Unit 1


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

Unit 3


**TEXTBOOKS:**

**REFERENCES:**
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.


TEXTBOOKS:

REFERENCES:

CHY251 CHEMISTRY OF ENGINEERING MATERIALS 3 0 0 3

Unit 1
Chemical materials in Electronics and Electrical Engineering: Structural correlation to behavior of conducting polymers, Semi-conducting polymers - properties of organic polymers containing metal groups such as poly ferrocene - optical fibers - definition, principle and structure - characteristics of optical fibre - photo resist optical fibre - advantages of optical fibre - liquid crystalline - peizo and pyroelectric polymers - magnetic materials, hard and soft magnets – sensors (voltametric).


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 - SO₃ - NO₃ - 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:

REFERENCES:
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

TEXTBOOKS:

SYLLABI B. Tech. - Mechanical Engg. 2010 admissions onwards

REFERENCES:
3. Jayadev Sreedhar and Govarkar, “Polymer Chemistry”.

CHY254 POLYMERS FOR ELECTRONICS 3 0 0 3

Unit 1

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

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

TEXTBOOK:

REFERENCE:

CHY255 CHEMISTRY OF TOXICOLOGY 3 0 0 3

Unit 1
Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of
Syllabi B. Tech. - Mechanical Engg. 2010 admissions onwards

Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury - medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants - solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

Unit 2
Exposure Classes, Toxicants in Air, Water, Soil, Domestic and Settings: Occupational Air, water and soil as primary media for human exposure to various classes of chemical toxicants in environmental, domestic, and occupational settings - historic and present status of air pollution and air quality - introduction to the major classes of soil and water pollutants - sources, exposure routes and potential adverse health effects - Classes of occupational toxicants - route of exposure and permissible levels - specific examples of concern.

Unit 3
Toxicant Analysis and Quality Assurance Principles: Introduction to procedures, principles and operation of analytical laboratories in toxicology. Summary of the general policies - analytical laboratory operation, analytical measurement systems, quality assurance (QA) - quality control (QC) procedures.


Textbook:

References:

CHY256 CHEMISTRY OF NANOMATERIALS 3003

Unit 1
Introduction: Introduction to Nanomaterials: Size dependence of properties -

Textbooks:
Schools of Engineering
Amrita Vishwa Vidyapeetham

CHY257 BIOMATERIALS SCIENCE 3 0 0 3

Unit 1
Introduction: Bulk properties, Surface properties and characterization - polymers, silicone biomaterials, medical fibres and biotextiles - Smart polymers - bioreversible and bioerodible materials - natural materials, metals and ceramics - physicochemical surface modification.

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

Unit 2
Chemical and biochemical degradation of polymers - degradation of metals and ceramics - calcification of biomaterials.

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

Unit 3
Biological testing of biomaterials: Invitro and invivo assessment of tissue compatibility - evaluation of blood materials interaction - microscopy in biomaterials.

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

TEXTBOOK:

REFERENCES:

CHY258 ENVIRONMENTAL CHEMISTRY 3 0 0 3

Unit 1
Air and air pollution (earth’s atmosphere): Regions - ozone - CFC and other chemicals - catalytic decomposition of ozone - ‘ozone hole’ formation - Air pollution due to gas emission from industries - Atmospheric aerosols – dust, combustion products, aerosol concentration and lifetimes - Automobile exhausts, smog and effects - Acid rain - chemistry of acid rain, roll of meteorology, greenhouse gases and global warming - air pollution due to jet engines.

CHY259 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3

Unit 1
Separation Techniques: Brief outline of column, paper and thin layer chromatography - ion exchange methods - principle and application - HPLC.

Unit 2
Gas chromatography - principle and applications - gel chromatography.
Electro analytical techniques: Potentiometry - Potentiometric titration - determination of equivalence point - acid base, complexometric, redox and precipitation titrations - merits and demerits. Voltammetry - Cyclic voltammetry - basic principle and application - Polarography - introduction - theoretical principles - migration current - residual current - half wave potential - instrumentation - analytical applications.

Unit 3
Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

TEXTBOOKS:

REFERENCES:

Unit 3

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

TEXTBOOK:

REFERENCES:

CHY262
MEDICINAL ORGANIC CHEMISTRY
3 0 0 3

Unit 1

Unit 2
Enzymes and hormones: Enzymes - nomenclature, classification and characteristics of enzymes - mechanism of enzyme action, factors affecting enzyme action, cofactors and co-enzymes, enzyme inhibition, enzymes in organic synthesis. Hormones and vitamins - representative cases. Medicinal agents from natural products: Natural products as therapeutic agents, medicinal plants, animal products as medicine, isolation methods of alkaloids, terpenes, anti-oxidants.

Unit 3
Medicinal agents: Medicinal agents belonging to steroids, polypeptides, modified nucleic acid bases, sulphonamide and sulpha drugs, antibiotics, antifungal, antiseptics and disinfectants, anesthetics, antihypertensive drugs, analgesics, histamine and anti-histamine agents.

TEXTBOOKS:

CHY263
ORGANIC REACTION MECHANISMS
3 0 0 3

Unit 1
Introduction to organic chemistry: Lewis structure and formal charges of organic compounds - electro negativities and dipoles, resonances, aromaticity and anti aromaticity - equilibrium, tautomerism and hyper conjugation - acidity and basicity - pKa, nucleophiles and electrophiles - hydrogen bonding - different types of organic reaction - addition, substitution, elimination and rearrangement - oxidations and reductions - general principles of writing organic reaction mechanism - reactive intermediates.

Reaction of nucleophiles and bases: Nucleophilic substitution - $S_{N}$1 and $S_{N}$2 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
S 15

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

Unit 3

**Radical and radical ions:** Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - S_{RN} 1 reaction - radical ions - Birch reduction - Hofmann-Loffler-Freytag reaction - Barton reaction - McMurry reaction.


**TEXTBOOK:**

**REFERENCES:**

CHY264 GREEN CHEMISTRY AND TECHNOLOGY 3 0 0 3

Unit 1

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

Unit 2

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

Unit 3

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

**REFERENCES:**
1. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.
CHY271 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES

Unit 1
Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanché type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

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

Unit 3

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

REFERENCES:
4. Derek Pletcher and Frank C. Walsh, “Industrial Electrochemistry”, Blackie Academic and

CHY272 COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING

Unit 1
Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.
Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.

Unit 2
Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.
Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel’s coefficient matrix - Wheeland’s method - Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3
Self consistent fields: Elements of secular matrix - Variational calculations -
Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation - Roothaan - Hall equation - Semi empirical models and approximations.

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

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

**TEXTBOOKS:**

**REFERENCES:**

**CHY273 FUEL CELLS - PRINCIPLES AND APPLICATIONS 3 0 0 3**

**Unit 1**
**Introduction:** relevance, importance and classification of fuel cells.

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

**Unit 2**
**Description, working principle, components, applications and environmental aspects of the following types of fuel cells:** alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

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

**Unit 3**
**Hydrogen:** sources of hydrogen and preparation - clean up and storage - use as fuel in cells.

**SYLLABI**
**B. Tech. - Mechanical Engg.**
2010 admissions onwards

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

**TEXTBOOK:**

**REFERENCES:**

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

**Unit 1**
**Symmetry in Crystal Systems:** Types of symmetry, plane, axis and centre of symmetry, crystal systems and symmetry elements. Law of rational indices, Miller indices, Weiss indices - plane systems, space lattices, unitcells - unitcell dimension, determination. Space lattice - definition and types Bravais lattice - kinds of bravais lattices, number of atoms in SC, BCC, FCC lattices, void space, Radius ratio rule and application. Crystal defects - types of defects in crystals - stoichiometric defect - schottky and frenkel defects - Non-stoichiometric defects - metal excess and metal deficiency defects, influence of defects on the properties of solids.

**Unit 2**
**Electrical and Magnetic Properties:** Development of free electron theory to band theory of solids - metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; Insulators - dielectric, ferroelectric, pyroelectric and piezoelectric properties and the relationship between them. Dia, para, ferro, ferri, antiferro and antiferri magnetic types - selected magnetic materials such as spinels, garnets and perovskites, superconductors.

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

**Unit 3**
SYLLABI

B. Tech. - Mechanical Engg.  2010 admissions onwards

REFERENCES:

SYLLABI

B. Tech. - Mechanical Engg.  2010 admissions onwards

CSE100  COMPUTER PROGRAMMING  3 0 0 3

Unit 1
Introduction to problem solving - algorithm development, flowcharting. C fundamentals, datatypes, variables, constants, enumerations, operators, bitwise operators, expressions, type cast, data input and output statements - formatted & unformatted, control structures - if, if else, switch.. case, while loop, do.. while, for loop, continue, break, goto. Arrays – defining an array, processing an array, multidimensional arrays.

Unit 2
Strings, string handling functions. User defined functions - defining a function, function prototypes, calling a function, passing arguments to a function, recursion. Variable scope - auto, extern, static, register. Pointers - declarations, call by reference, functions returning pointer, pointer arithmetic. Pointer to pointer, pointers and arrays - pointer to array, array of pointers, dynamic memory allocation - malloc(), calloc(), free().

Unit 3

TEXTBOOK:

REFERENCES:
CUL102  CULTURAL EDUCATION II  2 0 0 2

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

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

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

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

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

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

Unit 1
Goals of Life – Purusharthas
What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life; & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)
Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);

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

Unit 2
Personality Development
What is Personality – Five Dimensions – PanchaKosas (Physical/ Energy/Mental/ Intellectual/ Bliss); Stress Management &Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)

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

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

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 Yudhananda published by Advaltha Ashram, Kolkatta
10. Yogas in Daily Life - Swami Sivananda – published by Divine Life Society
12. All about Hinduism – Swami Sivananda - Published by Divine Life Society
15. Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi
17. Mind Sound Resonance Technique (MSRT) published by Swami Vivekananda Yoga Prakashana, Bangalore.
18. Yoga & Memory - Dr H R Nagendra & Dr.Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.
Unit 1
1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2
6. Astronomy & mathematics in Jain and Buddhist literature;
7. The transition to the Siddhantic period; Aryabhata and his time;
8. The Aryabhatiya: concepts, content, commentaries;
9. Brahmagupta and his advances;
10. Other great Siddhantic savants;
11. Bhaskara II and his advances;

Unit 3
12. The Kerala school of mathematics;
13. The Kerala school of astronomy;
14. Did Indian science die out?
15. Overview of recent Indian scientists, from S. Ramanujan onward;
16. Conclusion: assessment and discussion;

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

REFERENCE:
IFIH’s interactive multimedia DVD on Science & Technology in Ancient India.

CUL153 EXCELLENCE IN DAILY LIFE 1 0 2 2

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

Unit 2
4. The play of the mind. Emotions – convert weakness into strength.
5. The 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.

CUL154 YOGA PSYCHOLOGY 1 0 2 2

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

Unit 1
Introduction
Introduction to Modern Psychology
A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

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

Patanjali Yoga Sutra – 1

Patanjali Yoga Sutra – 2

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

Patanjali Yoga Sutra – 4

Patanjali Yoga Sutra – 5
Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep
- by meditation as desired.

Patanjali Yoga Sutra – 6

Patanjali Yoga Sutra – 7

Unit 3
Patanjali Yoga Sutra – 8

Patanjali Yoga Sutra – 9

Patanjali Yoga Sutra – 10
Asanam – Pranayama - various kinds of Pranayama - Pratyahara - Mastery over the senses.

Report review
Conclusion

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

ECE100 ELECTRONICS ENGINEERING 3 0 0 3

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

Unit 1
Physics of conductors and semiconductors: conductors, semiconductors, silicon crystals, intrinsic semiconductors, two types of flow, doping a semiconductor, two types of extrinsic semiconductors, unbiased diode, forward bias, reverse bias, breakdown, barrier potential and temperature, reverse biased diode, diode approximations.

TEXTBOOK:

REFERENCES:

EEE100 ELECTRICAL ENGINEERING 3 0 0 3

Unit 1
Introduction to electrical engineering. System of units. Electric current, Coulomb’s law, Ohm’s law, Faraday’s law of electromagnetic induction, Kirchoff’s laws, Ampere’s law. Ideal independent current and voltage-sources; Reference directions and symbols, energy and power; R, L and C- parameters; Series and parallel combination of resistances, capacitances and inductances, series-parallel circuits, superposition theorem, conversion of a voltage source to current source and vice versa, voltage divider and current divider rule. Network reduction by star–delta transformation, analysis of dc circuits by Mesh-current and nodal methods.

Unit 2
Transient analysis with energy storage elements (for RC-, RL- circuits with DC excitations): Writing differential equations for first order circuits, steady state
solution of circuits containing inductors and capacitors, initial and final conditions, transient response of RL and RC circuits (rise and decay).

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

Unit 3
Magnetic circuits: MMF, magnetic flux, reluctance, flux density, analogy with electric circuits, analysis of magnetic circuits, self and mutual induced emfs, energy stored in a magnetic circuit.
Transformers; construction and principle of operation of transformers, Emf equation.
Three phase Induction motor: Types, construction, rotating magnetic field, principle of operation, slip, rotor induced emf.
Measuring instruments, Different types of instruments to measure voltage, current and power and energy.

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.

EEE290 ELECTRICAL ENGINEERING AND ELECTRONICS LAB. 0 0 3 1

List of Experiments:
1. Load Test on single phase induction motor.
2. Load Test on three phase induction motor.
3. Implement & verify Boolean expressions using logic gates & universal gates.
4. Implementation of multiplexer, de multiplexer, encoder & decoder.
5. Implementation of shift registers.

ENG111 COMMUNICATIVE ENGLISH 2 0 2 3

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

Unit 1
Reading: Different styles of communication – reading comprehension - critical thinking and analysis – note-making.

Unit 2
Writing: Prewriting techniques - kinds of paragraphs - basics of continuous writing; Grammar and usage – topics including spelling and number rules (Workbook).

Unit 3
Practical sessions (listening & speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – listening comprehension and note-taking.
Activities: Short speeches, seminars, quizzes, language games, debates, discussions and book reviews, etc.
TEXTBOOKS:
1. Language through Reading: Anthology compiled by Amrita.
2. Language through practice: Work book compiled by Amrita

REFERENCES:

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

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:

ENG 252     INDIAN THOUGHT THROUGH ENGLISH  1 0 2 2

Objectives:
To expose the students to the greatness of Indian Thought in English
To develop a sense of appreciation for the lofty Indian Thought
To develop an understanding of the eclectic Indian

Unit 1

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.

ENG 253     INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE  1 0 2 2

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

Objectives -
· to expose the students to different genres of Literature
· to inculcate reading skills
· to provide deeper critical and literary insights
· to enhance creative thinking
· to help the student develop critical and analytical skills
· to promote the aesthetic sense

Unit 1
Poetry
Seamus Heaney – Digging; Philip Larkin – Ambulances; W.B.Yeats - Prayer for my daughter; W. H Auden - Miss Gee; Peter Porter - Your Attention Please; Rabindranath Tagore ‘s poems “Defamation” and “Playthings”.

Unit 2
Drama
Oscar Wilde - Importance of Being Earnest; Anton Chekov – Proposal; Scenes from the great tragedies of Shakespeare.

Unit 3
Essays
Bibhuti Mishra “When I took over from her”; R.K.Narayan ‘Junk”; M K Naik * The Postman’s Knock”.

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

REFERENCES:
ENV200  ENVIRONMENTAL STUDIES  3 1 0 4

Unit 1
Overview of the global environmental crisis; Biogeochemical cycles; Climate change and related international conventions and treaties and regulations; Ozone hole and related international conventions and treaties and regulations; Overpopulation; Energy crisis; Water crisis, groundwater hydrogeology, surface water resource development.

Unit 2
Ecology, biodiversity loss and related international conventions, treaties and regulations; Deforestation and land degradation; Food crisis; Water pollution and related international and local conventions, treaties and regulations; Sewage domestic and industrial and effluent treatment; Air pollution and related international and local conventions, treaties and regulations; Other pollution (land, thermal, noise).

Unit 3
Solid waste management (municipal, medical, e-waste, nuclear, household hazardous wastes); Environmental management, environmental accounting, green businesses, eco-labeling, environmental ethics, environmental impact assessment; Constitutional, legal and regulatory provisions; Sustainable development;

TEXTBOOK:

REFERENCE BOOKS:

FRE201  PROFICIENCY IN FRENCH LANGUAGE (LOWER)  1 0 2 2

Unit 1  Population - Identity
How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions; Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

Unit 2  The suburbs - At the train station
Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city (church, town hall, post office…)
Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3  Paris and the districts - Looking for a room
Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.
Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:
Metro St Michel - Publisher: CLE international

FRE202  PROFICIENCY IN FRENCH LANGUAGE (HIGHER)  1 0 2 2

Unit 1  The first room of a student
A party to celebrate the 1st room; Description of a room; furniture; Locate objects; prepositions (devant, derrière, dans…); Read advertisement; Appreciation (I like, I prefer).
Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son…); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2  Small jobs
Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.
Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec…); Pronoun as direct object (le, la, l’, les).

Unit 3  University Restaurant
Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).
Grammar - Partitif (expressing quantity) (du, de la, pas de…); Comparison (plus…que, moins…que, autant …que); Interrogation (continuation), inversion, Est-ce que, qu’est-ce que ?

TEXTBOOK:
Metro St Michel - Publisher: CLE international
## SYLLABI

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GER201</td>
<td>PROFICIENCY IN GERMAN LANGUAGE (LOWER)</td>
<td>1022</td>
</tr>
<tr>
<td>GER202</td>
<td>PROFICIENCY IN GERMAN LANGUAGE (HIGHER)</td>
<td>1022</td>
</tr>
<tr>
<td>GER211</td>
<td>GERMAN FOR BEGINNERS I</td>
<td>1022</td>
</tr>
<tr>
<td>GER212</td>
<td>GERMAN FOR BEGINNERS II</td>
<td>1022</td>
</tr>
<tr>
<td>HUM250</td>
<td>INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY</td>
<td>1022</td>
</tr>
</tbody>
</table>

### GER201
**PROFICIENCY IN GERMAN LANGUAGE (LOWER) 1022**

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) 1022**

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 1022**

**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.

### GER212
**GERMAN FOR BEGINNERS II 1022**

**Unit 1**
Shopping and orientation in supermarket; Conversation between the customer and
salesman; Where one finds what in supermarket; Asking for requests and
suggestions.
Grammar: Dative of personal pronouns. Imperative form.
Vocabulary: Consumables and measurements;

**Unit 2**
Appointments; Work and leisure time activities; Time, weekdays, months and
seasons; saying the date; fixing up an appointment.
Grammar: Model verbs; Prepositions with time and place; Ordinal numbers.
Vocabulary: Leisure activities, weekdays, months and seasons.

**Unit 3**
Family and household; Family and relations; household and daily routine.
Grammar: Possessive articles; Divisible and indivisible verbs.
Vocabulary: Family circle; Household articles.

### HUM250
**INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY 1022**

**Unit 1**
Introductory study of the Bhagavad Gita and the Upanishads

**Unit 2**
The relevance of these classics in a modern age –

**Unit 3**
Goals of human life-existential problems and their solutions in the light of these
classics etc.
REFERENCE:
The Bhagavad Gita, Commentary by Swami Chinmayananda

HUM251  INTRODUCTION TO INDIA STUDIES  1 0 2  2

Preamble:
This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Unit 1
A brief outline of Indian history from prehistoric times to the present times.
Contributions of India to world culture and civilization:
Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2
Modern India: Challenges and Possibilities –
Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3
Modern Indian Writing in English: Trends in Contemporary Indian Literature in English

TEXTBOOK:
Material given by the Faculty

BACKGROUND LITERATURE:
1) Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
2) Selections from the Complete Works of Swami Vivekananda, Adwaita Ashrama publication.
3) Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
4) Outlines of Indian Philosophy, M. Hiriyanna, MLBD.
5) An Advanced History of India, R. C. Majumdar et al, Macmillan.
6) India Since 1526, V. D. Mahajan, S. Chand & Company
7) The Indian Renaissance, Sri Aurobindo.
8) India’s Rebirth, Sri Aurobindo.
9) On Nationalism, Sri Aurobindo.

HUM252  GLIMPSES OF ETERNAL INDIA  1 0 2  2

Unit 1
Introduction
A peep into India’s glorious past
Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira’s ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy – Kautiya and his Arthisatra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region: The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2
India’s contribution to the world: spirituality, philosophy and sciences
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.
The arrival of Europeans, British paramountcy and colonization
What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.
Unit 3
Women in Indian society
The role and position of women in Hindu civilization; Gleanings from the Vedas, Brhadaranyak Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya’s Arthasastra and Mrichchhakatikam of Sudraka;
The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

Modern India
The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

Conclusion
The Wonder that was India; The ‘politics’ and ‘purpose’ of studying India

REFERENCES:
17. Aurobindo, Sri. The Indian Renaissance / India’s Rebirth / On Nationalism.
SYLLABI  B. Tech. - Mechanical Engg.  2010 admissions onwards

Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3
Modern India: 1720 - 1947
the Indian market and economy before the arrival of the European traders;
Colonisation and British supremacy (dismantling of everything that was 'traditional' or 'Indian') – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations – division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place. Independent India – from 1947
India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

REFERENCES:
1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

SYLLABI  B. Tech. - Mechanical Engg.  2010 admissions onwards

HUM254  Glimpses of Indian Economy and Polity  1 0 2  2

Unit 1
Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.
Ancient India – up to 600 B.C.
Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajapatala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramaraja) – Yudhisthira’s ramaraja; 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

HUM254  Glimpses of Indian Economy and Polity  1 0 2  2

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SYLLABI

B. Tech. - Mechanical Engg.  2010 admissions onwards


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

Unit 1
Introduction
Western and Indian views of science and technology
Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2
Indian sciences
Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD Science and technology under the British rule Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3
Science and technology in Independent India
Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on oilseeds economy; Planning without the spirit and the determination. Building upon the Indian tradition
Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty for all in plenty.

Conclusion

SYLLABI

B. Tech. - Mechanical Engg.  2010 admissions onwards

REFERENCES:
18. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

* The syllabus and the study material in use herein has been developed out of a ‘summer programme’ offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

JAP201  PROFICIENCY IN JAPANESE LANGUAGE (LOWER)  1 0 2 2

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

Schools of Engineering
Amrita Vishwa Vidyapeetham  S 45

Schools of Engineering
Amrita Vishwa Vidyapeetham  S 46
Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

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

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

Students will be given detailed lectures on Calligraphy.

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

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

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

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

Unit 2
Derivatives, curve sketching, improper integral. (Sections (in textbook 1): 3.1, 4.1, 4.3, 4.4, 4.8)
Basic concepts and ideas, exact differential equations, integrating factors, orthogonal trajectories of curves. (Sections: 1.1, 1.5, 1.8)

Unit 3

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

Unit 1
Vector and scalar functions, derivatives, curves, tangents, arc Length, curves in mechanics, velocity and acceleration, gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. (Sections: 8.4, 8.5, 8.6, 8.9, 8.10, 8.11)
Line integral, line integrals independent of path (Sections: 9.1, 9.2)

Unit 2
Green's theorem in the plane, surfaces for surface integrals, surface integrals, triple integrals – Gauss divergence theorem, Stoke's theorem. (Sections: 9.4, 9.5, 9.6, 9.7, 9.9)

Unit 3
Periodic functions, trigonometric series, Fourier series, functions of any period p = 2L, even and odd functions, half range expansions (theorem statement only), complex Fourier series, applications of Parseval's identity. (Sections: 10.1 to 10.5)
Basic concepts, modeling; vibrating string, wave equation, separation of variables, use of Fourier series, d'Alembert's solution of the wave equation, heat equation; solution by Fourier series. (Sections: 11.1 to 11.5)

TEXTBOOK:

MAT211 INTEGRAL TRANSFORMS AND COMPLEX ANALYSIS  3 1 0 4

Unit 1
Complex numbers, complex plane, polar form of complex numbers. Powers and roots, derivative. Analytic functions, Cauchy-Riemann equations, Laplace equation, conformal mapping, exponential function, trigonometric functions, hyperbolic functions, logarithms, general power, linear fractional transformation. (Sections: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9)
Unit 2
Complex line integral, Cauchy integral theorem, Cauchy integral formula, derivatives of analytic functions. (Sections: 13.1, 13.2, 13.3, 13.4.)
Power series, Taylor series and Maclaurin series. Laurent series, zeros and singularities, residues, Cauchy residue theorem, evaluation of real integrals using residue theorem. (Sections: 14.4, 15.1, 15.2, 15.3, 15.4)

Unit 3
Laplace transforms, inverse transforms, linearity, shifting, transforms of derivatives and Integrals, differential equations, unit step function, second shifting theorem, Dirac’s delta function. Differentiation and integration of transforms. Convolution, integral equations, partial fractions, differential equations, systems of differential equations. (Sections: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7)
Fourier integrals (Fourier integral theorem statement only), Fourier cosine and sine transforms, Fourier transforms. (Sections: 10.8 to 10.10)

TEXTBOOK:

MAT212 MATHEMATICAL STATISTICS AND NUMERICAL METHODS 3 1 0 4

Unit 1
Probability, random variables, probability distributions (continuous and discrete), mean and variance of a distribution, expectation and moment generating functions, binomial, poisson and normal distributions, random sampling, estimation of parameters. (Sections: 22.3, 22.5, 22.6, 22.7, 22.8, 23.1, 23.2)

Unit 2
Confidence interval and central limit theorem, testing of hypothesis. (Sections: 23.3, 23.4)
Solution of equations by iterative methods, interpolation. (Sections: 17.2, 17.3)

Unit 3

TEXTBOOK:
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.

**Demo and practice workshop:**
**Fitting:** Study of tools, practice in chipping, filing and making joints.
**Carpentry:** Study of tools, planning practice and making joints.

**REFERENCES:**
Concerned Workshop Manual

**MEC181 ENGINEERING DRAWING**

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

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

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

Orthographic views of three-dimensional solids.

**Isometric projection.**

**TEXTBOOK:**

**REFERENCES:**

**MEC182 COMPUTER AIDED DRAWING**

*Introduction to CAD*

Preparation of drawings using CAD Tools

Introduction to VBA / LISP

Introduction to 3D modeling and Surface Modeling

**TEXTBOOKS:**

**REFERENCES:**
CADian Manual

**MEC200 METALLURGY AND MATERIALS SCIENCE**

*Unit 1*


*Unit 2*


Phase diagram - phase rule, lever principle, isomorphous, eutectic, peritectic and eutectoid reactions. Iron-carbon phase diagram, equilibrium and non-equilibrium cooling in solid state, isothermal transformation, martensite and bainite reactions.

*Unit 3*


Classification of cast iron and steels - properties, microstructures and uses of cast irons, plain carbon, alloy, stainless, heat resistant, tool and die steels. Composition, properties, microstructures and uses of non-ferrous alloys - brass, bronze, aluminium, magnesium, nickel and zinc alloys.
MEC206  KINEMATICS OF MACHINERY  3 1 0 4

Unit 1
Basics of mechanisms - terminology and definitions - degree of freedom - mobility - Kutzbach criterion – Grashoff’s law – kinematic Inversions of 4-bar chain and slider crank chains.


Unit 2
Introduction to kinematic synthesis of linkages - type, number and dimensional synthesis - two position synthesis of slider crank mechanism - basic features of dimensional synthesis.


Unit 3

Gyroscope - gyroscopic forces and torques - gyroscopic stabilization - gyroscopic effects in automobiles, ships and airplanes.

TEXTBOOK:

REFERENCES:

MEC210  MECHANICS OF SOLIDS  3 1 0 4

Unit 1
Stresses and strains. Strains and deformations in axially loaded bars - normal


Torsion - torsion of a circular shaft - the torsion formula - design of circular members in torsion - combined bending and torsion - open coiled and close - coiled helical springs.

Unit 2

Unit 3
Complex stresses - principal stresses and planes - graphical construction - Mohr's circle of stresses. Thin cylinders and thick cylinders: thin cylindrical shells subjected to internal pressure - circumferential stress - longitudinal stress - change in diameter, length and volume - thick walled cylinders subjected to internal and external pressures - Lame’s theory.

Columns - axially loaded columns - different end conditions - Euler’s formula for long columns - Rankine’s formula.

Theories of failure.

TEXTBOOK:

REFERENCES:

MEC220  ENGINEERING THERMODYNAMICS  3 1 0 4

Unit 1
Introduction and importance of thermodynamics, different approaches in the study of thermodynamics, SI units, basic concepts and definitions - system, surroundings, types of systems, properties. Pressure measurement, thermodynamic equilibrium, quasi-static process, cyclic process, thermodynamic energy interactions - evaluation of work type energy interaction, heat interaction, energy and forms of energy. History of laws of thermodynamics. First law for closed system, analysis of closed systems. Concept of zeroth law, thermometry, temperature scales. Perfect gas, equation of state, specific heats, characterisation of various thermodynamic processes. Real gas models - Van der Waals equation, Virial equation of state, compressibility chart.
Thermodynamic properties of fluids, pure substance, phase-change process of pure substance, p-v-T surface, T-v, p-v and other diagrams, specific internal energy and enthalpy and other properties, steam tables.

Open system - conservation of mass applied to a control volume, conservation of energy applied to a control volume, application of steady-state flow process for typical work transfer and heat transfer devices. Throttling process, application of throttling process.

Unit 2
Second law of thermodynamics, statement of Kelvin-Planck and Clausius, heat engine, heat pump, refrigerator, irreversible processes, reversible processes, Carnot cycle, Carnot engine, Carnot theorems. Clausius inequality and thermodynamic temperature scale, concept of entropy, entropy change in different processes, principle of Increase in entropy for closed systems.

Unit 3
Thermodynamic property relations: Introduction, important mathematical relations, cyclic rule, Maxwell relations, enthalpy, entropy, internal energy, and specific heat relations; Clausius-Clapeyron equation, Joule-Thomson coefficient and Inversion line. Introductory treatment of power and refrigeration cycles - air standard Otto and diesel cycles, Rankine cycle, reversed Carnot cycle as a refrigeration cycle, vapour compression cycle.

TEXTBOOK:

REFERENCES:

MEC222 FLUID MECHANICS AND MACHINERY 3 1 0 4

Unit 1
Basic concepts & hydrostatics: Concept of a fluid, classifications of fluid flow, properties of fluids, pressure & its measurements, fluid statics, buoyancy & stability. Fluid kinematics: System and control volume, Lagrangian and Eulerian descriptions of fluid flow, fundamentals of flow visualization, plots of fluid flow data, kinematic descriptions, the Reynold’s transport theorem.

Unit 2
Governing equations of fluid flow: Derivation of governing equations for mass, linear and angular momentum, energy in the integral form, Bernoulli’s equation. Practical applications of integral form such as propellers, pumps, turbines, etc. Flow through pipes: Boundary layer concepts, laminar flow in pipes, Hagen poiseuille equation, entrance region, losses in pipes, pipes in series & parallel, equivalent pipe, flow rate measurement – venturi meter, orifice meter & Pilot tube, introduction to turbulent flow in pipes.

Unit 3

TEXTBOOK:

REFERENCES:
**S Y L L A B I**

**B. Tech. - Mechanical Engg.**

2010 admissions onwards

**TEXTBOOKS:**


**REFERENCES:**


**MEC290**

**MACHINE DRAWING**

1133

**Unit 1**

BIS codes for practice of machine drawing - dimensioning, sectional views, abbreviations and conventions, welding symbols, surface finish symbols, screws, bolts, nuts and rivets.

Introduction to sketch mode and 2D draft mode in a 3D software package – 2D sketching, relationship/constraints, dimensioning.

Fits and tolerances - geometric tolerances. Machine elements - keys, pin joints, fasteners, hexagonal and square head bolts and nuts, conventional representation of threads.

Introduction to solid modelling using 3D software package - reference planes.

Protrusion, revolved protrusion, swept protrusion, round, cutout, revolved cutout, hole, pattern, mirror, thread, chamfer.

**Unit 2**

Joints - cotter joints - sleeve, spigot and socket, jib and cotter, knuckle joints, couplings - flange coupling, universal coupling, riveted joints - single and multiple rivets - chain, zigzag and structural riveted joints, welded joints.

Advanced feature creations using solid modelling package - rib, thin wall, lip, mounting boss, web etc - editing features, creation of views from 3D model and section views.


**Unit 3**

Assembly modeling using relations/constraints and conversion of parts and assembly to drafting – creation of bill of material – calculation of mass properties – interference checks between solids.

Automated preparation of part drawings and assembly drawings from 3D of screw jack, connecting rod assembly, crossheads of steam engine.

**TEXTBOOKS:**


**MEC291**

**METALLURGY AND MATERIALS TESTING LAB.**

0132

**Metallurgy Lab.**

1. Preparation of metallurgical specimen for microscopic examination
2. Microstructure studies of ferrous and non-ferrous alloys
3. Heat treatment of steels and study of their microstructures
4. Determination of hardenability of steel by Jominy End Quench test
5. Study of the effect of quenching media on hardenability
6. Introduction to Non-destructive testing

**Materials Testing Lab.**

1. Tension test on metals
2. Double shear test
3. Static bending test on wood
4. Compression test on wood
5. Tensile test on thin wires
6. Deflection test on beams
7. Rockwell hardness test
8. Brinell hardness test
9. Spring test
10. Impact test – charpy
11. Impact test – izod

**MEC292**

**MANUFACTURING PROCESS LAB. I**

0132

**Lathe operations**

Study of different types of lathes: Centre, capstan & turret and automatic lathes and their accessories - selection of cutting parameters: speed, feed, depth of cut based on work – tool combinations, coolant types - exercises on plain, step, taper turning & eccentric turning - thread machining: external & internal threads - knurling - drilling, boring & tapping.

**Foundry**

Study of various processes, tools and equipments used in foundry – exercises on mould preparation.

**Press work**

Study & demo of press operations in hydraulic and mechanical presses.
MEC301 HEAT POWER ENGINEERING 3 1 0 4

Unit 1
Combined first law and second law analysis for open system, reversible steady flow work, available energy, irreversibility, exergy, second law efficiency, exergy change of a system, exergy transfer by heat, work and mass, decrease of exergy principle and exergy destruction, exergy balance.
Combustion thermodynamics – energy and energy sources, stoichiometry, enthalpy of formation and enthalpy of combustion, adiabatic flame temperature.
Classification and working of I.C. engines - four and two stroke using gasoline and diesel - testing and performance of internal combustion engines.
Gas turbine - open and closed cycle - practical gas turbine cycle - regeneration, inter cooling and reheating.

Unit 2
Steam nozzles - flow of steam through nozzles, shape of nozzles, effect of friction, critical pressure ratio, supersaturated flow.
Steam turbines - impulse and reaction turbines - compounding principles – velocity diagrams.

Unit 3
Vapour compression refrigerator system - description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP, refrigerants and their desirable properties. Air cycle refrigeration, reversed Brayton cycle.
Properties of atmospheric air, dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidity and the relation between the two. Enthalpy and adiabatic saturation temperature. Psychrometric chart, human comfort and air-conditioning, basic air-conditioning processes.

TEXTBOOKS:

REFERENCES:
MEC310  DESIGN OF MACHINE ELEMENTS I  3 1 0 4

Unit 1

Variable and cyclic loads: Fatigue strength and fatigue limit-S-N curve - combined cyclic stresses - design based on Soderberg and Goodman equations. Miner’s rule.

Unit 2

Unit 3
Springs: Design of springs for static and varying loads - helical and leaf springs. Design of IC engine parts: piston, connecting rod, crank shaft and flywheel. Probabilistic and robust design: Concepts and theories of probability, application of probability to mechanical design, optimum design, reliability, concept of robust design, quality loss function, control of noise variables, design of experiments.

TEXTBOOKS:

REFERENCES:

MEC311  INTRODUCTION TO FINITE ELEMENT METHOD  3 1 0 4

Unit 1
Basic concepts: Introduction to finite element method – element types and discretization procedure – interpolation models.


SYLLABI  B. Tech. - Mechanical Engg.  2010 admissions onwards

MEC312  DESIGN OF MACHINE ELEMENTS II  3 1 0 4

Unit 2
Application to solid mechanics: Static analysis of one-dimensional problems – trusses, beams and frames – two-dimensional problems - plane stresses and plane strain – axisymmetric problems – introduction to three dimensional problems – dynamic analysis.

Unit 3
Application to heat transfer: Finite element formulations of heat transfer problems -1-D and 2-D steady state and transient heat transfer problems. Introduction to finite element packages: Introduction to commercial FE packages - preprocessing, solution, and post-processing – simple solid mechanics and heat transfer problems.

TEXTBOOKS:

REFERENCES:
5. Fish, J., and Belytschko, T., 'A first course in Finite Elements', Wiley Inter Science, 2007.
Unit 3
Cam drives - types of cam drives – pressure angle and under cutting, base circle determination - forces and surface stresses, design of cam drives for IC engines and machine tools.
Friction drives: Design of plate clutches – axial clutches - cone clutches - internal expanding rim clutches. Design of internal and external shoe brakes.
Engineering design: Product design process, need identification, concept generation and evaluation, embodiment design, cost evaluation, target costing and professional responsibilities and ethics.

TEXTBOOKS:

REFERENCES:

MEC320 HEAT TRANSFER 3 1 0 4

Unit 1
Unsteady heat conduction: Unsteady state conduction – lumped heat capacity system, plane wall with convection, infinite cylinder & sphere with convection, semi-infinite solid.

Unit 2

TEXTBOOK:

REFERENCES:

MEC330 MANUFACTURING TECHNOLOGY II 4 0 0 4

Unit 1

Unit 2

Unit 3
SYLLABI
B. Tech. - Mechanical Engg. 2010 admissions onwards

TEXTBOOKS:

REFERENCES:

MEC350
THEORY OF ELASTICITY 3 0 0 3
(Pre-requisite: MEC210)

Unit 1
Analysis of stress and strain: stress at a point; stress tensor; stress transformations; principal stresses; octahedral stress; geometrical representation of stress at a point; equations of equilibrium.
Infinitesimal affine transformation for deformation; strain tensor; principal strains; strain-displacement relations for finite and infinitesimal strains; compatibility conditions. Constitutive equations: general theory; generalized Hooke’s law for anisotropic and isotropic materials.

Unit 2
Equations of elasticity: common equations of elasticity theory like Mitchel-Beltrami and Navier equations, formulation of the general elasticity problem; boundary conditions.

Unit 3
Solution of some special boundary value problems: simplifications; two-dimensional problems in rectangular and polar coordinates; Airy’s stress function; a few problems like stress concentration around a circular hole and Boussinesq problem.
A few representative three-dimensional problems; torsion and bending of non-circular prismatic bars (Saint-Venant’s solution); membrane analogy, simple plate bending.

TEXTBOOKS:

REFERENCES:

SYLLABI
B. Tech. - Mechanical Engg. 2010 admissions onwards


MEC351
AUTOMOTIVE TECHNOLOGY 3 0 0 3

Unit 1
Vehicle and engine construction - chassis, frame and body construction, engine types, construction details and multi-cylinder engines, valve arrangements, valve drives, engine cooling and lubrication, air supply system, carburetors, electronic fuel injection systems, exhaust systems.
Power drive line: clutch - types and construction, fluid coupling, transmissions - manual, semi and automatic transmission, continuously variable transmission, overdrives, torque converter, propeller shaft, differential and axles, front and all wheel drive vehicles.

Unit 2
Running systems: Steering geometry and types, steering linkages, power and power assisted steering, types of front axle, suspension systems, suspension design consideration active suspension, braking systems - hydraulic, pneumatic brakes and power brakes, anti-lock brake system - wheels and tyres.
Electrical and electronic systems: electrical systems – storage, charging, starting and ignition systems, electronic controls for engine and vehicle body, electronic dashboard instruments, electronic and computer controlled transmissions, intelligent transportation systems. Onboard diagnosis system, safety and security systems.

Unit 3
Performance of automobiles: Design aspects - ergonomics, seating and packaging, vehicle body aerodynamics, forces and couples, traction and tractive effort, power for propulsion, cornering properties, stability of vehicle, dynamics of vehicles.
Future automobiles: automobile air pollution, pollution control norms, alternate power units for automobiles - use of natural gas, LPG and hydrogen in automobiles as fuels, fuel cells, electric and hybrid vehicles. Indian traffic rules.

TEXTBOOKS:

REFERENCES:
MEC352  AUTOMOTIVE CHASSIS DESIGN  3 0 0  3

Unit 1
CLUTCH DESIGN CALCULATION: Design of single plate clutch, multi plate clutch, design of centrifugal clutch, cone clutch, energy dissipated, torque capacity of clutch, design of clutch components, design details of roller and sprag type of clutches.

GEAR BOX: Performance of vehicle, total resistance to motion, traction and tractive effort, acceleration, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes.

Unit 2
VEHICLE FRAME AND SUSPENSION: Study of loads, moments and stresses on frame members, computer aided design of frame for passenger and commercial vehicles, computer aided design of leaf springs, coil springs and torsion bar springs.

Unit 3
FRONT AXLE AND STEERING SYSTEMS: Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings, wheel spindle bearings, choice of bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

FINAL DRIVE AND REAR AXLE: Design of propeller shaft, design details of final drive gearing, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

TEXTBOOK

REFERENCES

MEC353  OPTIMIZATION TECHNIQUES IN ENGINEERING  3 0 0  3

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

MEC354  CONDITION MONITORING AND DIAGNOSTIC  3 0 0  3

MAINTENANCE

Unit 1
Basic concepts: Machinery failures, basic maintenance strategies, factors influencing maintenance strategies, machine condition monitoring, transducer selection and location, PC interfacing and virtual instrumentation. Vibration signatures of faults in rotating and reciprocating machines; detection and diagnosis of faults.

Unit 2
Instrumentation and signal processing: Types of sensors in condition monitoring: vibration, acoustics and noise, acoustic emission, temperature, ultrasonic and infra-red sensors - signal processing: basic signal and systems concepts, time
domain analysis, frequency domain analysis, time-frequency analysis, wavelets and wavelet packets.

Unit 3

**TEXTBOOKS:**

**REFERENCE BOOKS:**

**MEC 356  MATERIALS SELECTION IN MECHANICAL DESIGN  3 0 0 3**

**Unit 1**
Overview of materials properties - modulus, tensile, fatigue, creep strengths, toughness, hardness, fracture toughness, damping capacity, thermal, oxidation, corrosion and wear resistances.

Materials property charts. Materials families and classes - metals, ceramics, glasses, polymers, elastomers, composites, foams, natural.

**Unit 2**

**Unit 3**
Case studies in materials selection for various applications - oar, table leg, flywheel, kiln walls, passive solar heating, heat exchangers, bearings, springs, pressure vessel.


**TEXTBOOK:**

**REFERENCE:**
MEC357  AIRCRAFT SYSTEMS AND ENGINEERING  3 0 0 3

Unit 1
Aircraft industry overview: Evolution and history of light, types of aerospace industry, key players in aerospace Industry, aerospace manufacturing, industry supply chain, prime contractors, tier 1 suppliers, key challenges in industry supply chain, OEM supply chain strategies, mergers and acquisitions, aerospace industry trends, advances in engineering/CAD/CAM/CAE tools and materials technology, global and Indian aircraft scenario.

Introduction to aircrafts: Basic components of an aircraft, structural members, aircraft axis system, aircraft motions, control surfaces and high lift devices.

Types of aircrafts - lighter than air/heavier than air aircrafts. Conventional design configurations based on power plant location, Wing vertical location, intake location, tail unit arrangements, landing gear arrangements. Unconventional configurations - biplane, variable sweep, Canard layout, twin boom layouts, span loaders, blended body wing layout, STOL and STOVL aircraft, stealth aircraft. Advantaged and disadvantages of this configuration.

Unit 2
Introduction to aircraft systems: types of aircraft systems. Mechanical systems. Electrical and electronic system. Auxiliary systems. Mechanical system: Environmental control systems (ECS), pneumatic systems, hydraulic systems, fuel systems, landing gear systems, engine control systems, ice and rain protection systems, cabin pressurization and air conditioning systems, steering and brake systems, auxiliary power unit. Mechanical systems: Avionics, flight controls, autopilots and flight management systems, navigation systems, communication systems, auxiliary power unit. Mechanical systems: Avionics, flight controls, autopilots and flight management systems, navigation systems, communication systems, information systems, radar systems.

Unit 3
Basic principles of flight: Significance of speed of sound, air speed and ground speed, properties of atmosphere, Bernoullie's equation, forces on the air plane, air flow over the wing section, pressure distribution over a wing section, generation of lift, drag, pitching moments, types of drag, lift curve, drag curve, lift/drag ratio curve, factors affecting lift and drag, center of pressure and it's effects. Aerofoil nomenclature, types of aerofoil, wing section - aerodynamic center, aspect ratio, effects of lift, drag, speed, air density on drag.

Basics of flight mechanics: Mach waves, mach angles, sonic and supersonic flight and its effects. Stability and control: Degree of stability - lateral, longitudinal and directional stability and controls of aircraft. Effects of flaps and slats on lift coefficients, control tabs, stalling, landing, gliding turning, speed of sound, mach numbers, shock waves. Aircraft performance and maneuvers: Power curves, maximum and minimum speeds of horizontal flight, effects of changes of engine power, effects of altitude on power curve, forces acting on an aeroplane during a turn, loads during a turn, correct and incorrect angles of a bank, aerobatics, inverted maneuvers, maneuverability.

REFERENCES:

TEXTBOOKS:

MEC358  MECHATRONICS  3 0 0 3

Unit 1

Unit 2

Unit 3
Programmable logic controllers - basic structure - input/output processing - programming - mnemonics - timers, internal relays and counters - shift registers - master and jump controls - data handling - analogs input/output - selection of a PLC problem. Stages in designing mechatronics systems - traditional and mechatronic design - possible design solutions. Case studies of mechatronics systems, pick and place robot - automatic car park systems - engine management systems.

TEXTBOOK:
REFERENCES:

MEC359 MICRO-ELECTRO MECHANICAL SYSTEMS 3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

MEC360 TOOL ENGINEERING DESIGN 3 0 0 3

Unit 1

TEXTBOOK:

REFERENCES:
Unit 2
Fracture mechanism in metals and non-metals: Ductile fracture, cleavage, the ductile-brittle transition, intergranular fracture, fracture in polymeric materials, and fracture in ceramic and ceramic composites.

Unit 3
Applications: Introduction to fracture toughness testing of metals and non-metals for determination of fracture parameters, application of fracture mechanics concepts in the analysis of fatigue crack growth.
Computational fracture mechanics: overview of numerical methods for fracture mechanics problems, traditional methods in computational fracture mechanics – point matching and energy methods, the energy domain integral, finite element implementation, design of finite element mesh, linear elastic convergence study, analysis of growing cracks.

TEXTBOOK:

REFERENCES:

MEC362 COMPUTATIONAL METHODS IN ENGINEERING 3 0 0 3

Unit 1
Basic concepts: Approximations and round-off errors - truncation errors and the Taylor series – accuracy and precision - error propagation.
Basic applications: Interpolation and curve fitting - methods to solve nonlinear equations – roots of equations - numerical differentiation and integration techniques: Newton-Cotes integration and Gauss quadrature - optimization: constrained and unconstrained optimization methods.

Unit 2
Linear algebra: system of linear equations: Gauss elimination, Gauss Jordan, LU, QR and SVD - iterative methods of solution – Eigenvalues and eigenvectors, physical meaning and methods of determining eigenvalues and eigenvectors.

Unit 3

TEXTBOOKS:

REFERENCE BOOKS:

MEC363 DESIGN FOR MANUFACTURE AND ASSEMBLY 3 0 0 3

Unit 1
Design impact on cost, design for “X” - DFM approach, DFM framework, material and process evaluation, general DFM guidelines, machining and casting guidelines and examples, minimize finishing requirements. Computer applications for DFMA. Design features to facilitate machining: datum features - functional and manufacturing. Component design - machining considerations, redesign for manufacture, examples. Form design of castings and weldments.

Unit 2

Unit 3
Datum systems: degrees of freedom, grouped datum systems - computation of translational and rotational accuracy - geometric analysis and applications. True position theory: co-ordinate and conventional method of feature location, tolerance and true position tolerance, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position...
tolerance, functional gauges, paper layout gauging - examples. Principles of design for assembly, minimize part count, standardization and minimize part variety, design guidelines for manual assembly, DFA analysis, DFA index, design for automated assembly. Introduction to usage of DFMA software.

**TEXTBOOKS:**

**REFERENCES:**

**MEC364 PRESSURE VESSEL DESIGN 3 0 0 3**
(Pre-requisite: MEC210)

**Unit 1**
Introduction to pressure vessels, design philosophy, structural integrity - failure modes and theories - working loads and allowable stresses - fatigue, fracture and buckling. Stress categorization - primary, secondary and peak. Design of cylindrical shells - ASME equations - thin shell equations - thick shell equations - buckling of cylindrical shells.

**Unit 2**

**Unit 3**
Bolted flanges - RF and FF flanges - gasket loading behavior - application of ASME equations for flange analysis and bolt design. Design of supports - lug support - support skirts - saddle support.

**TEXTBOOKS:**

**MEC365 THEORY OF VIBRATIONS 3 0 0 3**

**Unit 1**
Introduction - derivation of equation of motion - free vibration of undamped single degree of freedom systems - free vibration of damped single degree of freedom systems. Forced response of single degree of freedom systems - rotating unbalance, support motion, whirling of shafts, different types of damping. Response of sdof systems to arbitrary excitation - convolution integral, Fourier transforms method.

**Unit 2**

**Unit 3**
Vibration of continuous systems - wave equation - longitudinal and torsional vibration of rods, lateral vibration of beams. Vibration control - vibration isolation, vibration absorbers. Vibration measuring instruments, vibration exciters, free and forced vibration tests.

**TEXTBOOKS:**

**REFERENCES:**

**MEC366 REFRIGERATION AND AIR CONDITIONING 3 0 0 3**

**Unit 1**

SYLLABI

Unit 1
Design of Thermal Systems

- Basic design principles: Basic design principles - workable and optimal systems - matching of system components - economic analysis - depreciation - gradient present worth factor.
- Mathematical modeling for simulation: Mathematical models, principles, types, equation fitting, information flow diagram, workable systems, optimal systems.

Unit 2
Modeling thermal equipment: Modeling of heat exchangers, evaporators, condensers, absorption and rectification columns, compressor, pumps - simulation studies - information flow diagram - solution procedures.

Unit 3

SYLLABI


TEXTBOOKS:

REFERENCES:

MEC 368
INTERNAL COMBUSTION ENGINES AND POLLUTION CONTROL

Unit 1
Spark ignition engines: mixture requirement - feedback control carburetors - fuel injection systems. Stoichiometric combustion - combustion with excess air-equivalence ratio.

Unit 2
- Thermo chemistry: Pollutant formation, instrumentation to measure pollutants - pollutant calculation - effect of air-fuel ratio.

Unit 3
- Alternate fuels: engine modifications for alternate fuels (liquid and gaseous fuels), homogenous charge compression ignition engines.

TEXTBOOKS:
REFERENCES:

MEC369 TURBOMACHINERY 3 0 0 3

Unit 1
Definition and classification of turbomachines - specific work - T-s and h-s diagram - incompressible and compressible flow - losses - total to total efficiency - total-to-static efficiency - effect of reheat and preheat factor. Degree of reaction. Energy transfer - Euler’s equation, velocity triangles. Dimensional analysis, dimensionless parameters and their physical significance, specific speed, hydraulic pumps: Centrifugal pumps - some definitions - pump output and efficiencies - effect of Vane angle - cavitition - pump characteristics - multistage pumps.

Unit 2

Unit 3
Centrifugal compressors: constructional details - stage pressure rise - stage pressure coefficient - stage efficiency - degree of reaction - various slip factors - introduction to fans and blowers, working principle, fan laws, performance characteristics. Axial flow compressors: general expression for degree of reaction; velocity triangles for different values of degree of reaction, blade loading and flow coefficient, static pressure rise, workdone factor. Steam and gas turbines: axial turbine stages - stage velocity triangles - work single stage impulse turbine - speed ratio - maximum utilization factor - compounding of turbines and its types, degree of reaction reaction stages. Inward flow radial turbine stages (IFR) - working principle and performance characteristics.

TEXTBOOKS:

REFERENCES:

MEC370 FLUID POWER DRIVES AND CONTROLS 3 0 0 3

Unit 1

Unit 2
Design of hydraulic circuits: selection and sizing of components - calculation of frictional head loss - equivalent length for various components - actuator load calculation - pump sizing.

Unit 3

TEXTBOOK:

REFERENCES:

MEC371 RENEWABLE SOURCES OF ENERGY 3 0 0 3

Unit 1
Wind energy: principles of wind power, site characteristics, wind rows diagram, types of wind turbines – construction, working and performance characteristics, synchronization of wind energy with the grid.

Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:

MEC372  ADVANCED FLUID MECHANICS  3 0 0 3
(Pre-requisite: MEC222)

Unit 1
Fundamentals of fluid dynamics: Differential approach - the material derivative, integral approach – RTT, path lines, streamlines and stream function, stress, rates of deformation, vorticity and circulation, stream function equation, vorticity transport equation, conservation equations – mass, momentum, energy, boundary conditions, moving coordinate systems. Exact solution of Navier Stokes equation: Couette (wall–driven) steady flow, Poiseuille (pressure driven) steady duct flow, Wind driven (Ekman) flow, unsteady duct flow.

Unit 2

Unit 3
Boundary layer theory: Boundary layer concept, boundary layer equations for 2D flows, Blasius similarity solution, Karman momentum integral equation, boundary layer thicknesses, boundary separation with various pressure gradient, laminar and turbulent boundary layers. Introduction to turbulence: Nature of turbulence, origin of turbulence, characterization of turbulence, Reynolds modification of Navier-Stokes equations, Reynolds stresses, turbulence models – Prandtl mixing length model.

TEXTBOOK:

REFERENCES:

MEC373  COMBUSTION ENGINEERING  3 0 0 3
(Pre-requisite: MEC221)

Unit 1

Unit 2

Unit 3
- devolutilisation of solid fuels - fuel-bed combustion - suspension burning - fluidized bed combustion.

**TEXTBOOKS:**

**REFERENCES:**

**MEC374  COMPUTATIONAL FLUID DYNAMICS  3 0 0 3**

(Pre-requisite: MAT212, MEC222)

Unit 1

Unit 2

Unit 3
Computational heat transfer: steady one & two dimensional heat conduction, unsteady one dimensional heat conduction, overrelaxation and under relaxation. One dimensional steady convection and diffusion. Computational fluid flow: Solution methods for incompressible flows - collocated and staggered grid, pressure correction equations, SIMPLE and SIMPLER algorithm.

**TEXTBOOKS:**

**REFERENCES:**

**MEC375  AUTOMOTIVE ELECTRONICS  3 0 0 3**

Unit 1

Unit 2
Instrumentation systems: introduction to instrumentation systems - various sensors used for different parameters sensing - driver instrumentation systems - vehicle condition monitoring - trip computer different types of visual display. Electronic control of braking and traction: Introduction - control elements and control methodology - electronic control of automatic transmission: introduction - control of gear shift and torque converter lockup - electric power steering - electronic clutch.

Unit 3
TEXTBOOK:

REFERENCES:

MEC376  FUNDAMENTALS OF NUCLEAR ENGINEERING  3 0 0 3

Unit 1
Principles of nuclear energy: Introduction - atomic structure - energy from nuclear reactions - nuclear fission and fusion – radioactivity - decay rates and half lives - neutron flux - reaction rates.

Unit 2
Power reactor systems: Pressurised water reactors - boiling water reactors - gas cooled and high temperature gas cooled reactors - pressurised heavy water reactors - fast breeder reactors - LMFBR & GCFBR

Unit 3

TEXTBOOKS:

REFERENCE:

MEC377  POWER PLANT ENGINEERING  3 0 0 3

Unit 1
Hydrological data - capacity and type - selection - general layout and types of hydro electric power plants.
General layout of diesel power plant and their components - types of plant layouts

TEXTBOOK:

REFERENCES:

MEC390  THERMAL ENGINEERING AND FLUID MECHANICS LAB.  0 1 3 2

a) THERMAL ENGINEERING LAB.
I.C. Engines Lab.
1. Study of I.C. engines, components and loading devices
2. Valve timing and port timing diagrams
3. Performance test on 4-stroke diesel engine.
4. Heat balance test on 4-stroke diesel engine.
5. Morse test on multi cylinder petrol engine.
6. Retardation test to find frictional power of a diesel engine.

Steam Lab.
- Study of steam generators and turbines.
- Performance and energy balance test on a steam generator.
- Performance and energy balance test on steam turbine.

b) FLUID MECHANICS LAB.
Flow experiments: Calibration of orifice meter, venturimeter, V and rectangular notch, pipe friction.
Verification of Bernoulli’s theorem, Reynolds number, metacentric height.
MEC391 MANUFACTURING PROCESS LABORATORY II  0 1 3 2

a) Study of special machines
Exercises on milling machines - plain & gang milling operations - shaping and planing operations - gear milling & gear hobbing - grinding machines: surface, cylindrical grinding operations.
Measurement of cutting force in drilling operation - measurement of shear plane angle: turning and shaping operation.


MEC392 HEAT TRANSFER AND DYNAMICS LAB.  0 1 3 2

a) Heat Transfer Lab.
Heat transfer studies in a pin fin apparatus, parallel flow & counter flow heat exchanger, determination of Stefan Boltzmann constant - heat transfer coefficient in natural convection - heat transfer coefficient in forced convection.
b) Dynamics Lab.
Measurements
Measurement of shaft speed, force, torque, pressure, strain, temperature, velocity, displacement, frequency, amplitude, acceleration, noise.
Kinematics
Dynamics

MEC393 FLUID POWER AND FLUID MACHINERY LAB.  0 1 3 2

a) FLUID POWER LAB
1. Familiarizing of elements of pneumatic and hydraulic systems.
2. Familiarizing of Automation studio – pneumatic/hydraulic circuit design and simulation software.
3. Speed control circuits in a pneumatic trainer.
4. Single and double acting cylinder circuits using different direction control valves.
5. Sequencing of pneumatic circuits.
7. Logic circuits - pneumatic and Electro-pneumatic.
9. Study of PLC.
10. PLC based Electro-pneumatic sequencing circuits.
The circuits to be simulated using Automation studio and then assembled to check the correctness of the circuit.
b) FLUID MACHINERY LAB
Performance test on centrifugal pump, reciprocating pump, jet pump, submersible pump, gear pump
Performance test on Francis turbine, Pelton wheel.

MEC400 INSTRUMENTATION AND CONTROL SYSTEMS  3 0 0 3

Unit 1
Displacement measurement - potentiometer - LVDT, Piezo electric type - Syncropair resolver - micro syn - linear syn - nozzle flapper - LASER interferometer - Fotonic sensor - infra red sensor – encoder (digital transducer) - speed measurement.
Nature of vibration, quantities involved, seismic transducer - different types of accelerometers, mountings.

Unit 2
Strain measurement types, mechanical strain gauge optical and acoustical SG - electrical strain gauge, selection of strain gauge. Temperature measurement - bimetallic thermometer - platinum resistance thermometers – thermocouples – pyrometers - pressure fundamentals, manometers - elastic transducers, Mcleod gauges - thermal conductivity gauges, dead weight tester, flow measurement - ultrasonic flow meter - turbine type meters - hot wire anemometers.

Unit 3
TEXTBOOKS:

REFERENCES:

MEC401 OPERATIONS RESEARCH 3 0 0 3

Unit 1
Linear programming: Formulations - graphical solutions - simplex method - duality, dual simplex method.
Transportation model: Assignment model – travelling salesman problem.
Dynamic programming: concepts, Bellman’s principle – solutions to simple problems.

Unit 2
Decision theory: Decision trees. Game theory - 2 person zero sum; mixed strategies; 2 x n and m x 2 games.

Unit 3
Sequencing model – 2 machines ‘n’ jobs, ‘m’ machines ‘n’ jobs – n jobs 2 machines.
Inventory models: deterministic & probabilistic models. Quantity discounts. Selective inventory management.
Queueing models: Poisson arrival and exponential service times. Single server, multi-server. Queues - infinite and finite capacity queues.
Simulation – Monte Carlo simulation: simple problems.

TEXTBOOK:

REFERENCES:

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

MEC451 COMPOSITE MATERIALS AND PROCESSING 3 0 0 3

Unit 1
Types of reinforcements, their mechanical properties and functions - ceramics, glass, carbon, boron. silicon carbide, metal, aramid. Forms of reinforcements - particulate, fibre, filaments, whiskers, flakes. Pre-fabricated forms - preforms, prepregs, fabrics, honeycomb. Type of matrix, its mechanical properties and functions - polymers (thermosets and thermoplastics), metals, ceramics, glass and carbon. Basic principles in the design of composites and selection of matrix and reinforcement. Bonding mechanisms.

Unit 2
Anisotropic behaviour and relationship between structure - mechanical properties.

TEXTBOOKS:

REFERENCES:

MEC452 MODERN PRACTICES IN PRODUCT DESIGN AND MANUFACTURE 3 0 0 3

Unit 1
SYLLABI  B. Tech. - Mechanical Engg.  2010 admissions onwards

Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:

MEC453  NON-DESTRUCTIVE TESTING  3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOKS:

REFERENCE:

MEC454  INDUSTRIAL ROBOTICS  3 0 0 3

Unit 1
Evolution of robotics. Robot anatomy - design and control issues. Manipulation and control - sensors and vision

Unit 2
Unit 3

TEXTBOOKS:

REFERENCE:

MEC455 ADVANCED CASTING TECHNOLOGY 3 0 0 3

Unit 1
Melt processing techniques for ferrous and non-ferrous alloys such as stainless steels, nickel, titanium alloys. Vacuum melting equipment and practice. Elementary aspects of pattern and mould design using CAD softwares. Resin-bonded mould and core making processes and machines. Special casting processes and their applications - low pressure die casting, investment casting, squeeze casting, thixo-forming. Illustrations of automotive and aerospace applications.

Unit 2
Gating and riser design - principles of fluid flow, governing equations, heat transfer applied to casting solidification, governing equations, boundary conditions for different casting methods, concept of directional solidification, gating and risers, application of simulation methods. Use of casting software in solving practical problems.

Unit 3
Casting defects and remedies. Inspection methods - visual, penetrant, magnetic, metallurgical, X-ray and Gamma ray radiography and. Mechanization and automation.

TEXTBOOK:

REFERENCE BOOKS:

Unit 1
Micromachining – definition - principle of mechanical micromachining - classification of micromachining and nanofinishing processes - molecular dynamics simulations of machining at atomic scale.

Unit 2

Unit 3
Micro metrology - scanning electron microscope, optical microscopy, atomic force microscope, molecular measuring machine, micro-CMM, transmission electron microscope – principles - applications.

TEXTBOOKS:

REFERENCES:

MEC457 ADVANCED WELDING TECHNOLOGY 3 0 0 3

Unit 1
Overview of welding processes and their classification, types of joints, edge preparation, weld symbols, weld nomenclature, bead geometry, power density,

Advanced welding processes: submerged arc, TIG, MIG, electro-slag, ultrasonic, electron beam and laser beam welding. Case studies and applications - industrial, automotive and aerospace.

Unit 2

Solidification behaviour of fusion weld: structural zones, epitaxial growth, weld pool shape and columnar grain structures. Weldability of metals - steels, stainless steels, aluminium, copper, nickel and titanium alloys.

Unit 2

TEXTBOOKS:

REFERENCES:

MEC458 ADVANCED MANUFACTURING PROCESSES 3 0 0 3

Unit 1
Nontraditional manufacturing processes - chemical machining – electro chemical machining - ultrasonic machining - physical setup, metal removal rate, process parameters, process capabilities and applications.

Nontraditional manufacturing processes - electrical discharge machining - wire EDM - abrasive flow machining - physical setup, metal removal rate, process parameters, process capabilities and applications.

Unit 2
High-speed machining: high performance machining of components. Application of HSM, improved material removal rate, surface finish and integrity, accuracy, economic considerations.

Unit 3
Modern grinding technologies, high speed and high performance grinding. Hard machining using single point tools. Laser applications in manufacture: Cutting, welding, surface treatment, automation and in-process sensing.

TEXTBOOK:

REFERENCE BOOKS:

MEC459 ADVANCED MATERIALS AND PROCESSES 3 0 0 3

Unit 1

Unit 2
Aerospace alloys: High strength aluminium and magnesium alloys, nickel and cobalt based superalloys, titanium alloys, their structures, structure-property relationships, heat treatment. Directional solidification and single crystal turbine blades. Case studies.

Unit 3
Smart materials: concept of shape memory, crystal structure, phase transformation mechanism and characteristics, properties, classification, applications. Nanomaterials: properties, classification, characterization, materials behaviour, fabrication and applications.
SYLLABI B. Tech. - Mechanical Engg. 2010 admissions onwards

TEXTBOOKS:

REFERENCES:

MEC460 ADVANCED METROLOGY AND SENSING SYSTEMS 3003

Unit 1
Computer aided inspection: High precision measurements – interfacing - software metrology - automated visual inspection in manufacturing, contact and non-contact type inspection methods, electrical field techniques, radiation techniques, ultrasonic - Atomic Force Microscopes (AFM), Talysurf instruments.

Unit 2

Unit 3
Edge detection techniques, normalization, grey scale correlation – reflectance map concepts; surface roughness and texture characterization - photogrammetry. Application of machine vision in inspection - measurement of length, diameters, surface roughness - automated visual inspection - 3D and dynamic feature extraction. On-line quality control: on-line feedback quality control variable characteristics - control with measurement interval, one unit, and multiple units control systems for lot and batch production.

TEXTBOOKS/REFERENCES:

SYLLABI B. Tech. - Mechanical Engg. 2010 admissions onwards


MEC461 QUALITY CONTROL AND RELIABILITY ENGINEERING 3003

Unit 1
Introduction: Review of statistics and probability. Quality related costs, contemporary quality engineering philosophy, quality systems and international standards and 6 sigma. Control charts for variables: X-bar and R charts, X-bar and S charts; control charts for individual measurements; exponentially Weighted Moving Average (EWMA) and Deviation (EWMD) charts.

Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:
MEC462                     SIMULATION MODELING OF MANUFACTURING SYSTEMS

Unit 1

Unit 2

Unit 3
Simulation output analysis: design of simulation experiments: determination of warm up period, run length, number of replications - statistical analysis of simulation output – terminating and non-terminating simulations – comparing alternative system designs – variance reduction techniques – simulation optimization.

TEXTBOOKS:

REFERENCES:
Maintenance (TPM) - FMEA.

TEXTBOOK:

REFERENCES:

MEC482 FINANCIAL MANAGEMENT

Unit 1
Fundamental valuation concepts: Time value of money – risk and return.

Unit 2

Unit 3
Cash and liquidity management. Working capital financing.
Mergers and takeovers - international trade.

TEXTBOOK:

REFERENCES:

MEC483 MANAGERIAL STATISTICS

Unit 1
Quantitative methods: basic terminology in probability, probability rules, conditions of statistical dependence and independence, Bayes theorem, discrete random variables review of probability distributions, measure of central tendency.
Sampling and sampling distributions: Introduction to sampling, random sampling, design of experiments, introduction to sampling distributions.
Estimation: point estimates, interval estimates and confidence intervals, calculating interval estimates of mean from large samples, using t test, sample size estimation.

Unit 2
Testing hypothesis: Introduction, basic concepts, testing hypothesis, testing when population standard deviation is known and not known, two sample tests.
Chi- square and analysis of variance: introduction, goodness of fit, analysis of variance, inferences about a population variation.

Unit 3
Regression and correlation: Estimation using regression line, correlation analysis, finding multiple regression equation, modelling techniques, Non parametric methods and time series and forecasting: sign test for paired data, rank sum test, rank correlation, Kolmogrov – smirnov test, variations in time series, trend analysis, cyclic variation, seasonal variation and irregular variation. Decision theory: decisions tree analysis.

TEXTBOOKS:
MEC484  PROJECT MANAGEMENT  3 0 0 3

Unit 1
Foundations of project management: Project life cycle - project environment - project selection - project proposal - project scope - work breakdown structure.

Unit 2
Scheduling with limited resources: resource planning - resource allocation - project schedule compression - project scheduling software. Precedence diagrams - decision CPM - generalized activity networks - GERT.

Unit 3
Estimation of project costs: earned value analysis. Monitoring project progress.
Project appraisal and selection - recent trends in project management.

TEXTBOOK:

REFERENCES:

MEC485  SUPPLY CHAIN MANAGEMENT  3 0 0 3

Unit 1
Introduction: introduction to SCM - the complexity and key issues in SCM – location strategy – facility location decisions – single facility and multiple location models.

Unit 2
Inventory: Inventory management and risk pooling - managing inventory in the SC. Value of information - bullwhip effect - lead time reduction.

MEC486  ENGINEERING ECONOMIC ANALYSIS  3 0 0 3

Unit 1
Economics: nature and scope of managerial economics. Economic theory and managerial economics.

Unit 2
Profit and revenue maximization: Optimal input combination. Total revenue maximization.

Unit 3

TEXTBOOK:

REFERENCE BOOKS:
MEC487  INDUSTRIAL ENGINEERING  3 0 0 3

Unit 1
Work system: elements of work, maintenance of machines, interaction, effect of working conditions and environment, physical and mental fatigue.
Productivity; productivity, factors affecting production, measurement of productivity.
Work study: definition and scope of work study; Areas of application of work study in industry; Human aspects of work study.
Method study: Information collection, recording techniques, and processing aids; critical examination; development, installation and maintenance of improved methods.

Unit 2
Motion economy and analysis: principles of motion economy; motion analysis; Micromotion and Memomotion study; Therbligs and SIMO charts; normal work area and design of work places; basic parameters and principles of work design.
Work measurement: work measurement techniques; calculation of standard time, work sampling and predetermined motion time systems.
Wages and incentive schemes: introduction, wage payment of direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour.

Unit 3
Plant layout: concept of plant layout, types of layout; factors affecting plant layout, work station design, factors considered in designing a work station.
Material handling: introduction and functions of material handling equipment, selection of material handling equipment for different requirements, safety requirements.
Ergonomics: ergonomic design of equipment and work place. Ergonomic design standards - study of development of stress in human body and their consequences.
Case studies.

TEXTBOOKS:

REFERENCE BOOKS:

MEC488  MARKETING MANAGEMENT  3 0 0 3

Unit 1
Marketing process: definition, marketing process, dynamics, needs, wants and demands, value and satisfaction, marketing concepts, environment, mix.
Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.
Buying behaviour and market segmentation: Major factors influencing buying behaviour, buying decision process, business buying behaviour. Segmenting consumer and business markets, market targeting.

Unit 2
Product pricing and marketing research: objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

Unit 3
Marketing planning and strategy formulation: components of marketing plan - strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.
Advertising sales promotion and distribution: characteristics, impact, goals, types, and sales promotions - point of purchase - unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TEXTBOOKS:

REFERENCES:

MEC489  LEAN MANUFACTURING  3 0 0 3

Unit 1
Introduction to lean and factory simulation: history of lean and comparison to other methods - the 7 wastes, their causes and the effects - an overview of lean principles/concepts/tools - stockless production.
The tools of lean manufacturing: continuous flow - continuous flow manufacturing and standard work flow - 5S and Pull systems (Kanban and ConWIP systems) - error proofing and set-up reduction – Total Productive Maintenance (TPM) - Kaizen event examples. Toyota production systems, Ford production systems.

Unit 2
Value stream mapping – current state: preparation for building a current state
value stream map - building a current state map (principles, concepts, loops, and methodology) - application to the factory. Simulation scenario.

Unit 3
Value stream mapping – future state: Key issues in building the future state map - process tips in building the map and analysis of the customer loop, supplier loop, manufacturing loop and information loop - example of completed future state maps - application to factory simulation – implementation of lean practices - best practices in lean manufacturing.

TEXTBOOKS:

REFERENCES:
2. Rother, M. and Shook, J., 'Learning to see', The Lean Enterprise Institute, Brookline, USA, 2003.

MEC490 ENTERPRISE MANAGEMENT

Unit 1

Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:

MEC491 CAE / CAM LAB.

1. Part modeling with dimensions and constraints.
2. Assembly modelling and creation of bill of materials.
3. Drafting and detailing of assembly and components.
4. Application programming and customization of CAD package.
5. Modeling, meshing and analysis of a simple machine element.
9. Robot programming for pick and place of objects.

MEC492 INSTRUMENTATION CONTROL AND METROLOGY LAB.

a) INSTRUMENTATION AND CONTROL LAB
Control system exercises
1. Level control using relay
2. Control using PC: Stepper motor, DC motor, flow, level
Instrumentation exercises
Basic circuit building exercises for given specification:
1. Amplifier using transistor
2. Instrumentation Amplifier using op-amp
3. Power supply
4. Amplifier using transistor
Calibration exercises
1. Dead weight pressure gage tester
2. Dead weight vacuum gage tester
Measurement Experiments
1. Torque
2. Power – using dynamometer
3. Speed - using stroboscope (optical type) and magnetic pickup.
4. Temperature - using thermocouple, RTD and thermistor.
5. Force - using proving ring.
7. Strain - one arm, two arms and four arms conditions.
8. Digital counter.

b) METROLOGY LAB.
Basics of measurements and measuring instruments.
Calibration of instruments: Micrometer, Vernier Caliper, Dial Indicator.
Linear measurements: Comparison of accuracies of various instruments.
Angle measurements: Sine Bar, Bevel Protractor.
Linear, angle and radius measurements: Profile Projector, Tool Maker's Microscope.
Comparative measurements: Electronic Comparator, Pneumatic Comparator.
Bore measurements: Bore Gauge.
Measurement of internal and external tapers: Standard sphere, Pin-Gear,
metrology: Gear Tooth Vernier, Disc Micrometer, Gear Roll Tester
Screw thread metrology: Floating Carriage Micrometer - Surface texture
measurements
Micro hardness measurement
Measurement of geometric tolerances: Parallelism, Perpendicularity, Angularity,
Cylindericity, Circularity, Straightness, Flatness and run-out

MEC497 SEMINAR 0 0 3 1

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

MEC499 PROJECT WORK 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.

The student is expected to work on a topic in the field of Mechanical engineering
which could involve theoretical and / or fabrication and / or experimental and or
computational work. Evaluation will be done during the course of the project as well as at the end of the semester.

MNG400 PRINCIPLES OF MANAGEMENT 3 0 0 3

Unit 1
HISTORICAL DEVELOPMENT: definition of management – science or art – management
and administration – development of management thought – contribution of Taylor
and Fayol – functions of management – types of business organisations.
PLANNING: nature & purpose – steps involved in planning – objectives – setting
objectives – process of managing by objectives – strategies, policies & planning
premises - forecasting – decision-making.

Unit 2
ORGANISING: nature and purpose – formal and informal organization – organization
chart – structure and process – departmentation by difference strategies – line
and staff authority – benefits and limitations – de-centralization and delegation of
authority – staffing – selection process - techniques – HRD – managerial
effectiveness.
DIRECTING: scope – human factors – creativity and innovation – harmonizing
objectives – leadership – types of leadership motivation – hierarchy of needs –
motivation theories – motivational techniques – job enrichment.

Unit 3
Communication: process of communication – barriers and breakdown – effective
communication – electronic media in communication.
CONTROLLING: system and process of controlling – requirements for effective
control – the budget as control technique – information technology in controlling –
use of computers in handling the information – productivity – problems and
management – control of overall performance – direct and preventive control –
reporting – the global environment – globalization and liberalization – international
management and global theory of management.

TEXTBOOKS:

REFERENCES BOOKS:
Hall of India, 1996

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:
REFERENCES:

PHY181 PHYSICS LAB. 0 0 3 1

Experiments on mechanics
1. Torsional pendulum.
2. Co-efficient of viscosity of liquid.

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:
PHY251 OPTOELECTRONIC DEVICES

Unit 1

Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence, electro luminescence, radioactive and non-radiative recombination, wave trains.

Unit 2
Semiconductor light-emitting diodes: Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency, semiconductor heterojunctions, double-heterostructure LEDs.

Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes.

Unit 3
Semiconductor light modulators: Modulating light (direct modulation of laser diodes, electro-optic modulation, acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching).

Semiconductor light detectors: I-V characteristics of a p-n diode under illumination, photovoltaic and photoconductive modes, load line, photocells and photodiodes, p-i-n photodiodes, responsivity, noise and sensitivity, photodiode materials, electric circuits with photodiodes, solar cells.

REFERENCES:

PHY253 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3

Unit 1
Electrostatics: Coulombs law and electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of sheet of charge, electric flux density, Gauss’s law, application of Gauss’s law, Maxwell’s first equation.

Poisson’s and Laplace’s equations: The potential field of a point charge, potential field of a system of charges :conservative property, potential gradient, the dipole.

Unit 2
Poisson’s and Laplace’s equations, uniqueness theorem, examples of the solution of Laplace’s equation, solution of Poisson’s equation.

Electromagnetics: Biot Savart law, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, derivation of steady magnetic field laws, Faraday’s laws, displacement current, Maxwell’s equations in point and integral form, retarded potentials.

Unit 3
Electromagnetic waves: EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio. Transmission line equations, line parameters-examples, dipole radiation, retarded potentials, electric dipole radiation.

TEXTBOOK:

REFERENCES:

PHY254 MICROELECTRONIC FABRICATION 3 0 0 3

Unit 1
Introduction to semiconductor fabrication – scaling trends of semiconductor devices; crystal structure of semiconductor materials, crystal defects, phase diagrams and solid solubility; physics of Czochralski growth of single crystal silicon, Bridgeman method for GaAs, float zone process; diffusion science: Ficks laws of diffusion, atomistic models of diffusion, dopant diffusion mechanisms; kinetics of thermal oxidation, Deal-Grove Model, nitridation of silicon, structure and characteristics of oxides, effect of dopants on oxidation kinetics, dopant redistribution;

Unit 2
Physics of ion implantation: Coulombic scattering and projected range, nuclear and electronic stopping, channeling, implantation damage removal, dopant activation by rapid thermal annealing; principles of optical lithography – optics and diffraction, light sources and spatial coherence, physics of pattern transfer, nodulation transfer function; chemistry of lithographic processes: organic and polymeric photoresists, developing and exposure, contrast; principles of non-optical lithography: electron beam, X-ray lithography, resists, sources; etching: Chemistry of wet etching, plasma physics, chemistry of plasma etching and reactive ion etching; chemical mechanical polishing.

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

REFERENCE:

PHY255 ELECTRONIC MATERIALS SCIENCE 3 0 0 3

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

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

Unit 3

TEXTBOOK:

REFERENCE:

PHY260 PHYSICS OF LASERS AND APPLICATIONS 3 0 0 3

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

Unit 2
Properties of LASERS
Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of Dw FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity. Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3
Types of LASERS
Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO2 LASER - principle, construction, working and application. Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homon 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:

REFERENCES:

PHY261 LASERS IN MATERIAL PROCESSING 3 0 0 3

Unit 1
Basic optical theory: Nature of electromagnetic radiation, interaction of radiation with matter, reflection, refraction, polarization, laser fundamentals, laser beam characteristics, beam quality (laser cavity modes), Q-switching, mode locking, continuous wave, types of lasers, energy and power.

Laser interaction with materials: Optical properties of materials, laser interaction with metals, insulators, semiconductors, polymers and biological materials.

Laser surface treatment: Introduction to laser surface hardening, laser surface melting, laser surface alloying, laser surface cladding, laser cleaning. Laser ablation:
mechanisms (photothermal, photophysical and photochemical), mask projection
techniques, laser micro and nano structuring.

Unit 2
Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting,
factors controlling cut quality and kerf width. Laser assisted drilling.
Laser welding: Introduction to keyhole welding and contrast with conduction
limited welding, applications.
Direct laser fabrication (DLF): Laser sintering & laser rapid manufacturing,
comparison with rapid prototyping. Main potential and limitations of DLF for direct
fabrication and for the production of novel engineering materials and structures.

Unit 3
Laser forming: Mechanisms involved, including thermal temperature gradient,
buckling, upsetting. Applications in alignment and straightening and in rapid production
processes.
Scope of application of laser materials processing: focused on industrial
application of laser in materials processing including laser welded tailored blanks.
Laser safety: Introduction to safety procedures in the use of lasers, including
wavelength effects and laser safety standards.

REFERENCES:
3. J. F. Ready, D.F. Farson. LIA Handbook of Laser Materials Processing Laser Institute of
6. W.W. Duley, UV lasers: effects and applications in materials science, Cambridge University,
7. J. Dutta Majumdar, and I. Manna, Laser Material Processing, Sadhana, Vol. 28, Year: 2003,
495-562.

PHY262  NON-LINEAR DYNAMICS  3 0 0 3

Unit 1
Introduction: examples of dynamical systems, driven damped pendulum, ball on
oscillating floor, dripping faucet, chaotic electrical circuits.
One-dimensional maps: the logistic map, bifurcations in the logistic map, fixed
points and their stability, other one-dimensional maps.
Non-chaotic multidimensional flows: the logistic differential equation, driven damped
harmonic oscillator, Van der Pol equation, numerical solution of differential equations.
Dynamical systems theory: two-dimensional equilibrium and their stability, saddle
points, are contraction and expansion, non-chaotic three-dimensional attractors,
stability of two-dimensional maps, chaotic dissipative flows.

Unit 2
Lyapunov exponents: for one- and two-dimensional maps and flows, for three-
dimensional flows, numerical calculation of largest Lyapunov exponent, Lyapunov
exponent spectrum and general characteristics, Kaplan-Yorke dimension, numerical
precautions. Strange attractors: general properties, examples, search methods, probability
of chaos and statistical properties of chaos, visualization methods, basins of
attraction, structural stability.
Bifurcations: in one-dimensional maps and flows, Hopf bifurcations, homoclinic
and heteroclinic bifurcations, crises.
Hamiltonian chaos: Hamilton’s equations and flows, and 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,
tenropy, 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:

REFERENCES:
(India) Private Limited, 2005
PHY263 CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY

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:

REFERENCE:

PHY264 THIN FILM PHYSICS

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

Electrical behaviors: sheet resistivity, electron mobility and concentration, Hall effect, conduction in MIS structure.

Mechanical behaviors: stress, adhesion, hardness, stiffness.

Applications of thin films in various fields: Antireflection coating, FET, TFT, resistor, thermistor, capacitor, solar cell, and MEMs fabrication of silicon wafer: Introduction. preparation of the silicon wafer media, silicon wafer processing steps.

TEXTBOOK:

REFERENCES:

PHY270 MEDICAL PHYSICS

Unit 1

Ultrasonics - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiology – resolution – speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.

Unit 2
Nuclear medicine - principles of nuclear physics – natural radioactivity, decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Nuclear Isomerism, internal conversion - ideal energy for radiotherapy based on interactions. Radionuclide used in medicine - radioisotope production – dosimetry – safety - radiation hazards – PET.

Nuclear magnetic resonance physics - magnetic moment – magnetization – relaxation - nuclear magnetic resonance spectroscopy.

Unit 3
Nuclear magnetic resonance imaging (MRI) – principle - chemical shift - magnetic resonance signal induction and relaxation - pulse sequencing and spatial encoding.


TEXTBOOK:

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

PHY271 ADVANCED CLASSICAL DYNAMICS 3 0 0 3

Unit 1
Introduction to Lagrangian dynamics
Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D’Alembert’s principle and Lagrange’s equation, simple applications of the Lagrangian formulation, variational principles and Lagrange’s equations, Hamilton’s principles, derivation of Lagrange’s equations from Hamilton’s principle, conservation theorems and symmetry properties.

Unit 2
Central field problem
Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler’s problem.
effect and applications.

Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces – fission - principle of nuclear reactor - elementary particles - leptons, hadrons, quarks, field bosons - the standard model of elementary particles.

TEXTBOOK:
A Beiser, Perspectives in Modern Physics,Mc Graw Hill

REFERENCES:

PHY273 COMPUTATIONAL PHYSICS 3 0 0 3

Unit 1
Differentiation: Numerical methods, forward difference and central difference methods, Lagrange's interpolation method.
Integration: Newton - coles expression for integral, trapezoidal rule, Simpsons's rule, Gauss quadrature method.

Unit 2

Unit 3
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 Hijroth 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 Supernovae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds-Nebulae.

Unit 3
Galactic astronomy: Distance measurement - red shifts and Hubble’s law – age of the universe, galaxies – morphology - Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.
Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

REFERENCES:
5. ‘Stellar Astronomy’ by K.D Abhayankar.
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.

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

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

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

Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptarithms.

TEXTBOOKS:
5. Quantitative Aptitude by R.S. Aggarwal, S. Chand

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


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.
SYLLABI
B. Tech. - Mechanical Engg.  2010 admissions onwards

TEXTBOOKS:
4. The Hard Truth about Soft Skills, by Amazon Publication.
5. Quick Maths – Tyra.
6. Quicker Arithmetic – Ashish Aggarwal
7. Test of reasoning for competitive examinations by Thorpe.E. TMH
8. Non-verbal reasoning by R.S. Aggarwal .S. Chand

REFERENCES:
3. The BBC and British Council online resources
4. Owl Purdue University online teaching resources
4. 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:
4. The Hard Truth about Soft Skills, by Amazon Publication.
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.