 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, Maxwell's 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:

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:

PHY255 ELECTRONIC MATERIALS SCIENCE 3 0 0 3

Unit 1
Types of bonding in solids, Crystallography and crystalline defects: Crystallography, Directions and planes, Crystalline defects, line defects, Planar defects, Volume defects; Binary and Ternary Phase Diagrams: Lever rule and phase rule, Eutectic, peritectic and Eutectoid systems, Applications of Phase diagrams; Basic Quantum Physics - atomic structure, Use of band theory and occupation statistics to explain existence and basic properties of metals and nonmetals. Working of Semiconductor Devices using band diagrams and their electrical characteristics: pn junctions, BJT, MOSFET.

Unit 2
Use of band theory to explain optoelectronic properties of materials and optoelectronic devices: LEDs, Solar Cells, Lasers, pin diodes, photodiodes; Magnetic properties and Superconductivity: Magnetic moments and Magnetic Permeability, types of magnetism, saturation magnetization, magnetic domains, soft and hard magnetic materials, superconductivity and its origin, Giant Magneto Resistance, Josephson effect, Energy band diagrams and Magnetism, Applications of magnetic materials- Magnetic recording materials, etc.

Unit 3

TEXTBOOK:

REFERENCE:

PHY260 PHYSICS OF LASERS AND APPLICATIONS 3 0 0 3

Unit 1
Review of some basic concepts and principle of laser.

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
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.

REFERENCES:
**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:**


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**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:

PHY263 CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY 3003

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

Unit 2
Tools for characterization:

Nanoscale materials – properties and applications:
Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

Unit 3

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:

PHY264 THIN FILM PHYSICS 3003

Unit 1

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 microscope 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

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:

REFERENCES:

**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.

**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.

**TEXTBOOK:**

**REFERENCE BOOKS**
1. Glasser.O.Medical Physics Vol.1, 2, 3 Book Publisher Inc Chicago, 1980

**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 - coring maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

**TEXTBOOKS:**

**REFERENCE BOOKS**

**PHY272 QUANTUM PHYSICS AND ITS APPLICATIONS 3 0 0 3**

**Unit 1**
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
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:

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

Unit 3

PHY274 ASTROPHYSICS 3 0 0 3

Unit 1
Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Unit 2
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.
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:
5. 'Stellar Astronomy' by K.D Abhay rankar.

SSK111 SOFT SKILLS I

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.

SSK112 SOFT SKILLS II


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.

Spatial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

TEXTBOOKS:
4. Quick Maths – Tyra.
5. Quicker Arithmetic – Ashish Aggarwal
6. Test of reasoning for competitive examinations by Thorpe.E. TMH
7. Non-verbal reasoning by R.S. Aggarwal, S. Chand

REFERENCES:
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources
5. www.the grammarbook.com online teaching resources
6. www.englishpage.com online teaching resources and other useful websites.

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.

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:
5. Data Interpretation  by R.S. Aggarwal ,S. Chand
6. Logical Reasoning and Data Interpretation – Niskit K Sinkha
7. Puzzles –Shakuntala Devi

REFERENCES:
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources
5. www.the grammarbook.com online teaching resources
6. www.englishpage.com online teaching resources and other useful websites.