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


TEXTBOOKS:


SYLLABI

B. Tech. - Electrical & Electronics Engg.

2010 admissions onwards

REFERENCES:


CHY181

CHEMISTRY LAB. 0 0 3 1

1. Estimation of Hardness of sample water.
2. Estimation of alkalinity of sample water.
4. Estimation of HCl and CH₃COOH by conductometric titration.
5. Estimation of Fe²⁺ by potentiometric titration.
6. Phase diagram of two component system.
7. Determination of Corrosion rate and Inhibitor efficiency by weight loss method.
10. Adsorption by Activated charcoal method.
(Any 9 experiments of the above list)

Experiments for Demonstration

11. Desalination by Reverse osmosis.
13. Spectrophotometric analysis of trace element (Fe) in water.

CHY250

CATALYTIC CHEMISTRY 3 0 0 3

Unit 1

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

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

Unit 2

Catalysis by macromolecules, Phase transfer catalysis.

CATALYTIC CHEMISTRY

REFERENCES:


1. Estimation of Hardness of sample water.
2. Estimation of alkalinity of sample water.
4. Estimation of HCl and CH₃COOH by conductometric titration.
5. Estimation of Fe²⁺ by potentiometric titration.
6. Phase diagram of two component system.
7. Determination of Corrosion rate and Inhibitor efficiency by weight loss method.
10. Adsorption by Activated charcoal method.
(Any 9 experiments of the above list)

Experiments for Demonstration

11. Desalination by Reverse osmosis.
13. Spectrophotometric analysis of trace element (Fe) in water.

TEXTBOOKS:

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 ferroocene - optical fibers - definition, principle and structure - characteristics of optical fibre - photo resist optical fibre - advantages of optical fibre - liquid crystalline - peizoelectric 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 - SOx - NOx - 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 ferroocene - photo resist optical fibers and sensors, photo chromic & thermo chromic materials.
**Photochemistry in Electronics:** Laws of absorption - quantum efficiency and quantum yield - florescence and phosphorescence – photosensitization.

**High energy materials:** Preparation, properties and application of ammonium nitrate (AN), NH$_4$NO$_3$, ammonium perchlorate (AP), NH$_4$ClO$_4$, ammonium dinitramide (AND), NH$_4$N(NO$_2$)$_2$, hydrazinium nitroformate (HNF), N$_2$H$_5$C(NO$_2$)$_3$ etc.

**TEXTBOOKS:**

**REFERENCES:**

**CHY253 ADVANCED POLYMER CHEMISTRY 3 0 0 3**

**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**

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**SCHOOL OF ENGINEERING Amrita Vishwa Vidyapeetham**

**SYLLABI**
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**TEXTBOOKS:**

**REFERENCES:**
3. Jayadev Sreedhar and Govankar, "Polymer Chemistry".

**CHY254 POLYMERS FOR ELECTRONICS 3 0 0 3**

**Unit 1**
**Conducting polymers:** Conducting mechanisms - Electron transport and bipolar polymers - electrodepositable resists, resins. Applications - Organic light emitting diodes, Sensors, EMI shielding, printed Circuit Boards, Artificial nerves, Rechargeable Batteries, Electromechanical Actuators and switches.

**Unit 2**
**Photoconductive polymers:** Charge carriers, charge injectors, charge transport, charge trapping. Polymers for optical data storage - principles of optical storage, polymers in recording layer.

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

**Unit 3**
**Thermosensitive polymers:** Applications - Mechanical actuators and switches - Tissue culture, Drug delivery, Photo resists - Types - Chemically amplified photoresists - Applications. Magnetic polymers - structure and Applications.

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

**TEXTBOOK:**

**REFERENCE:**
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 - 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.  

**TEXTBOOK:**  

**REFERENCES:**  

CHY257 BIOMATERIALS SCIENCE 3 0 0 3

Unit 1
Introduction: Bulk properties, Surface properties and characterization - polymers, silicone biomaterials, medical fibres and bionetextiles - 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: In vitro and in vivo 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:
CHY259  INSTRUMENTAL METHODS OF ANALYSIS  3 0 0 3

Unit 1

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

Unit 2
Gas chromatography - principle and applications – gel chromatography.

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

Unit 3

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

TEXTBOOKS:

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

CHY260  ORGANIC SYNTHESIS AND STEREOCHEMISTRY  3 0 0 3

Unit 1
Nomenclature of Organic compounds: Polyenes, Alkynes with and without functional groups by IUPAC nomenclature. Aromatic and Heteroaromatic systems - nomenclature of heterocycles having not more than two hetero atoms such as oxygen, sulphur, nitrogen.

Stereochemistry: Tactility, 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

TEXT BOOKS:

REFERENCES:

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

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

Unit 2


Unit 3

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

**Amination:** Amination by reduction - methods of reduction - catalytic, metal and acid, sulphide and electrolitic 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:**

**CHY263 ORGANIC REACTION MECHANISMS 3 0 0 3**

Unit 1

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

**Reaction of nucleophiles and bases:** Nucleophilic substitution - $S_N1$ and $S_N2$ reactions, nucleophilic substitution at aliphatic sp2 carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organo lithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.
Unit 2
Michael and 1,4-addition reaction - Favorskii rearrangement - benzilic acid rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

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

Unit 3
Radical and radical ions: Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - S_n,1 reaction - radical ions - Birch reduction - Hofmann-Loffler-Freytag reaction - Barton reaction - McMurry reaction.


TEXTBOOK:

REFERENCES:
SYLLABI

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REFERENCES:

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REFERENCES:
Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3

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

**Ab-initio calculations:** Gaussian implementations – Gamess - Thermodynamic functions - Koopman’s theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments-mini projects with softwares - Introduction to HPC in Chemical calculations.

**Molecular modeling 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:**

**SYLLABI**

**FUEL CELLS - PRINCIPLES AND APPLICATIONS**

**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.
Unit 3

REFERENCES:

CSE100 COMPUTATIONAL 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, 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

TEXTBOOK:

REFERENCES:

CSE180 COMPUTER PROGRAMMING LAB. 0 0 3 1
1. Programs using various input/output statements (scanf, printf, getchar, gets, puts, putchar)
2. Programs using bitwise operators and enumerated data types
3. Programs using control structures (if, if else, switch, & loops)
4. Programs using numeric one dimensional array
5. Programs using numeric multidimensional array
6. Programs using strings & string handling functions
7. Functions using static, external and auto variables
8. Programs using recursive functions
9. Programs using call by reference and pointer arithmetic
10. Pointer to array & array of pointers using dynamic memory allocation
11. Structures – arrays, structure within structure
12. Array of structures, unions
13. Programs using text files
14. Programs using binary files
15. Programs using random access of files
16. Programs using command line arguments

CSE380 INFORMATION TECHNOLOGY ESSENTIALS 3 0 0 3

Unit 1
Computer hardware and system software concepts: computer architecture, system software, operating systems, computer networking. Programming fundamentals: problem solving concepts, modular approach though use of functions, error handling techniques, structured programming and data structures, structured statements, string handling functions, sorting and searching, file handling functions. Object oriented concepts: managing software complexity, concepts of object oriented programming, abstraction, class, object, member data, member methods, encapsulation, data hiding, inheritance, polymorphism, binding.
Unit 2
Analysis of algorithms: principles and tools for analysis of algorithms, analysis of popular algorithms, code tuning techniques, intractable problems. Relational database management: basic RDBMS concepts, database design, SQL commands, embedded SQL concepts, OLTP concepts.

Unit 3
System development methodology: software engineering and software development life cycle (SDLC), quality concepts and quality system procedures, analysis and design methods, structured programming concepts and principles of coding, software testing. User interface design: process of user interface design, elements of user interface design, speech user interface, web design issues. Introduction to web architecture: basic architecture of a web application, security, performance of web based applications, architecture documents.

REFERENCES:

CUL101  CULTURAL EDUCATION I  2002

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  2002

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 -  1022
AN INDIAN PERSPECTIVE

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

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

Unit 2
Personality Development
What is Personality – Five Dimensions – PanchaKosas (Physical/ Energy/Mental/ Intellectual/ Bliss); Stress Management &Personality; Self Control & personality; Fundamental Indian Values & Personality;
Learning Skills (Teachings of Amma)
Art of Relaxed Learning; Art of Listening; Developing 'Sraddha' – a basic qualification for obtaining Knowledge;

Communication Skills - An Indian Perspective;

Unit 3
Developing Positive Attitude & Friendliness- (Vedic Perspective);
Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);
Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

REFERENCE BOOKS:
1. Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9
2. Complete works of Swami Vivekananda (Volumes 1 to 9)
3. Mahabharata by M.N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)
4. Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Volumes 1 to 3)
7. Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
8. Will Power and its Development- Swami Budhananda published by Advaitha Ashram, Kolkatta
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, Kolkatta
15. Vaimiki 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 ANCIENT INDIA

Objectives: This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as 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.
3 To work towards excellence, one must know where he is. Our present state...
   An introspective analysis. Our faculties within.

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

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

REFERENCES:
The Bhaja Govindam and the Bhagavad Gita.

CUL154 YOGA PSYCHOLOGY 1022

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 Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

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

ECE100 ELECTRONICS ENGINEERING 3003

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.

Unit 3
Asynchronous sequential circuits: Asynchronous behavior, analysis of asynchronous circuits, synthesis of asynchronous circuits, state reduction, state assignment, hazards.

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.

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.

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

Unit 2
b) IIR filters: Design from analog filters - design by approximation of derivatives, impulse invariance and Bilinear transformation. Characteristics of commonly used analog filters, frequency transformations for analog and digital filters.

Unit 3
Digital filters realizations: Structures for the realization of discrete time system - structures for FIR systems - direct form structures, cascade form structures, frequency sampling structures, lattice structures. Structures for IIR systems - direct form structures, cascade form structures, parallel form structures and lattice and lattice-ladder structures, analysis of finite word length effect and limit cycle oscillations in recursive systems.

Applications of DSP: Multirate digital signal processing, sampling rate conversion, decimation and interpolation, sub-band coding of speech signals, introduction to QMFs. Linear predictive coding, forward linear prediction, Levinson-Durbin algorithm, signal synthesis, application in digital transmission of speech signals.

Textbook:

References:

ECE310 INTRODUCTION TO MICROCONTROLLERS AND APPLICATIONS 3 1 0 4
(Pre-requisite: ECE210)

Unit 1
Introduction to 8085 microprocessor-architecture and programming.


Introduction to elementary processor: Organization - Data Transfer Unit (DTU) - operation - Enhanced Data Transfer Unit (EDTU) – Opcode - machine language - assembly language - pipeline scheme and system clock.
Unit 2


Unit 3

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

**Introduction to 8051 microcontrollers:** architecture - instruction set – interrupts – ports – timers.

**TEXTBOOK:**

**REFERENCES:**

**ECE480 FINANCIAL ENGINEERING 3 0 0 3**

Unit 1

**Cash flows and fixed income securities:** Investments & markets, principal and interest, present & future values of streams, IRR - fixed income securities - market value for future cash, bond value, bond details, yields, convexity, duration, immunization, bond portfolio management - level of market interest rates, term structure of interest-rate theories.

Unit 2

**Stocks and derivatives:** Common stock valuation - present value of cash dividends, earnings approach, value versus price, efficient markets theory, technical analysis, analysis of financial statements - derivatives - futures and options.

Unit 3

**Portfolio analysis and capital market theory:** Covariance of returns, correlation, portfolio return, portfolio standard deviation, two asset case, efficient frontier, optimum portfolio.

**Capital market theory** - capital market line, simple diversification reduces risk, characteristic line, capital asset pricing model - arbitrage price theory, stock performance evaluation.

**TEXTBOOKS:**

**REFERENCE:**

**EEE100 ELECTRICAL ENGINEERING 3 0 0 3**

Unit 1

Introduction to electrical engineering. System of units. Electric current, Coulomb's law, Ohm's law, Faraday's law of electromagnetic induction, Kirchhoff's laws, Ampere's law. Ideal independent current and voltage-sources; Reference directions and symbols, energy and power; R, L and C- parameters; Series and parallel combination of resistances, capacitances and inductances, series-parallel circuits, superposition theorem, conversion of a voltage source to current source and vice versa, voltage divider and current divider rule. Network reduction by star–delta transformation, analysis of dc circuits by Mesh-current and nodal methods.

Unit 2

Transient analysis with energy storage elements (for RC-, RL- circuits with DC excitations): Writing differential equations for first order circuits, steady state solution of circuits containing inductors and capacitors, initial and final conditions, transient response of RL and RC circuits (rise and decay). Sinusoidal steady state analysis: Generation of sinusoidal functions, average and effective values of periodic functions, instantaneous and average power, power factor, phasor representation of sinusoids, response of single elements (R, L and C) for sinusoidal excitation; phasor concept and phasor diagram; Impedance and Admittance concepts; The series RL, series RC and series RLC circuits, complex power and power triangle. Introduction to 3-phase systems; Balanced 3-phase systems (STAR and DELTA connections).

Unit 3

Magnetic circuits: MMF, magnetic flux, reluctance, flux density, analogy with electric circuits, analysis of magnetic circuits, self and mutual induced emfs, energy stored in a magnetic circuit. Transformers; construction and principle of operation of transformers, Emf equation. Three phase Induction motor: Types, construction, rotating magnetic field, principle of operation, slip, rotor induced emf. Measuring instruments, Different types of instruments to measure voltage, current power and energy.
SYLLABI B. Tech. - Electrical & Electronics Engg. 2010 admissions onwards

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-

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.

Network functions: Driving point and transfer functions. Two-port networks:

Indefinite admittance Matrix, transmission lines, filters, and amplifiers.

TEXTBOOK:
REFERENCE:

EEE213 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION 3 1 0 4

Unit 1
Qualities of measurements: Introduction, performance characteristics, errors in measurements, types of static error, sources of error, dynamic characteristics, statistical analysis, standards.
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 transducer, 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:

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

EEE221 ELECTRICAL MACHINES I 3 1 0 4
(Pre-requisite: EEE212)

Unit 1
Definition of magnetic quantities, theory of magnetism, magnetization curves of ferromagnetic materials, magnetic circuit, concept and analogies, units for magnetic circuit calculations, magnetic circuit computation, Hysteresis and Eddy current losses in ferromagnetic materials, self and mutual inductances.

Principles of electromechanical energy conversion, basic concepts of rotating machines, dynamic equation of electromechanical systems.

Unit 2
DC Machines: EMF and torque, circuit model, armature reaction, compensating winding, commutation, methods of excitation, magnetization characteristic, self-excitation, types – shunt, series, compound generators and characteristics of DC generators, types and characteristics of DC Motors, starting of DC motors, speed control of DC motors, braking of DC motors, efficiency and testing, permanent magnet DC machine applications.

Unit 3
Transformer: Construction and practical considerations, transformer on no-load, ideal transformer, real transformer and equivalent circuit, transformer losses, transformer testing, efficiency and voltage regulation, excitation phenomenon in transformers, autotransformers, three-phase transformers, star-star, star-delta, zig-zag connection. Methods of cooling, parallel operation of transformers, three-winding transformers.

TEXTBOOK:

REFERENCES:

EEE222 ELECTROMAGNETIC THEORY 3 1 0 4
(Pre-requisite: EEE100)

Unit 1
Vectors and co-ordinate systems: Cartesian, cylindrical and spherical co-ordinate
syllabi

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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 sinusoidal 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, clamper 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
Operational amplifiers: *Review Ideal and practical op amp Inverting and non inverting configuration, differential configuration, practical op amp parameters, open loop and closed loop frequency response, gain bandwidth product, slew rate, CMRR.
Operational amplifiers applications: adder, integrators, differentiators, voltage comparators, Schmitt trigger, peak detector, instrumentation amplifier, zero crossing detector, sample and hold circuit, precision rectifier, RC waveform shaping circuits, data converter circuits - D/A converters Binary weighted type, R-2R ladder type, A/D converters feedback type converter, flash converter Phase-Locked Loops.

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:
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 ELECTRONICS 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 3 0 0 3
(Pre-requisite: EEE321)

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 3 0 0 3

Unit 1
Recent developments in core and insulation materials used in electrical machines; optimization techniques as applied to design of electrical machines; study of cooling systems. Computer aided design**: Advantage of computer aided design, flow chart for computer aided design. Standard specifications **: Indian standard specifications for copper conductor, power transformers and induction motor. (**) Self study

TEXTBOOK:

REFERENCES:
Schools of Engineering

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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:
MSP430f2274, Reference manual, Texas Instruments.
www.microchip.com
www.ti.com

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.
Unit 2

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:
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

Solution
War: 3

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

REFERENCES:

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.
EEE450 OPTIMIZATION TECHNIQUES  3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOKS:

REFERENCE:

EEE451 POWER SYSTEM STABILITY  3 0 0 3

Unit 1

Unit 2

Unit 3

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
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 – dermets of mechanical resistance control, advantages of variable speed drives, specific energy consumption, system design using VSD.

TEXTBOOKS / REFERENCES:

EE453 FLEXIBLE AC TRANSMISSION SYSTEMS

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:

REFERENCES:
EEE454	POWER SYSTEM CONTROL	3 0 0 3
(Pre-requisite: EEE332)

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:

EEE455	HIGH VOLTAGE ENGINEERING	3 0 0 3

Unit 1
Introduction: different types of dielectrics, uniform and non-uniform electric field, electric field in some geometric boundaries.
Conduction and breakdown in gases: Collision process, ionization process, Townsend’s theory, streamer theory, Paschen’s law, breakdown in non-uniform fields and corona discharges - vacuum insulation.
Conduction and breakdown in liquid dielectrics; Classification of liquid dielectrics, breakdown in liquid dielectric. Different types of solid dielectric materials-breakdown in solid dielectrics-field configuration in the presence of voids.
Breakdown in composite dielectric.

Unit 2
Generation of high voltages - ac voltages, dc voltages, impulse voltages. Generation of impulse currents.
Measurement of high voltages and currents - high DC, AC and impulse voltages, direct, alternating and Impulse currents.

Unit 3
Non-destructive insulation test techniques, measurement of insulation resistance under dc voltage, measurement of loss angle and capacitance, partial discharge measurement.
Testing of high voltage apparatus based in International and Indian standards - non-destructive testing - testing of insulators – bushings – cables - isolators and circuit breakers – transformers - surge arresters.

TEXTBOOK:

REFERENCES:
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.

TEXTBOOK:

REFERENCES:

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


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 imittance function, synthesis of LC driving point imittance, 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 \( \Omega \) 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.
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
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, Kohnen’s self organizing networks, Hopfield networks, distance measures.

Unit 2
Fuzzy sets: properties, membership functions, fuzzy operations, applications,
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:
2. R. C. Gonzalez, R. E. Wood “Digital image processing using MATLAB”, Pearson Education, 2004

EEE480  POWER SYSTEM MANAGEMENT  3 0 0 3

Unit 1
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.

EIE413 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:
REFERENCES:

ENG111 COMMUNICATIVE ENGLISH 2023

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:

ENG112 TECHNICAL COMMUNICATION 2023

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

Unit 1

Unit 2
Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals - reports – proposals; Formal correspondence: Letter writing, including job applications with resume.

Unit 2

REFERENCES:

ENG250 PROFESSIONAL COMMUNICATION 2022

Unit 1
Reading Comprehension: Focus will be on understanding of the given information, vocabulary, inference, logical thinking, and decision - making.

Unit 2
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:

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

Unit 2

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

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.

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<th>Course Code</th>
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<tr>
<td>GER212</td>
<td>GERMAN FOR BEGINNERS II</td>
<td>102</td>
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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.

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<tr>
<td>HUM250</td>
<td>INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY</td>
<td>102</td>
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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 Chhinmayananda

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<tr>
<td>HUM251</td>
<td>INTRODUCTION TO INDIA STUDIES</td>
<td>102</td>
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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
tought 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, Advaitha Ashrama publication.
3) Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
4) Outlines of Indian Philosophy, M. Hriyanna, 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. Sethuraman, Macmillan.
15) Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.
16) Web of Indian Thought, Sister Nivedita
## SYLLABI

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

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<tr>
<td>HUM252</td>
<td>GLIMPSES OF ETERNAL INDIA</td>
<td>1 0 2 2</td>
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### 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 – Ramaraja – Yuddhisthira’s ramaraja; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy – Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harisavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

### Unit 2

India’s contribution to the world: spirituality, philosophy and sciences

Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy: Ancient Indian science and technology. The arrival of Europeans, British paramountcy and colonization

What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

### Unit 3

Women in Indian society

The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadaranyak Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya’s Arthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great

## REFERENCES:

18. Danino, Michel. The Invasion That Never Was.
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 Bharatarvansha / 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 purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira’s ramarajya;
Sarasvati - Sindhu civilization and India’s trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2
Classical India: 600B.C. – 1200 A.D.
The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya’s Arthasastra; Of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India’s maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas
Medieval India: 1200 A.D. – 1720 A.D.
Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3
Modern India: 1720 - 1947
the Indian market and economy before the arrival of the European traders;
Colonisation and British supremacy (dismantling of everything that was ‘traditional’ or ‘Indian’) – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Talas 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.
JAP201 PROFICIENCY IN JAPANESE LANGUAGE (LOWER) 1 0 2 2

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

JAP202 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER) 1 0 2 2

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

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics. By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

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

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

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

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

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.

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

REFERENCES:
Concerned Workshop Manual

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
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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


**TEXTBOOK:**

**PHY181 PHYSICS LAB. 0 0 3 1**

Experiments on mechanics
1. Torsional pendulum.
2. Co-efficient of viscosity of liquid.
3. Young’s modulus - non-uniform bending.

Experiments on optics
1. Determination of lycopodium powder particle size using laser.
2. Dispersive power of prism.

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

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

**REFERENCE:**

**PHY250 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3**

Unit 1
Conducting materials: The nature of chemical bond, crystal structure Ohm’s law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it’s consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.
Unit 2  
**Magnetic materials:** Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it’s applications.

Unit 3  
**Dielectric materials:** Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

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

**TEXTBOOK:**

**REFERENCES:**

**PHY252 PHYSICS OF SEMICONDUCTOR DEVICES 3 0 0 3**

Unit 1  
**Introduction:** Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects.

**Electrical conductivity:** Classical free electron theory – assumptions, drift velocity, mobility and conductivity, drawbacks. Quantum free electron theory – Fermi energy, Fermi factor, carrier concentration. Band theory of solids – origin of energy bands, effective mass, distinction between metals, insulators and semiconductors.

Unit 2  
**Theory of semiconductors:** Intrinsic and extrinsic semiconductors, band structure of semiconductors, carrier concentration in intrinsic and extrinsic semiconductors, electrical conductivity and conduction mechanism in semiconductors, Fermi level in intrinsic and extrinsic semiconductors and its dependence on temperature and carrier concentration. Carrier generation-recombination, mobility, drift-diffusion current. Hall effect.

**Theory of p-n junctions – diode and transistor:** p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

Unit 3  
**Bipolar junction transistor, p-n-p and n-p-n transistors:** principle and modes of operation, current relations. V-I characteristics. Fundamentals of MOSFET, JFET. Heterojunctions – quantum wells.

TEXTBOOKS:

REFERENCES:

**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, pn 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**
Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO$_2$ LASER - principle, construction, working and application.
Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:
LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.
Applications of LASERS in other fields:
Holography: Principle, types, intensity distribution, applications. laser induced fusion.

**REFERENCES:**
### PHY261  LASERS IN MATERIAL PROCESSING  

**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.

### PHY262  NON-LINEAR DYNAMICS  

**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 3 0 0 3
Unit 1
Introduction
Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement

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 3 0 0 3
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
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.

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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
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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

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Eigen values and Eigen vectors of matrix: Determinant of a matrix, characteristic equation of a matrix, eigen values and eigen vectors of a matrix, power method.

TEXTBOOK:
Rubin H Landau & Manuel Jose Paez Mejia, "Computational Physics", John Wiley & Sons

REFERENCES:
2 M Hiroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

PHY274 ASTROPHYSICS 3 0 0 3

Unit 1

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

Celestial mechanics - Kepler's laws - and derivations from Newton’s laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2

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: Cosmic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.
REFERENCES:
5. ‘Stellar Astronomy’ by K.D Abhayankar.

SSK111  SOFT SKILLS I  0 0 3 1
Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words. Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level – I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level – II: Time speed and distance; work time problems;

Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.

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

TEXTBOOKS:
5. Quantitative Aptitude by R.S. Aggarwal , S. Chand
6. Quantitative Aptitude – Abijith Guha , TMH.
7. Quantitative Aptitude for Cat- Arun Sharma. TMH.

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

SSK112  SOFT SKILLS II  0 0 3 1

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

REFERENCES:
3. The BBC and British Council online resources
www.the grammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.

SSK113 SOFT SKILLS III 0 0 3 1

Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation/knowledge about the company, professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, critical reasoning: A course on verbal reasoning. Listening comprehension advanced: An exercise on improving listening skills.

Reading comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Problem solving level – IV: Geometry; Trigonometry; Heights and distances; Co-ordinate geometry; Mensuration.

Specific training: Solving campus recruitment papers, national level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In mathematics). Lateral thinking problems. Quick checking of answers techniques; Techniques on elimination of options, estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

TEXTBOOKS:
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
www.the grammarbook.com online teaching resources
www.englishpage.com online teaching resources and other useful websites.