Amrita University’s Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

<table>
<thead>
<tr>
<th>Course Offered</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message from Amma’s Life for the Modern World</strong></td>
<td>Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.</td>
</tr>
<tr>
<td><strong>Lessons from the Ramayana</strong></td>
<td>Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.</td>
</tr>
<tr>
<td><strong>Lessons from the Mahabharata</strong></td>
<td>Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.</td>
</tr>
<tr>
<td><strong>Lessons from the Upanishads</strong></td>
<td>Introduction to the Upanishads: Sruti versus Smriti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.</td>
</tr>
<tr>
<td><strong>Life and Message of Swami Vivekananda</strong></td>
<td>Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.</td>
</tr>
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</tr>
</tbody>
</table>
| **Kerala Mural Art and Painting** | Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this
form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

**Course on Organic Farming and Sustainability**

Organic farming is emerging as an important segment of human sustainability and healthy life. Haritamritam is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. In Amma’s words “it is a big step in restoring the lost harmony of nature”.

**Benefits of Indian Medicinal Systems**

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

**Traditional Fine Arts of India**

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is ‘Unity in Diversity” and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

**Science of Worship in India**

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

**15CHY100 CHEMISTRY 3 0 0 3**

**Unit 1**

**Chemical Bonding**

Review of orbital concept and electronic configuration, electrovalency and ionic bond formation, ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan’s rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - co-ordinate covalent compounds and their characteristics, molecular orbital theory for H2, N2, O2 and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

**Unit 2**

**Thermodynamic Parameters**

Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations - Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity – Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff’ relation (integrated form) - bond enthalpy and bond order - Problems based on the above.

**Kinetics**

Review of molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions) - complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its significance, Michaelis Menden kinetics-enzyme catalysis.

**Unit 3**

**Electrochemistry**

Electrolytes - strong and weak, dilution law, Debye-Huckel theory, faraday’s laws, origin of potential, single electrode potential, electrochemical series, electrochemical cells, Nernst equation and its application, reference electrodes- SHE, Ag/AgCl, Calomel.

**Photochemistry**

Photochemistry, laws of photochemistry - Stark-Einstein law, Beer-Lamberts law, quantum efficiency-determination, photochemical processes - Jablonsky diagram, internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo sensitization, photo polymerization.

**REFERENCE BOOKS**

Physical chemistry, Puri and Sharma
Inorganic chemistry, Puri and Sharma
15CHY181 CHEMISTRY LAB. 0 0 2 1

1. Acid base titration (double titration)
2. Complexometric titration (double titration)
3. Redox (permanganometry) titration (double titration)
4. Conductometric titration
5. Potentiometric titration
6. Ester hydrolysis

15CHY231 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:

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

15CHY232 BIOMATERIALS SCIENCE 3 0 0 3

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

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

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

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

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

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

TEXTBOOK:

REFERENCES:

15CHY233 CATALYTIC CHEMISTRY 3 0 0 3

Unit 1
Catalysis: Introduction, Industrial applications. Rates of reactions - equilibrium, energy of activation and the catalyst's role. Elementary reactions in catalytic transformations homogeneous and heterogeneous catalysis.

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

**Unit 2**
Catalysis by macromolecules, Phase transfer catalysis.

Catalysis by Enzymes: Introduction - kinetics of enzyme catalyzed reaction, catalysis through enzyme, organic catalysis, metalloenzyme catalysis, supported enzymes. Industrial applications of enzyme catalyst.

Catalysis by Polymers: Attachment of catalytic groups to polymer supports, Adsorption and the Kinetics of polymer-catalyzed reactions.

**Unit 3**
Catalysis in polymer gels, bifunctional and multifunctional catalysis, porous polymers, Applications of polymer catalysis.


**TEXTBOOKS:**

**REFERENCES:**

**15CHY234 CHEMISTRY OF ADVANCED MATERIALS 3 0 0 3**

**Unit 1**
Chemistry of Engineering Plastics: Preparation, properties and applications of ABS, polycarbonates, epoxy resins - polyamides - Nylon and Kevlar.


**TEXTBOOKS:**

**REFERENCES:**

**15CHY235 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).

**SYLLABI**

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

2015 admissions onwards

**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 - NOx - Heavy metals - lead, arsenic, mercury, antimony, barium, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

**TEXTBOOK:**


**REFERENCE:**


**15CHY236 CHEMISTRY OF NANOMATERIALS 3 0 0 3**

**Unit 1**

Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nanostructures - SEM, AFM - TEM and STM - Raman spectroscopy.

Synthesis of Nanomaterials: Synthetic approaches: Colloidal Self-Assembly (Self-assembled monolayers - SAMs) and electrostatic self-assembly, electrochemical methods, sol-gel deposition.

**Unit 2**

Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.

**SYLLABI**

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

2015 admissions onwards

Carbon nanostructures: Carbon Clusters: Fullerenes, structure, synthesis, alkali doped C60 - superconductivity in C60, applications of fullerenes. Carbon nanotubes: Classification, properties, synthesis, characterization, and potential applications, growth mechanism of carbon nanotubes.

Other Nanostructures: Quantum Dots: Preparation, properties and applications of Au, CdS and CdSe quantum dots.

**Unit 3**

Fabrication and applications of conducting polymer nanotubes, TiO2 and metallic nanotubes.

Molecular Electronics and Machines: Molecular electronics: Working of Molecular and supramolecular switches, transistors and wires. Molecular machines: Working of Molecular motors, rotors, cars, elevators and valves.

**TEXTBOOKS:**


**REFERENCES:**


**15CHY237 CHEMISTRY OF TOXICOLOGY 3 0 0 3**

**Unit 1**

Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury -
medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants – solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

Unit 2
Exposure Classes, Toxics 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:

15CHY238 COLLOIDAL AND INTERFACIAL CHEMISTRY 3 0 0 3

Unit 1
Introduction to surfaces, interfaces and colloids: Molecular origin, Surface phenomena and structure of interfaces, Surfactants structure, colloids in action - shapes and size distribution, Types of interaction forces - Physical and Chemical interaction, Classification of physical forces - Vander Waals force, electrostatic forces.
Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.


Introduction to Quantum mechanics - Schrodinger equation - Position and momentum - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2
Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - 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:
Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

TEXTBOOKS:

REFERENCES:

15CHY242 ENVIRONMENTAL CHEMISTRY 3 0 0 3

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


Unit 2
Aerobic processes - wastewater treatment systems (brief description only) - anaerobic and aerobic - sewage treatment, primary, secondary and tertiary processes - water reuse and recycle. Eutrophication of lakes, nitrogen and phosphorus in effluents - Drinking water standards - sources - fluoride and arsenic in water, purification, sterilization - chemistry of chlorination - water purification for domestic use - reverse osmosis - nano filters and membranes.

Industrial Pollution and its control: Industrial pollution and waste waters from various types of industries - environmental pollution due to paper mills, textile mills etc., and its control. Solid waste disposal - methods - solid waste from mining and metal production and its disposal - Electrochemical treatment of pollution control, electro-coagulation and flocculation - Green chemical processes and green solvents - reaction conditions to control industrial pollution.

Unit 3
Other types of pollution: Soil pollution - agricultural pollution - use of chemical fertilizers - Organic chemicals and environment, dioxins and furans - chemistry of some of the pesticides, insecticides and herbicides, ill effects due to uncontrolled use - Bulk storage of hazardous chemicals and disasters, Radioactive pollution, radiation units, sources - exposure and damage - safety standards - radioactive wastes and their disposal - Toxicological substances, testing of toxic substance, enzyme inhibition and biochemical effects of toxic chemicals on humans.

Sampling and Measurements of Pollutants: Sampling and analysis techniques of air pollutants (brief outline only) - analysis of particulate matter and lead - Sampling and measurements of water pollutants - organic loadings, phosphates and nitrogen compounds - monitoring of water quality - water test kits, various analytical methods (brief outline only).

TEXTBOOKS:
Unit 1
Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.


Unit 2
Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

**TEXTBOOK:**

**REFERENCES:**
Unit 2
Gas chromatography - principle and applications – gel chromatography.


Unit 3

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

TEXTBOOKS:

REFERENCES:

15CHY246 MEDICINAL ORGANIC CHEMISTRY 3 0 0 3

Unit 1

Physicochemical properties in relation to biological action: solubility, partition coefficient, dissociation constant, hydrogen bonding, ionization, drug shape, surface activity, complexation, protein binding, molar refractivity, bioisosterism - Stereo chemical aspects of drug action - stereo isomerism - optical isomerism.

Unit 2
Enzymes and hormones: Enzymes - nomenclature, classification and characteristics of enzymes - mechanism of enzyme action, factors affecting enzyme action, cofactors and co-enzymes, enzyme inhibition, enzymes in organic synthesis. Hormones and vitamins - representative cases.

15CHY247 MODERN POLYMER COMPOSITES 3 0 0 3

Unit 1

Unit 2
Unit 3

TEXTBOOKS:

REFERENCES

15CHY248 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 - SN1 and SN2 reactions, nucleophilic substitution at aliphatic sp2 carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organo lithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.

Unit 2
Michael and 1,4-addition reaction - Favorskii rearrangement - benzilic acid rearrangement - reaction mechanism in basic media - Mannich reaction - enols and enolates.

Reaction involving acids and other electrophiles: Carbocations - formation and rearrangements - cationic rearrangement involving electron deficient nitrogen atom - Beckmann rearrangement - Curtius, Lossen and Schmidt rearrangement - electrophilic additions - acid catalyzed reaction of carboxyl compounds - hydrolysis of carboxyclic acid derivatives - electrophilic aromatic substitution - carbones 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 - SN1 reaction - radical ions - Birch reduction - Hofmann-Loeffler-Freytag reaction - Barton reaction - McMurry reaction.


TEXTBOOK:

REFERENCES:

15CHY249 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3

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

Stereochemistry: Tacticity, R/S system of nomenclature of central and axial molecules.

Unit 2
Atropisomerism - isomerism of biphenyls - allenes and spiranes - ansa compounds - Geometrical isomerism, E, Z Isomerism. Asymmetric synthesis.

Conformational Analysis: Optical activity and chirality - Conformational Analysis of cyclic and acyclic system - Conformational effects on reactivity of acyclic systems only.
Unit 3

TEXTBOOKS:

REFERENCES:

15CHY250 POLYMER MATERIALS AND PROPERTIES 3 0 0 3

Unit 1

Unit 2
Manufacturing, mechanical, thermal, electrical and chemical properties and applications of commodity plastics - PE, PP, PVC, PS, Engineering plastics - ABS, PC, PMMA, polyamide, polyacetal, PET, PBT, PTFE, High performance polymer - PES, PEI, PEEK, conducting polymer.

Unit 3
Thermoset materials - PF, UF, MF, epoxy and unsaturated polyester resin, Rubber - natural rubber, synthetic rubber - SBR, PB, nitrile, chloroprene, butyl, silicone - compounding and additives.

TEXTBOOKS:

REFERENCE BOOKS:
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.


Unit 3

Fourier synthesis - definition, applications of fourier synthesis in crystal structure analysis of S-Tetrazine. Structure of Rutile, Fluorite, Antifluorite, Zinc blende, Wurtzite, diamond and graphite.

REFERENCES:

15CHY331 BATTERIES AND FUEL CELLS 3 0 0 3

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

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

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

Unit 3
Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.


TEXTBOOKS:

REFERENCES:

15CHY332 CORROSION SCIENCE 3 0 0 3

Unit 1
Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2
Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

Unit 3
Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.


TEXTBOOKS:

REFERENCES:

15CSE100 COMPUTATIONAL THINKING AND PROBLEM SOLVING 3 0 2 4

Unit 1
SYLLABI  
2015 admissions onwards


15CSE180  COMPUTER PROGRAMMING LAB.  0 0 2 1

Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while, for), programs using user defined functions and library functions, programs on Files, arrays, matrices (single and multi-dimensional arrays), programs using DMA, programs on strings, structures.

REFERENCE:

15CUL101  CULTURAL EDUCATION I  2 0 0 2

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

Unit 2
Science and Technology in ancient India; Education in Ancient India; Goals of Life - Purusharthas; Introduction to Vendanta and Bhagavat Gita.

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

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

15CUL111  CULTURAL EDUCATION II  2 0 0 2

Unit 1
1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

Unit 2
4. Who is a Wise Man?
5. A Ruler’s Dharma
6. The Story of King Shibi

SYLLABI  
2015 admissions onwards

Unit 3
7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

Unit 4
9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

Unit 5
11. Patanjali’s Astanga-Yoga System for Personality Refinement
12. Examples of Heroism and Patriotism in Modern India

TEXTBOOKS:
Common Resource Material II (in–house publication)
Sanatana Dharma - The Eternal Truth (A compilation of Amma’s teachings on Indian Culture)

15CUL230  ACHIEVING EXCELLENCE IN LIFE - AN INDIAN PERSPECTIVE  2 0 0 2

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

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

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

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

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

Schools of Engineering  Amrita Vishwa Vidyapeetham  S 29

Schools of Engineering  Amrita Vishwa Vidyapeetham  S 30
Learning Skills (Teachings of Amma)
Art of Relaxed Learning; Art of Listening; Developing 'Shraddha' – a basic qualification for obtaining Knowledge;

Communication Skills - An Indian Perspective;

**Unit 3**
Developing Positive Attitude & Friendliness - (Vedic Perspective);

Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);

**Leadership Qualities** – (A few Indian Role models & Indian Philosophy of Leadership);

**REFERENCE BOOKS:**
1. Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9
2. Complete works of Swami Vivekananda (Volumes 1 to 9)
3. Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)
4. Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)
7. Art of Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
10. Yoga 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 N Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.

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**SYLLABI**  
**B. Tech. - Mechanical Engg.**  
**2015 admissions onwards**

**15CUL231 EXCELLENCE IN DAILY LIFE 2002**

**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?
7. Increase Productivity, reduce stress.. work patterning.

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

**REFERENCES:**
The Bhaja Govindam and the Bhagavad Gita.

**15CUL232 EXPLORING SCIENCE AND TECHNOLOGY 2002**

**IN ANCIENT INDIA**

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

**Unit 1**
1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanta Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;
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.

YSLEEBI B. Tech. - Mechanical Engg. 2015 admissions onwards

8. The Aryabhatiya: concepts, content, commentaries;
9. Brahmagupta and his advances;
10. Other great Siddhantic savants;
11. Bhaskara II and his advances;

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 – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

Report review
Conclusion

REFERENCES:
• The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
• “The message of Upanishads” written by Swami Ranganathananda. Published by Bharathiya Vidyabhavan.
Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttarajal.

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

Part A - Electronics
Identification of electronic components (Passive and Active)
Study of measuring instruments (Voltmeter, Ammeter and Multimeter)
Measurement and theoretical Verification of series and parallel combination of resistors and capacitors
Calibration of CRO and measurements of signal parameters (RMS, maximum value, peak value, time and frequency)
Calibration of function generator using CRO
Soldering practice

Part B - Electrical
1. Study on power supply and protective devices
2. Study on tools and electrical accessories
3. Study on sources of light
4. Study on energy efficiency
5. Study on water pump
6. Study on house hold appliances:
   a. Iron box
   b. Fan
   c. Refrigerator
   d. Air conditioner
7. House wiring I – Glow an incandescent lamp using SPST switch
8. House wiring II – Glow a fluorescent lamp using SPST switch
9. House wiring III – Operate a fan and an incandescent lamp using two independent SPST switch
10. House wiring IV – Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch
11. House wiring V – Staircase wiring
12. House wiring VI – Godown wiring

Unit 1
Electrical Engineering
Introduction to Electrical Power System - different sources of electrical energy (conventional / alternate), Ideal Independent Current and Voltage Sources.

Unit 2
Classification and Applications of Electrical Machines
DC Motor, Basic principle of operation, Different types of DC motors, Voltage equation of a motor, significance of back emf, Speed, Torque, Torque-Speed characteristics, Output Power, Efficiency.


Single Phase Transformer - Principle of Operation, Voltage transformation ratio, emf equation, working of single phase auto-transformer, Three Phase Transformer Connections, Star-delta, star-star.

Unit 3
Electronics Engineering
Introduction to semiconductors and doping: Intrinsic and extrinsic semiconductors, PN junction diode characteristics: forward and reverse bias – breakdown – barrier potential Rectifiers: half wave and full wave, Zener diode – design of regulators and Characteristics.

Introduction to BJT: BJT characteristics curves and region of operation, common emitter, common base configurations, MOSFET characteristics.

Introduction to Operational amplifier: inverting and non-inverting amplifier.

Introduction to logic gates: Boolean Algebra Theorems, De Morgan’s theorem. Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, NAND Gate, NOR Gate, X-NOR Gate.
Microcontrollers: Introduction to Microcontrollers, 8051, Microcontroller, Architecture and an example of Microcontroller, based stepper motor control system (only Block Diagram approach).

**TEXTBOOKS:**

**REFERENCES:**
3. S. K. Bhattacharya - 'Basic Electrical and Electronics Engineering' - Pearson - 2012

**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 – Any two pieces from the text.

**Unit 2**
Writing: Prewriting techniques - Kinds of paragraphs - basics of continuous writing.
Grammar & Usage: Parts of Speech, Tenses, Concord, Phrasal Verbs, Modal Auxiliaries, Modifiers (Workbook) - Any two pieces from the text.

**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 - Any two pieces from the text.

Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews, etc.

**BOOKS RECOMMENDED:**
15ENG231 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 psyche; to develop an understanding about the societal changes in the recent past.

Unit 1 Poems
Rabindranath Tagore's Gitanjali (1-10); Nizzim Ezekiel's Enterprise; A.K. Ramanujam's Small-Scale Reflections on a Great House.

Unit 2 Prose
Khushwant Singh's The Portrait of a Lady; Jhumpa Lahiri's Short Story - Interpreter of Maladies.

Unit 3 Drama and Speech
Vijay Tendulkar's Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru / S. Radhakrishnan / A. P. J. Abdul Kalam's My Vision for India etc. (any speech).

REFERENCES:

15ENG232 INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE 1 0 2 2

OBJECTIVES: To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.

Unit 1 Poems

Unit 2 Short Stories

REFERENCES:

15ENG233 TECHNICAL COMMUNICATION 1 0 2 2

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 2 Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

Unit 3 Technical paper writing: Library research skills - documentation style - document editing – proof reading – formatting. Practice in oral communication and Technical presentations

REFERENCES:

15ENG234 INDIAN SHORT STORIES IN ENGLISH 1 0 2 2

OBJECTIVES: To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio-cultural aspects of
the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Unit 1

Unit 2

Unit 3
Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

TEXT:

REFERENCE:

15ENV300  ENVIRONMENTAL SCIENCE AND SUSTAINABILITY  3 0 0 3

Unit 1
State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People’s action.

SYLLABI
2015 admissions onwards

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil / land degradation / pollution

Unit 2
Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people’s movements and activism, Indigenous knowledge systems and traditions of conservation.

Unit 3

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes / Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.

TEXTBOOKS / REFERENCES:
15FRE230  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

15FRE231  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).

SYLLABI  B. Tech. - Mechanical Engg.  2015 admissions onwards

15GER230    GERMAN FOR BEGINNERS I  1 0 2 2

Unit 1 Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation.

Numbers 1-100; Saying the telephone number.

Countries and Languages.

Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

Unit 2 Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.

Numbers till 1000. Saying a year.

Alphabets – spelling a word.
Filling up an application form; In the restaurant – making an order.

Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article

Vocabulary: Food items
Unit 3
Numbers above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.

Grammar: Accusative – definite article. Adjectives and plural forms.

Vocabulary: Furniture and currencies.

15GER231 GERMAN FOR BEGINNERS II 1 0 2 2

Unit 1
Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form.

Vocabulary: Consumables and measurements;

Unit 2
Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing up an appointment.

Grammar: Model verbs; Prepositions with time and place; Ordinal numbers.

Vocabulary: Leisure activities, weekdays, months and seasons.

Unit 3
Family and household; Family and relations; household and daily routine.

Grammar: Possessive articles; Divisible and indivisible verbs.

Vocabulary: Family circle; Household articles.

15GER232 PROFICIENCY IN GERMAN LANGUAGE (LOWER) 1 0 2 2

To have an elementary exposure to German language; specifically
1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;

5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.
(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.)

Some useful websites will be given.

15GER233 PROFICIENCY IN GERMAN LANGUAGE (HIGHER) 1 0 2 2

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative.

Some German culture. Films.

15HIN101 HINDI I 1 0 2 2

OBJECTIVES: To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.

Unit 1
Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindi language, Devanagari script and Hindi alphabet.

Shabda Bhed, Roopanth ki Drishti se - Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed - Sangya ke Roopanth - kriya.

Unit 2
Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context –understanding proper pronunciation – Conversations, Interviews, Short speeches.

Unit 3
Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada
Unit 4

Unit 5
Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos.

BOOKS:
1. Prem Chand Ki Sravashrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran, Anuvad Itaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi

OBJECTIVES: Appreciation and assimilation of Hindi Literature both drisya & shravya using the best specimens provided as anthology.

Unit 1
Kavya Tarang; Dhumil ke Anthim Kavitha [Poet-Dhumil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakth [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

Unit 2
Communicative Hindi - Moukhik Abhiivyakthi

Unit 3
Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. News reading and presentations in Radio and TV channels in Hindi.

Unit 4
Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

Unit 5

BOOKS:

Unit 1
Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2

Unit 3
Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost–savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

REFERENCES:

Unit 1
Introduction
General Introduction; ‘His + Story’ or ‘History’ ?; The concepts of ‘nation’, ‘national identity’ and ‘nationalism’; Texts and Textualities: Comparative Perspectives.

Unit 2
Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;
Unit 3

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.

Conclusion.

REFERENCES:
1. Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.
2. Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.
8. Nehru, Jawaharlal. The Quest” from Discovery of India.

15HUM232 GLIMPSES OF ETERNAL INDIA 2002

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 – Ramayana – Yudhisthira’s ramarajya; Sarasvati - Indus 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 – Kautliya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harshavarman; 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.

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

REFERENCES:
15HUM233 GLIMPSES OF INDIAN ECONOMY AND POLITY

Unit 1
Introduction

General Introduction: Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.

Ancient India – up to 600 B.C.
Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira's ramarajya; Sarasvati - Sindhu civilization and India's trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2
Classical India: 600 B.C. – 1200 A.D.
The rise of Magadha; emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthasastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya; dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.
Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

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

Conclusion

REFERENCES:
1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
2. Kautiya, Arthasastra.

SYLLABI
B. Tech. - Mechanical Engg. 2015 admissions onwards

15HUM234
HEALTH AND LIFE STYLE

Unit 1 Introduction to Health
Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2 Food and Nutritional Requirements during Adolescence
Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3 Need for a Positive Life Style Change
Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire-healthy Snacks

TEXTBOOKS:

REFERENCE BOOKS:
2. WHO Report on Adolescent Health: 2010

15HUM235
INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY

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

Unit 2
The relevance of these classics in a modern age.

Unit 3
Goals of human life - existential problems and their solutions in the light of these classics etc.
PREAMBLE: This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Unit 1
A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2
Modern India: Challenges and Possibilities.

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

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

TEXTBOOK:
Material given by the Faculty

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

**TEXTBOOKS AND REFERENCE BOOKS:**
1. Vakya Vyavahara- Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi
2. The Wonder that is Sanskrit - Dr.Sampadananda Mishra, New Delhi

15HUM238 NATIONAL SERVICE SCHEME 2 0 0 2

Unit 1
Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.

NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2
Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3
Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.

Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style

Unit 4
Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.


Unit 5
Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.

Project Work / Practical

15HUM239 PSYCHOLOGY FOR EFFECTIVE LIVING 2 0 0 2

Unit 1 Self-Awareness & Self-Motivation
Self analysis through SWOT, Johari Window, Maslow's hierarchy of motivation, importance of self esteem and enhancement of self esteem.

Unit 2 The Nature and Coping of Stress

Unit 3 Application of Health Psychology
Health compromising behaviours, substance abuse and addiction.

**TEXTBOOKS:**

15HUM240 PSYCHOLOGY FOR ENGINEERS 2 0 0 2

Unit 1
Psychology of Adolescents: Adolescence and its characteristics.

Unit 2
Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills, Mnemonics.

Unit 3
Attention & Perception: Definition, types of attention, perception.

**TEXTBOOKS:**
15HUM241 SCIENCE AND SOCIETY – AN INDIAN PERSPECTIVE

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

Unit 2
Indian sciences
Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD

Science and technology under the British rule
Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3
Science and technology in Independent India
Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition
Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

REFERENCES:
Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3


TEXTBOOKS / REFERENCES:

15HUM243 THE MESSAGE OF THE UPANISHADS 2 0 0 2

OBJECTIVES: To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

Unit 1
An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smruti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

Unit 2

Unit 3
Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada’s answers to the six questions in Prasnopanishad.

REFERENCES:
1. The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama
3. Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press
4. Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore
15JAP231 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER)  1 0 2  2

Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

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

15KAN101 KANNADA I  1 0 2  2

OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Unit 1
Adalitha Kannada: bhashe, swaroopa, belavanigeya kiru parichaya
Paaribhaashika padagalu
Vocabulary Building

Unit 2
Prabhanda – Vyaaghrha Geethe - A. N. Murthy Rao
Prabhanda – Bareddi...baredidi, Baduku mugiyuvudilla allige...- Nemi Chandra

REFERENCEs:
1. H. S. Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru
2. A. N. Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste
3. Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication
4. Sanna Kathegalu - Prasaranga, Mysuru University , Mysuru
5. B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu
6. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.
7. Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

15KAN111 KANNADA II  1 0 2  2

OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Unit 1
Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2
Nanna Hanate - Dr. G. S. Shivarudrappa
Ella Marethiruvaga - K. S. Nissaar Ahmed
Saviraru Nadigalu – S Siddalingayaya
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Unit 3

Unit 4
Sarva Sollegala turtu Maha Samelana - Beechi
Swarthakkaagi Tyaga - Beechi

Unit 5
Essay writing: Argumentative & Analytical
Précis writing

REFERENCES:
1. H. S. Krishnaswami Iyangar – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
4. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house
5. Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication

MALAYALAM I  1 0 2 2

OBJECTIVES: To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Unit 1
Ancient poet trio: Adhyatmaramayanam, Lakshmana Swanthanam (valsa soumitre... mungikidakayal), Ezhuthachan - Medieval period classics – Jnanappana (kalaminnu... vilasangalingane), Poonthanam

Unit 2

Unit 3
Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer - Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4
Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasaante Chiri - Kuttikrishna Maranu - Outline of literary Criticism in Malayalam Literature - Introduction to Kuttu Krishna Mararu & his outlook towards literature & life.

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B. Tech. - Mechanical Engg.  2015 admissions onwards

Unit 5
Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettillatha Malayalam
Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

MALAYALAM II  1 0 2 2

OBJECTIVES: To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Unit 1
Ancient poet trio: Kalayanasougandhikam, (kallum marangalun... namukkennarika vrikodara) Kunjan Nambiar - Critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Translated by Atto Krishna Pisharody).

Unit 2

Unit 3
Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

Unit 4
Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.
SYLLABI

B. Tech. - Mechanical Engg. 2015 admissions onwards

Unit 5
Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam

Writing - a. Expansion of ideas; b. Précis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

15MAT111    CALCULUS AND MATRIX ALGEBRA       2 1 0 3

Unit 1 Calculus

Limit and Continuity: Limit (One-Sided and Two-Sided) of Functions. Continuous Functions, Discontinuities, Monotonic Functions, Infinite Limits and Limit at Infinity.

Unit 2 Differentiation and its Applications: Derivative of a function, non-differentiability, Intermediate Value Property, Mean Value Theorem, Extreme Values of Functions, Monotonic Functions, Concavity and Curve Sketching, Integration: The Mean Value Theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques.

Unit 3 Matrix Algebra
Review: System of linear equations, linear independence


TEXTBOOKS:

SYLLABI

B. Tech. - Mechanical Engg. 2015 admissions onwards


15MAT121    VECTOR CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

Unit 1

Vector Integration: Line Integral, Line Integrals Independent of Path. Green’s Theorem in the Plane (Sections: 10.1, 10.2, 10.3, 10.4).

Unit 2
Surface Integral: Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke’s Theorem. (Sections: 10.5, 10.6, 10.7, 10.9)

First Order Differential Equations: First Order ODE, Exact Differential Equations and Integrating Factors (Sections 1.1 and 1.4).

Unit 3
Second Order Differential Equations: Homogeneous and non-homogeneous linear differential equations of second order (Review), Modelling: Free Oscillations, Euler-Cauchy Equations, Solution by Undetermined Coefficients, Solution by the Method of Variation of Parameters (Sections 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.10).


TEXTBOOK:

REFERENCE BOOKS:
15MAT204  TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS  2 1 0 3

Unit 1

Unit 2
Convolution, Integral Equations, Partial Fractions, Differential Equations, Systems of Differential Equations. (Sections: 6.1 to 6.7)


Unit 3

Partial Differential Equations: Basic Concepts, Modeling; Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series, Heat Equation; Solution by Fourier Series. (Sections: 12.1-12.5)

TEXTBOOK:

REFERENCE BOOKS:

15MAT302  NUMERICAL METHODS  2 0 2 3

Unit 1
Review of Errors: Accuracy and Precision, round-off error and truncation error. (Sec. 2.2-2.4)

Roots of Transcendental and Polynomial Equations: Bisection method, Iteration methods based on first degree equation, Rate of convergence, System of nonlinear equations. (Sec. 4.2, 4.3, 5.1-5.3, 5.5)


Unit 2
Interpolation and Approximation: Lagrange and Newton interpolation for unequal intervals, Finite difference operators, Interpolating polynomials using finite differences. (Sec. 13.1 – 13.4, 13.6)
Unit 3
Review of Ordinary Differential Equations:


Lab. - Implementation of these methods: MATLAB or EXCEL or Free and Open Source Software (FOSS) tools like R-programming and Scilab.

TEXTBOOK:

REFERENCE BOOKS:

15MEC101 ENGINEERING DRAWING - CAD 2 0 2 3


TEXTBOOK:

REFERENCES:
Dynamics of rigid bodies: General plane motion - translation and rotation of rigid bodies - Chasle’s theorem.

**TEXTBOOKS:**

**REFERENCES:**

**15MEC180**

**WORKSHOP A**

1. **Product Detailing Workshop**
   Disassemble the product of sub assembly - Measure various dimensions using measuring instruments - Free hand rough sketch of the assembly and components - Name of the components and indicate the various materials used - Study the functioning of the assembly and parts - Study the assembly and components design for compactness, processing, ease of assembly and disassembly - Assemble the product or subassembly.

2. **Pneumatics and PLC Workshop**
   Study of pneumatic elements - Design and assembly of simple circuits using basic pneumatic elements - Design and Assembly of simple circuits using Electro-pneumatics.
   Study of PLC and its applications - Simple programming using ladder diagrams.

3. **Sheet Metal Workshop**
   Study of tools and equipments - 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.

4. **Welding Workshop**
   Study of tools and equipments - Study of various welding methods - Arc welding practice and demonstration of gas welding and cutting.

   **(b) Demo and practice Workshop**
   Fitting: Study of tools, practice in chipping, filing and making joints.
   Carpentry: Study of tools, planning practice and making joints.

**15MEC201 ENGINEERING THERMODYNAMICS 3 0 0 3**

**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, and thermodynamic energy interactions - evaluation of work type 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.


**Unit 2**

The inequality of Clausius and thermodynamic Temperature scale, concept of entropy, Entropy change in different processes, principle of increase in entropy for closed systems.

**Unit 3**
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 and steam tables.

Perfect gas, equation of state, specific heats, characterization of thermodynamic processes. Real gas models - Van der waals equation, compressibility chart.

Thermodynamic property relations: Introduction, important mathematical relations, cyclic rule, Maxwell relations, enthalpy, entropy, internal energy and specific heat relations; Clausius-Clapeyrong equation, Joule Thomson coefficient and inversion line.
SYLLABI  B. Tech. - Mechanical Engg.  2015 admissions onwards

TEXTBOOK:

REFERENCES:

15MEC202  MACHINE DRAWING  2 0 2 3

1. DRAWING STANDARDS
Code of practice for Engineering Drawing, BIS specifications - Welding symbols, riveted joints, keys, fasteners – Reference to handbook for the selection of standard components like bolts, nuts, screws, keys etc.

2. 2-D DRAWINGS

3. CAD PRACTICE (USING APPLICATION PACKAGES)
Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, basic principles of GD & T (geometric dimensioning & tolerance).

4. ASSEMBLY DRAWING (MANUAL & USING APPLICATION PACKAGES)
Manual parts drawing and preparation of assembled views given part details for components followed by practicing the same using CAD packages.

5. PREPARATION OF BILL OF MATERIALS AND TOLERANCE DATA

SUGGESTED ASSEMBLIES:
Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations / plans / and side views with Dimensioning and bill of materials.

- Sleeve & Cotter joint, Spigot & Cotter joint, Knuckle joint, Stuffing Box, Screw Jack, Foot step bearing, Universal Coupling, Plummer Block, Swivel Bearing, Simple Eccentric, Machine Vice, Protected type flanged coupling, Connecting Rod, Tail Stock.

SYLLABI  B. Tech. - Mechanical Engg.  2015 admissions onwards

TEXTBOOKS:

REFERENCES:

15MEC203  MATERIAL SCIENCE AND METALLURGY  3 0 0 3

Unit 1


Unit 2


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.
**TEXTBOOK:**

**REFERENCES:**

**15MEC204 MECHANICS OF SOLIDS 3 0 0 3**

**Unit 1**
Simple Stress and Strain

Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants, Thermal stresses (including thermal stresses in compound bars). Strain Energy & Impact loading.

Compound Stresses
Introduction, Stress components on inclined planes, General two-dimensional stress system, Principal planes and stresses and Mohr’s circle of stresses.

**Unit 2**
Torsion of circular shafts
Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections.

Bending moment and shear force in beams
Introduction, Types of beams loadings and supports, Shearing force in beam, Bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL and Couple. Bending and shear stresses in beams.

**Unit 3**
Deflection of beams
Introduction – Definitions of slope, deflection, Elastic curve-derivation of differential equation of flexure, Sign convention Slope and deflection for standard loading classes using Macaulay’s method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.

Thick and Thin Cylinders and shells
Analysis of thinwalled shells and analysis of thick cylindrical shells using Lame’s equation.

Elastic stability of columns
Introduction – Short and long columns, Euler’s theory on columns, Effective length slenderness ration, radius of gyration, buckling load. Assumptions, derivations of Euler’s Buckling load for different end conditions, Limitations of Euler’s theory, Rankine’s formula and problems.

**TEXTBOOKS:**

**REFERENCES:**

**15MEC211 FLUID MECHANICS AND MACHINERY 4 0 0 4**

**Unit 1**

Hydrostatic Force on plane surfaces and curved surface.


Eulerian and Lagrangian description of fluids, local and convective acceleration. Flow visualization – streamlines, streak lines, pathlines, time lines, contour and vector plots.
Flow kinematics - vorticity and rotationality.

Unit 2
Reynold’s Transport Theorem. Governing equations for mass, linear and angular momentum and energy in the integral form. Applications of these equations. Laminar and turbulent flow regimes.

Bernoulli’s equation. Limitations. Applications of Bernoulli’s equation. Hydraulic and energy grade lines.


Laminar flow in circular pipes - average and maximum velocities, shear stress distribution, Pressure drop computation - Hagen Poiseuille Law.

Flow rate measurement for closed conduits - Venturimeter, Orificemeter, Pilot tube, rotameter, other electrical and mechanical flow measuring systems.

Unit 3


TEXTBOOK:

REFERENCES:

15MEC212 KINEMATICS OF MACHINES 3 0 2 4

Unit 1
Basics of Mechanisms
Definitions – Link, Kinematic pair, Kinematic chain, Mechanism and Machine - Degree of Freedom – Mobility - Kutzbach criterion (Gruebler’s equation) - Grashoff’s law

Kinematic Inversions of four-bar chain and slider crank chain - Mechanical Advantage - Transmission angle. Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Steering gear for automobile, Hooke’s joint, Toggle mechanism, Ratchets and escapements - Indexing Mechanisms, Steering gear mechanisms such as Davis and Ackermann Steering gear.

Unit 2
Kinematic Analysis
Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for displacement, velocity and acceleration, velocity and acceleration polygons, Instantaneous Centre of Velocity, Kennedy Theorem, Klein’s Construction; Shaping machine mechanism - Coincident points – Coriolis acceleration, Analytical method of analysis of slider crank mechanism and four bar mechanism. Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism.

Unit 3
CAMS
Classifications - Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions - Graphical construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams.

GEARS
Classification of gears - Gear tooth terminology - Fundamental Law of toothed gearing and involute gearing - Length of path of contact and contact ratio - Interference and undercutting - Gear trains - Simple, compound and Epicyclic gear trains - Differentials.

Unit 4 (Practicals)
• To study various types of kinematics links, pairs, chains and mechanisms
• To study inversions of a 4-Bar mechanism
• To study the inversions of single mechanism
• To study the inversions of double slider crank mechanism
• To plot joint angle, velocity and acceleration of coupler link against crank rotation for a four-bar mechanism.
• To plot slider displacement, velocity and acceleration of slider against crank rotation for slider crank mechanism
• To study various types of gears – helical, cross helical, worm, bevel gear, rack and pinion.
• To study various types of cam and follower arrangements.
To Study various types of gear trains – Simple, Compound, reverted, Epicyclic and Differential.

To Develop a prototype of a four-bar mechanism

To Develop a prototype of a Geneva mechanism

**TEXTBOOK:**

**REFERENCES:**

**15MEC213 MANUFACTURING PROCESS I 3 0 0 3**

**Unit 1**
Metal casting processes: Introduction to Metal casting - Pattern, core and Mould making - Moulding, sand properties and testing - Principles of gating and riser design - Melting furnaces - Casting processes - sand, die, gravity, centrifugal castings, shell mould and Investment casting. Fettling and cleaning of casting - Inspection of casting and Casting defects.

**Unit 2**

**Unit 3**
Metal joining processes: Principles of welding – fusion, resistance and solid state welding – soldering, brazing and adhesive bonding, arc welding, resistance welding, gas welding, thermit welding, ultrasonic welding, electron beam welding, laser beam welding and explosive welding – weld defects and inspection.

Powder metallurgy - production of metal powders - characteristics of metal powders - compaction - sintering - applications.

**TEXTBOOK:**

**REFERENCES:**
1. Roy A. Lindberg - 'Processes and Materials for Manufacture' - Prentice Hall of India Private limited - 2000
3. Amitabh A. Ghosh and Asok Kumar Maltil - 'Manufacturing Science' - Affiliated East-West, Press Private Limited - 2010

**15MEC230 AIRCRAFT SYSTEMS AND ENGINEERING 3 0 0 3**

**Unit 1**

Introduction to Aircrafts: Basic Components of an Aircrafts, 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. Advantages and Disadvantages of this Configuration.

**Unit 2**

Unit 3
Basic Principles of Flight: Significance of Speed of Sound, Air Speed and Ground Speed, Properties of Atmosphere, Bernoulli’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.


TEXTBOOKS:

REFERENCES:

15MEC231 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

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:

15MEC233 CONDITION MONITORING AND DIAGNOSTIC 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
Pattern Recognition: Feature extraction and feature selection methods, feature reduction using PCA - discriminant functions and decision boundaries, decision trees, maximum likelihood and nearest neighbour classification - Bayesian theory, neural networks, fuzzy logic and support vector machines (SVM) in classification.

Application and case studies of condition monitoring: Bearings, gear boxes, engines, structural health monitoring, machine tool condition monitoring etc.

TEXTBOOKS:
1. Balageas D., Fritzen C P. and Guemes A. - ‘Structural Health Monitoring’ - Published by ISTE Ltd., USA - 2006

REFERENCE BOOKS:

15MEC234 DESIGN FOR MANUFACTURE AND ASSEMBLY

Unit 1

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

Interchangeable part manufacture and selective assembly - control of axial play - introducing secondary machining operations, laminated shims - examples.

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.


TEXTBOOKS:

REFERENCES:

15MEC235 FRACTURE MECHANICS 3 0 0 3

Unit 1
Introduction to Fracture Mechanics: Failures in structures - types and causes, historical perspective, fracture mechanics approach to design - energy criterion, stress intensity approach, time dependent crack growth and damage tolerance, effect of material properties on fracture.

Linear Elastic Fracture Mechanics (LFEM): Stress concentration effect of flaws, Griffith energy balance, the energy release rate, instability and resistance curve (R-curve), stress analysis of cracks, relationship between stress intensity factor and energy release rate (K and G), crack tip plasticity, mixed mode crack initiation and propagation.

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.

SYLLABI B. Tech. - Mechanical Engg. 2015 admissions onwards

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:

15MEC236 MATERIALS SELECTION 3 0 0 3 IN MECHANICAL DESIGN

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.

Principles of process selection and classification - casting, forging, moulding, fabrication, welding, joining, machining, powder processing, composite processing. Illustration of the principles with case studies.

Multiple constraints and objectives - case studies. Design of hybrid materials - case studies.

TEXTBOOK:
Ashby M. F. - 'Materials selection in mechanical design' - Butterworth Heinemann - 2010 - 3rd Edition

REFERENCE:
ASM Handbook - 'Materials Selection and Design' - 1997

15MEC237 MECHATRONICS 3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:
3. Dan Neculescu - 'Mechatronics' - Pearson Education Asia - 2002
REFERENCES:

15MEC239 MODELING AND SIMULATION OF ENGINEERING SYSTEMS

Unit 1


Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15MEC240 OPTIMIZATION TECHNIQUES IN ENGINEERING

Unit 1

Linear programming methods for optimum design: Review of Linear programming methods for optimum design – Post optimality analysis - Application of LPP models in design and manufacturing.

Unit 2
Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy’s steepest descent method, Newton’s method, Conjugate gradient method.

Optimization algorithms for solving constrained optimization problems – direct methods – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Unit 3

TEXTBOOK:

REFERENCES:

15MEC241 PRESSURE VESSEL DESIGN

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
End Closures - ASME equations for various types of heads – Hemispherical, flat, ellipsoidal, torispherical, and conical heads.

Discontinuity Stresses - Discontinuity stresses - Beams on elastic foundation, Cutouts and Reinforcements – Stress concentrations around a hole – Reinforcements.

Fatigue Assessment - Exemption from fatigue analysis - S-N curves - Design curves - Cumulative damage - Fatigue evaluation.

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:
2. Chattopadhyaya S. - 'Pressure Vessels - Design and Practice' - CRC Press - 2005

REFERENCES:
1. Brownell and Young - 'Process Equipment Design' - Wiley Publishing Ltd. - 1959

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:

15MEC243 TOOL DESIGN 3 0 0 3

UNIT 1

UNIT 2

UNIT 3
Syllabi

B. Tech. - Mechanical Engg.  2015 admissions onwards

Drawing Dies: Metal flow and factors affecting drawing, blank size calculations, drawing force, single and double acting drawing dies, design and development of drawing dies for different components.

Bending and Forming Dies: Spring back, bend allowance; calculation of development length, bending force calculations types of bending dies. Curling dies.

Forging process and forging dies. (Introductory Treatment)

Textbooks:

Reference Books:

15MEC246  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.


Textbook

References

15MEC247  COMBUSTION ENGINEERING  3 0 0 3

Unit 1


Unit 2

Unit 3

**15MEC248 COMPUTATIONAL FLUID DYNAMICS 3 0 0 3**

**Unit 1**


**Unit 2**


**Unit 3**
Computational heat transfer: Steady one & two dimensional heat conduction, Unsteady one-dimensional heat conduction, over-relaxation and under-relaxation. One dimensional steady convection and Diffusion.


**TEXTBOOKS:**

**REFERENCES:**

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**15MEC249 DESIGN OF THERMAL SYSTEMS 3 0 0 3**

**Unit 1**


**Unit 2**

**Unit 3**


**TEXTBOOKS:**

**REFERENCES:**
1. ‘ASHRAE Guide & applications’ - ASHRAE, USA -1985
SYLLABI


2015 admissions onwards


15MEC250 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
Pneumatic system fundamentals: FRL, actuators and valves. Logic Circuits - Position - Pressure Sensing, switching, electro-pneumatic systems.


PLC programming – Microprocessors - Principles of Low Cost Automation - Case studies.

TEXTBOOK:

REFERENCES:

SYLLABI


2015 admissions onwards


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:

15MEC252 GAS DYNAMICS AND JET PROPULSION 3 0 0 3

Unit 1

Isentropic Flow: Nozzle and Diffusers, compressors and turbines - Use of Gas tables. Flow through ducts: Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - Variation of flow properties - Use of tables and charts - Generalized gas dynamics.

Unit 2
Normal and oblique shocks: Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl Meyer relations – Expansion of supersonic flow, Use of table and charts - Applications.
Unit 3


TEXTBOOKS:

REFERENCES:

15MEC253 INTERNAL COMBUSTION ENGINES 3 0 0 3 AND POLLUTION CONTROL

Unit 1


Unit 2

Thermo chemistry: Pollutant formation, Instrumentation to measure pollutants - Pollutant calculation - Effect of air-fuel ratio.

SYLLABI B. Tech. - Mechanical Engg. 2015 admissions onwards

Unit 3

Alternate Fuels: Engine modifications for alternate fuels (liquid and gaseous fuels), homogenous charge compression ignition engines.

TEXTBOOKS:

REFERENCES:

15MEC254 PETROLEUM REFINERY ENGINEERING 3 0 0 3

Unit 1
Origin, Extraction and Testing of petroleum.
Petroleum - Origin, nature, composition, classification, exploration, drilling, transportation and storage. Petroleum processing - Nature of crude from India, Indonesia, Burma and Middle East countries, classification of crude, evaluation of petroleum - Important properties and test methods T.B.P. and ASTM distillation.

Refining of Petroleum - Dewatering and desalting - Primary Oil refining - Treatments of crude - Topping, vacuum distillation.

Unit 2
Thermal cracking, visbreaking and coking, catalytic cracking, fluid bed and hydro cracking, reforming, chemical reforming and catalytic reforming, polymerization, alklylation, hydrogenation isomerisation, cyclization.

Treatment processes: Sweating, desalting, hydrogen treatment, hydrosulphurisation process, solvent extraction of kerosene, stabilization of gasoline. Lube oil manufacture - solvent dewaxing, solvent extraction, propane deasphalting, and treatment, clay treatment, hydro finishing, hydrotreatment, lube oil, additives and asphalt boiling.
UNIT 3
Petroleum products: LPG Motor spirit, aviation gasoline, kerosene, aviation turbine fuel, white spirit, and solvents, diesel fuel, gas oil, fuel oil, petroleum coke, petroleum waxes, lubricating oil and bitumen. Petrochemicals - Olefins, acetylene, propylene, butadiene, isoprene, aromatics, benzene, xylene etc. Methanol, formaldehyde, chloromethane, ethylene oxide, ethanol amine, acetone, cumene, phenol, styrene, phthalic anhydride.

TEXTBOOKS:

REFERENCE:
N. K. Sinha - 'Petroleum Refining & Petrochemicals'

15MEC255 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 - comparison of diesel plant with thermal plant.

Comparison and types of gas turbine power plants and their components, combined gas and steam power plants - Advantages of gas turbine plant over diesel and thermal plants.

Unit 2
General components of Nuclear reactors - types of reactors - location safety and economics of nuclear plants - comparison with thermal power plants.

Steam power plant layout and components - Modern steam generators - types - functions of super heater - Preheater - economizer and air heater.

Unit 3
Fuels and combustion - Fuel preparation and burning, grates, burners draft, combustion calculations, Boiler Trial, Fuel handling systems, Ash handling methods, Gas cleaning methods and dust collection.

Types of condensers - cooling towers - Water treatment methods

SYLLABUS  B. Tech. - Mechanical Engg. 2015 admissions onwards

Economics of power plant operation - Instrumentation and control - variable load operation and economics.

TEXTBOOKS:

REFERENCES:

15MEC256 REFRIGERATION AND AIR CONDITIONING 3 0 0 3

Unit 1


Unit 2

Selection and balancing of system components - Graphical method.

Psychrometry: Moist air behaviour - Psychrometric chart - Different Psychrometric process analysis.

Unit 3

TEXTBOOK:

REFERENCES:
15MEC257 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

Thermal: Pyrolysis, gasification process, variables affecting the process, types of gasifiers, construction and working of gasifiers. Application: Gasification of biomass, process industry waste viz. - paper mill, waste cotton mill, saw mill, etc.

Unit 3
Ocean energy: Tidal: Types of energy harnessing techniques, turbines – construction, working and performance characteristics. Ocean thermal: Open cycle, closed cycle, Components of ocean thermal power plant, working and challenges.

Fuel cells: Principle of working of Hydrogen, Carbon Monoxide, fuel cell etc.

TEXTBOOK:

REFERENCES:

15MEC258 TURBOMACHINERY 3 0 0 3

Unit 1

TEXTBOOKS:

REFERENCES:
15MEC261 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:

15MEC262 ADVANCED MANUFACTURING PROCESSES  3 0 0 3

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

Non-traditional 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.

TEXTBOOK:
Serope Kalpakjian and Steven R. Schmid - 'Manufacturing Engineering and Technology' - Prentice Hall - 2013 - 7th Edition

REFERENCE BOOKS:

15MEC263 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.

TEXTBOOKS:
REFERENCES:

15MEC264 ADVANCED METROLOGY AND SENSING SYSTEMS

Unit 1

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:
15MEC266  CNC MACHINES  3 0 0 3

Unit 1
Introduction: Definition of automation, types of automation, Definition of NC, basic components of NC system, the NC procedure, NC Coordinate system, NC motion control systems, Interpolators – linear, circular and parabolic, applications of numerical control.

Features of CNC Machine Tools
Structure, Spindle design, spindle bearings, spindle drives, feed drives – DC servo motors, stepper motors and AC servo motors, actuation systems – recirculating ball screws and anti-friction guide ways, feed-back devices – optical rotary encoders and linear scales.

CNC Machining center developments, turning center developments, high speed CNC machine tools, automatic tool changers.

Manual Programming
Turning center programming: Axes system, ISO standards for coding, tool function, speed function, feed function, miscellaneous functions, rapid positioning, linear interpolation, circular interpolation, thread cutting, canned cycles

Unit 2
Machining center programming: axes system, tool function, speed function, feed function, miscellaneous functions, rapid positioning, linear interpolation, circular interpolation, tool length compensation, canned cycles for drilling, tapping and boring, cutter radius compensation.

Computer Aided Part Programming
APT language structure, Geometry statements, Motion statements, Post processor & auxiliary statements, MACROs, complete part programming in APT.

Unit 3
CNC Tooling
Turning tool geometry, modular tooling systems for turning, collet chucks, end mill adapters, morse taper adapters, boring heads and tapping heads, milling tooling systems, tool presetting, work holding devices - vices, grid plates, pneumatic and hydraulic clamps.

Assembly Techniques
Guide ways, ball screws and nut, feedback elements, spindle bearings.

15MEC267  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, prepegs, 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.

Mechanical testing - tensile, compressive, Intra-laminar shear, Inter-laminar shear and fracture.


Unit 3

Metal and ceramic matrix composites - wettability of reinforcement to matrix and bonding, methods of manufacturing reinforcements with intermediate wetting layer.

**TEXTBOOKS:**

**REFERENCES:**

**15MEC268 METAL FORMING TECHNOLOGY 3 0 0 3**

**Unit 1**

**Unit 2**


**Unit 3**

**15MEC269 MICRO-MANUFACTURING 3 0 0 3**

**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**

TEXTBOOKS:

REFERENCES:

15MEC270 MODERN PRACTICES IN PRODUCT DESIGN AND MANUFACTURE

Unit 1
Creativity & Innovation: Aesthetics – Industrial design concepts – capturing customer voice – New product development – QFD.


Unit 2

Unit 3


TEXTBOOKS:

REFERENCES:

15MEC271 NON-DESTRUCTIVE TESTING

Unit 1


Unit 2

Unit 3

TEXTBOOKS:
SYLLABI  B. Tech. - Mechanical Engg.  2015 admissions onwards

REFERENCE:
ASM Metals Hand Book, 'Non-Destructive Evaluation and Quality Control' - American Society of Metals, Metals Park Ohio, USA - 1989

15MEC272    PRODUCT COST ESTIMATION    3 0 0 3

Unit 1
Cost estimation: Importance and aims of cost estimation - functions of estimation - difference between estimating and costing - importance of preparing realistic estimates - estimating procedure.

Elements of cost, Objectives - elements of costs - ladder of cost - determination of material cost - labour cost - expenses.

Unit 2
Analysis of overhead expenses, Distribution of overhead costs – depreciation - causes of depreciation - methods of calculating depreciation.

Estimation of machining time, Calculation of machining time for lathe operations - estimation of time on drilling machine - estimation of time for shaping, planning, milling and grinding.

Unit 3
Costing for metal forming and fabrication processes, Estimation of cost in welding - estimation in forging shop - cost estimation of foundry work.

TEXTBOOKS:

REFERENCES:

15MEC273    QUALITY CONTROL AND RELIABILITY ENGINEERING    3 0 0 3

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:
1. Montgomery D. C. - 'Introduction to Statistical Quality Control' - John Wiley - 2010

REFERENCES:
15MEC274 SIMULATION MODELING OF MANUFACTURING SYSTEMS

Unit 1

Introduction to Simulation softwares.


Unit 2

Model Building of Discrete systems: Modelling Paradigms - Modelling of Structural elements and Operational elements – Modelling issues – Model Verification and Validation.

Unit 3
Applications of Simulation in Manufacturing – Manufacturing Modelling Techniques – Modelling Material Handling system – Model building exercises using Arena - Case study.

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:

15ME281 MATERIALS TESTING AND METALLURGY LAB.

Mechanical testing of materials: Experiments to determine Young’s modulus, yield strength, ultimate tensile strength of ductile and brittle materials. Shear and impact test on materials, determination of Brinell’s, Rockwell and Vicker’s hardness, micro hardness, fatigue and flexural strength of materials.


15ME285 FLUID MECHANICS AND MACHINES LAB.

Calibration of flow measuring devices: Notches, Orifice meter, Venture meter, Verification of Bernoulli’s equation, Reynolds apparatus and Meta centric height of a floating body. Experiments to study frictional losses in pipes, losses in bends and elbows.

Performance test on different types of pumps, Impact of jet on vanes, Performance test on different types of turbines.

15ME301 DESIGN OF MACHINE ELEMENTS I

Unit 1
Introduction:

Design for Strength:
Design for Static Loading: Simple Stresses - tensile Stress, Compressive Stress and Shear Stress, Compound Stresses - Torsional Stress and Bending Stress, Types of Loading, Simple and Compound Stresses, Working Stress, Factor of Safety, Factors Influencing selection of FOS, Eccentric Loading, Combined Loading, Theories of Failure,


Stress Concentration: Stress Concentration, Stress Concentration Factor, Determination of Stress Concentration factor, Methods of Reducing Stress Concentration,
Unit 2

DESIGN OF SHAFTS: Design for strength and Rigidly with Steady loading, ASME & BIS codes for Power Transmission shafts, Shafts subjected to Combined Twisting Moment and Bending Moment, Shafts under Fluctuating loads and Combined loads.

KEYS AND COUPLINGS: Keys and Splines, Design of keys, Design of Rigid and Flexible couplings.

Unit 3
MECHANICAL JOINTS:
Welded Joints: Types, Strength of Butt and Fillet welds, Eccentrically loaded Welded Joints

POWER SCREWS: Types of Screw Threads used for Power Screws, Torque required to Raise and Lower the load, Efficiency and Self-locking, Design of Screw Jack. Design of screws for C-Clamp and machine vice.

TEXTBOOKS:

REFERENCES:

15MEC302 DYNAMICS OF MACHINES 3 0 0 3

Unit 1
Static and Dynamic Force Analysis

Flywheels
Turning moment diagrams - Flywheels of engines and punch press.

Unit 2
Balancing of rotating masses and Reciprocating masses
Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Primary and secondary unbalanced forces - Balancing Multi-cylinder Engines - Firing order - Balancing machines.

Unit 3
Control Mechanisms
Governors
Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling Force - Quality of governors - effect of friction.

Gyroscope
Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Automobiles, Airplanes and Ships

TEXTBOOKS:

REFERENCES:

15MEC303 HEAT POWER ENGINEERING 3 0 0 3

Unit 1
Combined first law and second law of open systems, reversible steady flow work, available energy, irreversibility, exergy and second law efficiency.
Vapour power cycles: Simple Rankine Cycle, reheat cycle, regenerative cycles


Steam turbines: Impulse and Reactions turbine, compounding principles.

Unit 2


Unit 3


Air conditioning systems: Psychrometry, Air-conditioning equipment, components and control, cooling load calculations.

**TEXTBOOKS:**

**REFERENCES:**
SYLLABI  
2015 admissions onwards

15MEC311  DESIGN OF MACHINE ELEMENTS II  3 1 0 4

Unit 1  
BEARINGS

Journal bearings (Sliding contact bearing) - Bearing characteristic numbers, Petroff's equation, Sommerfeld number, Mckee's equation, Journal bearings design.

Rolling Contact Bearings - Types, Static & Dynamic load carrying capacity, Reliability, Selection of antifriction bearings for Static & Dynamic conditions, Selection of antifriction bearings for constant and varying loads.

FLEXIBLE TRANSMISSION SYSTEM
Introduction, Classification & Application of flexible power transmission systems, Simple and Compound power drives.

Belt Drives - Flat belt drives, types, belt configuration, velocity ratio, slip, condition for maximum power transmission, length of open and cross belt drives, centrifugal tension, initial tension, selection of belts, flat belt pulleys, fast and loose pulleys, Designation of V-belt, Advantages and Disadvantages of v-belt drives, Selection of V-belt,

Rope Drives - Types, Designation of wire rope, Length of wire rope, factor of safety, Stresses in hoisting wire ropes, Selection of wire ropes, Wire rope Sheaves and Drums.

Chain drives - Introduction, Terms used in chain drives, Classification, Conveyor chains, Power transmitting chains, Roller chains, Factor of Safety for chain drives, Selection of chain drives.

Unit 2  
GEARS - Types, Applications and Gear Terminology,

Spur Gears - Law of gearing, conjugate action and interference in gears, Gear tooth profiles, involute profile, Influence of number of teeth and pressure angle, Gear tooth failure modes, beam strength of gear tooth - Lewis equation, Gear materials, Force analysis, Design for strength, Dynamic and wear load.

Helical gears – Applications, Virtual number of teeth on helical gears, Force analysis, Design of helical gears.

TEXTBOOKS:
3. 'Design Data: Data Book of Engineers' by PSG College Kalai Kathanachacharam, Coimbatore, 2012.

REFERENCES:

NOTE: Design of some of the above components for practical applications can be emphasized for better understanding and Continuous Evaluation of the Course.

SYLLABI  
2015 admissions onwards

15MEC312  HEAT TRANSFER  3 1 0 4

Unit 1  
Unit 2
Convective heat transfer: Newton's law of cooling, Prandtl number, hydrodynamic and thermal boundary layer, forced convection, Nusselt number, empirical relations in forced convection for flat plates, cylinders and spheres, Flow over tubes and bank of tubes internal flow and heat transfer: fully developed laminar flow in pipes, turbulent forced convection, free convection, Natural convection: dimensionless numbers, combined natural and forced convection, Phase change heat transfer: Pool boiling, convective boiling, film and drop wise condensation, empirical relations for heat transfer with phase change.

Unit 3
Heat exchangers: Types, classifications, selection, standards, parallel, counter and mixed flow, multiple passes, LMTD, correction factors, effectiveness, NTU methods. Process design and construction of double pipe and shell and tube heat exchangers. Radiation heat transfer: electromagnetic radiation spectrum, thermal radiation, absorptivity, reflectivity, transmissivity, emissivity, black body, gray body and white body, monochromatic and total emissive power, Planck's law, Stefan-Boltzmann law, Wein's Displacement law, Radiation exchange between surfaces, view factors, radiation shields, greenhouse effect.

TEXTBOOKS:

REFERENCES:
3. Adrian Bejan - 'Heat Transfer' - Wiley India Pvt Ltd. - 2011

15MEC313 INTRODUCTION TO FINITE ELEMENT METHODS 3 0 2 4

Unit 1
Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principal of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method, Galerkins method, Guass elimination method, Numerical integration.

Basic Procedure: General description of Finite Element Method, Engineering applications of finite element method, Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing.

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal triangle, Linear interpolation polynomials in terms of global coordinates of bar, triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates of bar, triangular (2D simplex) elements, CST element.


Unit 2
Solid Mechanics Applications: Direct method for bar element under axial loading, trusses, beam element with concentrated and distributed loads, matrices, Jacobian, Jacobian of 2D triangular element, quadrilateral, Consistent load vector.

Solution of bars, stepped bars, plane trusses, space truss, beams and frames by direct stiffness method. Solution for displacements, reactions and stresses by using elimination approach, penalty approach. Plane stress, plane strain and Axisymmetric problems. Dynamic Analysis.

Unit 3
Heat Transfer and Fluid Flow Problems: Steady state heat transfer, 1D and 2D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins, heat transfer 1D and 2D problems with conduction and convection.

Fluid flow problems and Introduction to Finite Element Packages and its application to solid mechanics, fluid and heat transfer problems

TEXTBOOKS:

REFERENCES:

15MEC314 METROLOGY AND MEASUREMENTS 3 0 0 3

Unit 1
Concept of Metrology: Definition and concept of Metrology - need of Inspection - Generalized measurement system - Units and standards - measuring instruments; sensitivity, stability, range, accuracy and precision, static and dynamic response, repeatability - systematic and random errors - correction; calibration.


Unit 2
Surface Texture and Screw Thread Measurement: Elements of surface texture - Evaluation of surface finish - Peak to valley height - Talysurf, Tomlinson surface meter - Screw thread terminology - Measurement of various elements of thread; Measurement of thread angle by two wire and Three wire methods; Thread gauges and floating carriage micrometer.

Form Measurements: Measurement of Straightness, Flatness, Parallelism, squareness testing, Roundness testing - Radius Gauge, Wire Gauge, etc.

Signal Representation – Signal conditioners, filters, ADC, DAC

Unit 3
Wheatstone bridge, use of bridge circuits - Displacement measurement - Potentiometer - LVDT, Piezo electric type - Velocity measurement.

15MEC331 ENGINEERING ECONOMIC ANALYSIS 3 0 0 3

Unit 1


Unit 2

Profit and revenue maximization: Optimal input combination. Total revenue maximization.
Unit 3


TEXTBOOKS:
Webster T. J. - ‘Managerial Economics - Theory and Practice’ - Elsevier - 2004

REFERENCE BOOKS:

15MEC332 ENTERPRISE MANAGEMENT 3 0 0 3

Unit 1


Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:

15MEC333 FINANCIAL MANAGEMENT 3 0 0 3

Unit 1


Unit 2

Unit 3


Mergers and Takeovers - International trade.

TEXTBOOK:

REFERENCES:
1. Denzi Watson & Antony Head - ‘Corporate Finance Principles and Practice’ - Pearson Education Asia, - 2002 - 2nd Edition

**15MEC334 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 .


**TEXTBOOKS:**


**15MEC335 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.


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

**TEXTBOOKS:**

**REFERENCES:**
2. Rother M. and Shook J. - ‘Learning to See’ - The Lean Enterprise Institute, Brookline, USA - 2003
15MEC336 MANAGERIAL STATISTICS 3 0 0 3

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: Decision tree analysis.

TEXTBOOKS:

REFERENCES:

15MEC337 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:
2. Tull D. S. and Hawkins - 'Marketing Research' - Prentice Hall of India – 1997
4. Skinner S. J. - 'Marketing' - All India Publishers and Distributes Ltd. - 1998
15MEC338 OPERATIONS MANAGEMENT

Unit 1


Unit 2

Quality engineering: TQM, Six sigma concepts - Lean manufacturing, ISO standards.

Unit 3
Forecasting: Forecasting system - Judgment methods, Time series methods.


TEXTBOOKS:

REFERENCES:

15MEC339 PROJECT MANAGEMENT

Unit 1


15MEC340 SUPPLY CHAIN MANAGEMENT

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

TEXTBOOK:

REFERENCES:
15MEC341  TOTAL QUALITY MANAGEMENT  3 0 0 3

Unit 1

Unit 2
Customer satisfaction – Customer retention - Employee involvement - Performance appraisal - Continuous process improvement - Supplier partnership - Performance measures. Seven tools of quality. Statistical fundamentals - Control Charts for variables and attributes - Process capability - Concept of six sigma - New seven management tools - Benchmarking.

Unit 3
Quality function deployment (QFD) - Taguchi quality loss function - Total Productive Maintenance (TPM) - FMEA.


TEXTBOOK:

REFERENCES:

15MEC381  MANUFACTURING PROCESS LAB.  0 0 2 1


Study of various processes, tools and equipment’s used in foundry, exercises on mould preparation, foundry sand testing.

15MEC382  THERMAL SCIENCES LAB.  0 0 2 1

Experiments to determine flash and fire point, viscosity, calorific values of solid, liquid and gaseous fuels, Carbon content (Carbon residue test).

Study of I.C engines, components and loading devices, Valve timing and port timing diagrams, Performance test, Heat balance sheet on Petrol and Diesel engines, to find Friction power: Morse test or Motoring test.

Study of Refrigeration and Air conditioning system - Performance Tests (COP), Study of Renewable energy systems (like Solar, Wind, Biomass etc.) - Performance tests.

15MEC385  HEAT TRANSFER AND THERMAL ANALYSIS LAB.  0 0 2 1

HEAT TRANSFER
To determine of thermal conductivity of metal rod and composite wall, heat transfer coefficient in free and forced convection. Performance test on extended surfaces, heat exchangers. Experiment on Transient conduction and radiation heat transfer.

THERMAL ANALYSIS
Introduction to the Software package, Analysis of flow through pipes, elbows and nozzles, Analysis of flow over different objects using CFD software, Analysis of conduction, convection and radiation problems using FEM package

15MEC386  METROLOGY AND MEASUREMENTS LAB.  0 0 2 1

METROLOGY LAB
LINEAR AND ANGULAR MEASUREMENTS: Slip gauges, Micrometers, Verniers, Dial gauges and Surface plates – Comparators: Mechanical, Electrical, Pneumatic and
Optical comparator. Angular measuring instruments - Sine bar, Angle gauges, Spirit level, Auto collimators.


MEASUREMENTS LAB
Calibration of Pressure Gauge, Thermocouple, LVDT, Load cell. Measurement of load, torque, speed, angular displacement. Study of strain gauge rosettes, determination of modulus of elasticity using strain gauges. Study of stress concentration using photo-elasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression.

15MEC390 / 15MEC490 LIVE-IN-LAB. 3 cr

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester or sixth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth or seventh semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

15MEC401 ADVANCED FLUID MECHANICS 3 0 0 3

Unit 1

Unit 2
The boundary layer equations. Displacement thickness. Momentum thickness. Turbulent flat plate boundary layer. Boundary layers with pressure gradients.

SYLLABI B. Tech. - Mechanical Engg. 2015 admissions onwards


Unit 3

TEXTBOOKS:

REFERENCES:
SYLLABI  B. Tech. - Mechanical Engg.  2015 admissions onwards

Schools of  Engineering  Amrita Vishwa Vidyapeetham


Unit 3

Control system analysis in state space: Introduction to the state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test

TEXTBOOKS:
1. K. Ogata - 'Modern Control Engineering' - Prentice Hall (India) - Pearson Education - 2009 - 5th Edition

REFERENCES:

15MEC403  INDUSTRIAL ROBOTICS  3 0 0 3

Unit 1


Unit 2
Direct Kinematic Model – Mechanical structure and notations - Description of links and joints - Kinematic modeling of manipulator - Denavit-Hartenberg Notation - Kinematic Relationship between adjacent links - Manipulator Transformation Matrix.

Inverse Kinematic Model – Manipulator Workspace – Solvability - Solution techniques - Closed form solution.

SYLLABI  B. Tech. - Mechanical Engg.  2015 admissions onwards

Schools of  Engineering  Amrita Vishwa Vidyapeetham

Unit 3

TEXTBOOK:

REFERENCE BOOKS:

15MEC404  MECHANICAL VIBRATIONS  3 0 0 3

Unit 1

Un-damped free vibrations: Single degree of freedom systems. Un-damped free vibration-natural frequency of free vibration, stiffness of spring elements, effect of mass of spring, Compound Pendulum.

Damped free vibrations: Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.

Unit 2
Forced Vibration: Single degree freedom systems, steady state solution with viscous damping due to harmonic force. Solution by Complex algebra, Reciprocating and rotating unbalance, vibration isolation - transmissibility ratio. Due to harmonic excitation and support motion, Whirling of Shafts - Whirling of shafts with and without air damping, Discussion of speeds above and below critical speeds.

Vibration measuring instruments & Vibration Control: Vibration exciters, vibrometer and accelerometer, free & forced vibration tests, vibration isolation, vibration absorbers.
Unit 3


TEXTBOOKS:

REFERENCES:

15MEC411 OPERATIONS RESEARCH 3 0 0 3

Unit 1
Linear programming: Formulations - graphical solutions, simplex method, duality, Transportation model, Assignment model-travelling salesman problem.

Unit 2

Unit 3
Sequencing model - 2 machines n jobs, m machines n jobs-n jobs 2 machines.

Inventory models - deterministic and probabilistic models, Queuing models-poison arrival and exponential service times, single server, multi-server. Simulation: Monte Carlo simulation - simple problems.
15MEC499  PROJECT PHASE II  10 cr

The project should be focused on the synthesis of knowledge gained over the past seven semesters and Phase-I of the project. The project should be relevant to Mechanical Engineering which could involve theoretical and/or computational and/or fabrication and/or experimental work. Students are required to submit a report at the end of the semester. Evaluation will be done during the course of the project as well as at the end of the semester by a committee of examiners appointed by the Chairman of the Department.

15PHY100  PHYSICS  3 0 0 3

Unit 1 Review of Classical Physics and dual nature of Waves/particle


Unit 2 Atomic Structure and Quantum Mechanics

Quantum Mechanics: Introduction - wave equation - Schrodinger’s equation (time dependent and independent) - expectation values, operators, Eigen value (momentum and energy) – 1D potential box (finite and infinite) - tunnel effect - harmonic oscillator.

Unit 3 Statistical Mechanics and Solid State Physics


TEXTBOOK:
torque-free motion - dual-spin spacecraft, satellite maneuvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

TEXTBOOKS:

REFERENCE BOOKS:

15PHY233 BIOPHYSICS AND BIOMATERIALS 3 0 0 3

OBJECTIVE: To equip the students with the knowledge on different kinds of biomaterials and other medical need, basic research, and to provide an overview of theory and practice of biomaterials.

Unit 1

Definition and classification of bio-materials, mechanical properties, visco-elasticity, wound-healing process, Application of biomaterial for the human body, body response to implants, blood compatibility. Implementation problems - inflammation, rejection, corrosion, structural failure. Surface modifications for improved compatibility.

Unit 2
Bioceramics, Biopolymers, Metals, ceramics and composites in medicine: Properties, applications, suitability & modifications required for certain applications.


Unit 3

TEXTBOOKS AND REFERENCES:

15PHY234 INTRODUCTION TO COMPUTATIONAL PHYSICS 3 0 0 3

Unit 1
Differentiation: Numerical methods, forward difference and central difference methods, Lagrange's interpolation method.
Integration: Newton - cotes expression for integral, trapezoidal rule, Simpsons’s rule, Gaussian 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
SYLLABI

B. Tech. - Mechanical Engg. 2015 admissions onwards

REFERENCES:
Suresh Chandra, “Computer Applications in Physics”, Narosa Publishing House, New Delhi
M Hjortroth Jensen, Department of Physics, University of Oslo, 2003 (Available in the Web)

15PHY238 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3

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

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it's consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2
Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti-ferromagnetic materials, ferrites and it's applications.

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

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

TEXTBOOK:

REFERENCES:

15PHY239 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3

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

Unit 2
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 3
Poisson’s and Laplace’s equations, uniqueness theorem, examples of the solution of Laplace’s equation, solution of Poisson’s equation.

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

Unit 3
Electromagnetic waves: EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio.

Transmission line equations, line parameters - examples, dipole radiation, retarded potentials, electric dipole radiation.

TEXTBOOK:

REFERENCES:

15PHY240 ELECTRONIC MATERIAL SCIENCES 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 Eutecloid 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
Used 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:**

**15PHY241 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.


**Unit 2**

Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting, factors controlling cut quality and kerf width. Laser assisted drilling.

Laser welding: Introduction to laser keyhole welding and contrast with conduction limited welding, applications.

**REFERENCES:**

**15PHY243 MICROELECTRONIC FABRICATION 3 0 0 3**

**Unit 1**

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

**Unit 2**

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

Unit 3
Vacuum science: Kinetic theory of gases, gas flow and conductance, vacuum pumps and seals; deposition of thin films: physics of sputtering and evaporation, step coverage and morphology of deposited films, chemical vapor deposition: chemical equilibrium and law of mass action, gas flow and boundary layers, types of CVD, plasma assisted CVD; thermodynamics of epitaxial growth, types molecular beam epitaxy, isolation and contact formation – LOCOS and trench, silicides, metallization with Al and Cu; process Integration: CMOS, bipolar process flow.

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

REFERENCE:

15PHY245
NUCLEAR ENERGY: PRINCIPLES AND APPLICATIONS

Unit 1

Fission and fusion: The fission process, energetic of fission, byproducts of fission, energy from nuclear fuels. Fusion reactions, electrostatic and nuclear forces, thermo nuclear reactions in plasma. Energetics of fusion. Comparison of fission and fusion reactions.

Unit 2
Neutron chain reactions and nuclear power: Criticality and multiplication, factors governing the multiplication, neutron flux and reactor power, reactor types and reactor operations. Methods of heat transmission and removal, steam generation and electric power generation, waste heat disposal.

Unit 3
Breeder reactors and fusion reactors: The concept of breeding nuclear fuel, isotope production and consumption, fast breeder reactor, breeding and uranium sources. Technical problems in the functioning of fusion reactor, requirements for practical fusion reactors, magnetic confinement, inertial confinement and other fusion concepts. Prospects of fusion power.

Radiation protection and waste disposal: Biological effects of radiation, radiation dose units, protective measures, internal exposure, and radon problem. Nuclear fuel cycle and waste classification, spent fuel storage and transportation, high level waste disposal, low level waste disposal.

TEXTBOOK:

REFERENCES:
1. David Bodansky, Nuclear Energy: principles, practices and prospects, Springer Verlag

15PHY247
PHOTOVOLTAICS

Unit 1
Introduction to semiconductors: Semiconductors: concept of electron and holes, conduction in semiconductors and concentration of charge carriers in semiconductors. Direct and indirect band gap semiconductors (quantum mechanical treatment). Extrinsic semiconductors: n-type, p-type & compensation doping, carrier concentration; PN junction - concept of bands at PN junction, junction under forward and reverse biases (conceptual).

Unit 2


Unit 3
Syllabi


2015 admissions onwards


Advanced Solar cell technologies (III Generation): Alternatives to conventional Si based solar cells - thin film solar cells, Hetero junction solar cells, Tandem solar cells: material properties, fabrication and stability (includes nano scale devices). Organic solar cells.

Textbook:

References:

15PHY248

Physics of Lasers and Applications

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 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. Lasers transition – role of electrons in Lasers transition, levels of Lasers action: 2 level, 3 level and 4 level laser system.

Applications in Communication field:
Lasers 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:

15PHY250

Quantum Physics and Applications

Unit 1

Unit 2
Bosons and Fermions - symmetric and antisymmetric wavefunctions - elements of statistical physics: density of states, fermi energy, Bose condensation - solid state physics: Free electron model of metals, elementary discussion of band theory and applications to semiconductor devices.
Einstein coefficients and light amplification - stimulated emission - optical pumping and laser action.

Unit 3
Operation of He-Ne laser and Ruby laser - laser in science and industry - Raman effect and applications.

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

TEXTBOOK:
A Beiser, Perspectives in Modern Physics, McGraw Hill

REFERENCES:

15PHY251   THIN FILM PHYSICS  3 0 0 3

Unit 1
Introduction and preparation of thin film: Difference between thin and thick film. Appreciation of thin film technology in modern era. Deposition technology: Physical methods, chemical methods, other new techniques, vacuum technology; Vacuum pumps & pressure gauges.

Defects in thin film: General concepts, nature of defect, microscopic defect and dislocation. Boundary defects. Defect and energy states - donar acceptor levels, trap and recombination centers, excitons, phonons.

Unit 2

Properties of thin film: Optical behaviors: transmission, reflection, refractive index, photoconductivity, and photoluminescence.

15PHY331   ASTRONOMY  3 0 0 3

Unit 1

Unit 2
Observational Astronomy
Observing the Universe - The classic Newtonian telescope - The Cassegrain telescope - Cataiodptic telescopes - The Schmidt camera - The Schmidt–Cassegrain telescope - The Maksutov–Cassegrain telescope - Active and adaptive optics - Some significant optical telescopes - Gemini North and South telescopes - The Keck telescopes - The South Africa Large Telescope (SALT) - The Very Large Telescope (VLT) - The Hubble Space Telescope (HST) - The future of optical
astronomy - Radio telescopes - The feed and low noise amplifier system - Radio receivers - Telescope designs - Large fixed dishes - Telescope arrays - Very Long Baseline Interferometry (VLBI) - The future of radio astronomy - Observing in other wavebands – Infrared – Sub-millimetre wavelengths - The Spitzer space telescope - Ultraviolet, X-ray and gamma-ray observatories - Observing the universe without using electromagnetic radiation - Cosmic rays - Gravitational waves.

Unit 3

TEXTBOOK:
Introduction to Astronomy and Cosmology, Ian Morison, Wiley (UK), 2008

REFERENCE BOOK:

15PHY333          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
Basic concepts – excitons, effective mass, free electron theory and its features, band structure of solids. Bulk to nanotransition – density of states, potential well...
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

TEXTBOOK:

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

15PHY338 PHYSICS OF SEMICONDUCTOR DEVICES 3 0 0 3

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


Unit 2

TEXTBOOKS:

REFERENCES:

15PHY532 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
Stellar astronomy: H-R diagram, color-magnitude diagram - main sequence - stellar evolution – red giants, white dwarfs, neutron stars, black holes - accretion disc -
Schwarzschild radius - stellar masses Saha–Boltzman equation - derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3
Galactic astronomy: Distance measurement - red shifts and Hubble’s law – age of the universe, galaxies – morphology - Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.


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:

15PHY535 EARTH’S ATMOSPHERE 3 0 0 3

Unit 1
Earth’s atmosphere: overview and vertical structure. Warming the earth and the atmosphere: temperature and heat transfer; absorption, emission, and equilibrium; incoming solar energy. Air temperature: daily variations, controls, data, human comfort, measurement. Humidity, condensation, and clouds: circulation of water in the atmosphere; evaporation, condensation, and saturation; dew and frost; fog.

Unit 2
Unit 3

Unit 4
Shorelines: coastal zone, waves & erosion, sand movement, shoreline features & stabilization; erosion problems along U.S. coasts, hurricanes, coastal classification, tides. Earthquakes and earth’s interior: faults, seismology, locating the source of an earthquake, measuring intensity, belts and plate boundaries, destruction, damage east of the Rocky Mountains, earthquake prediction, earth’s interior. Plate tectonics: continental drift, divergent boundaries, convergent boundaries, transform fault boundaries, testing the plate tectonics model, the breakup of Pangaea, measuring plate motion, what drives plate motions, plate tectonics in the future.

Unit 5
Origin and evolution of the ocean floor: continental margins, features of deep-ocean basins, anatomy of oceanic ridge, oceanic ridges and seafloor spreading, nature of oceanic crust, continental rifting, destruction of oceanic lithosphere. Crustal deformation and mountain building: structures formed by ductile & brittle deformation, mountain building at subduction zones, collisional mountain belts, fault-block mountains, vertical movements of the crust. Geologic time: time scales, relative dating, correlation of rock layers; dating with radioactivity, the geologic time scale, difficulties in dating. Earth’s evolution: birth of a planet, origin of the atmosphere and oceans, Precambrian (formation of continents); Phanerozic (formation of modern continents & earth’s first life); Paleozoic (life explodes); the Mesozoic (dinosaurs); Cenozoic era (mammals). Global climate change: climate & geology, climate system, detecting change; atmospheric basics & heating the atmosphere; natural & human causes; carbon dioxide, trace gases, and climate change; climate-feedback mechanisms, aerosols, some possible consequences.

TEXTBOOK:

REFERENCE:

15PHY540 NONLINEAR DYNAMICS 3 0 0 3

Unit 1
Introduction: examples of dynamical systems, driven damped pendulum, ball on oscillating floor, dripping faucet, chaotic electrical circuits.

One-dimensional maps: the logistic map, bifurcations in the logistic map, fixed points and their stability, other one-dimensional maps.

Non-chaotic multidimensional flows: the logistic differential equation, driven damped harmonic oscillator, Van der Pol equation, numerical solution of differential equations.

Dynamical systems theory: two-dimensional equilibrium and their stability, saddle points, are contraction and expansion, non-chaotic three-dimensional attractors, stability of two-dimensional maps, chaotic dissipative flows.

Unit 2
Lyapunov exponents: for one- and two-dimensional maps and flows, for three-dimensional flows, numerical calculation of largest Lyapunov exponent, Lyapunov exponent spectrum and general characteristics, Kaplan-Yorke dimension, numerical precautions.

Strange attractors: general properties, examples, search methods, probability of chaos and statistical properties of chaos, visualization methods, basins of attraction, structural stability.

Bifurcations: in one-dimensional maps and flows, Hopf bifurcations, homoclinic and heteroclinic bifurcations, crises.

Hamiltonian chaos: Hamilton’s equations and properties of Hamiltonian systems, examples, three-dimensional conservative flows, symplectic maps.

Unit 3
Time-series properties: examples, conventional linear methods, a case study, time-delay embeddings.
Nonlinear prediction and noise-reduction: linear predictors, state-space prediction, noise reduction, Lyapunov exponents from experimental data, false nearest neighbours. Fractals: Cantor sets, curves, trees, gaskets, sponges, landscapes.

Calculations of fractal dimension: similarity, capacity and correlation dimensions, entropy, BDS statistic, minimum mutual information, practical considerations.

Fractal measure and multifractals: convergence of the correlation dimension, multifractals, examples and numerical calculation of generalized dimensions.

Non-chaotic fractal sets: affine transformations, iterated functions systems, Mandelbrot and Julia sets.

Spatiotemporal chaos and complexity: examples, cellular automata, coupled map lattices, self-organized criticality.

**TEXTBOOK:**

**REFERENCES:**

**15PHY542**  **OPTOELECTRONIC DEVICES**  **3 0 0 3**

**Unit 1**

Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence, electroluminescence, 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:**

**15SAN101**  **SANSKRIT I**  **1 0 2 2**

**OBJECTIVES:** To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

**Unit 1**
Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit

**Unit 2**
Verbs- Singular, Dual and plural – First person, Second person, Third person.

Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi-karthariprayoga
SYLLABI  
2015 admissions onwards

Unit 3  
Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4  
Selected slokas from Valmiki Ramayana, Kalidasa’s works and Bhagavad Gita, Ramayana – chapter VIII - verse 5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa’s Sakuntalam Act IV – verse 4

Unit 5  
Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:  
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalalingusanasanam by Amarasimha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nimayasagar press

15SAN111   
SANSKRIT II

OBJECTIVES: To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1  
Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2  

Unit 3  
Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

Unit 4  
Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas - Bhagavad Gita –

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2015 admissions onwards

chapter - II verse 47, chapter - IV verse 7, chapter - VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa’s Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5  
Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:  
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalalingusanasanam by Amarasimha published by Travancore Sanskrit series

15SSK221   
SOFT SKILLS I

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

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

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

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

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

Problem solving level I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;
Problem solving level II: Time speed and distance; work time problems;

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

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

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

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

15SSK321 SOFT SKILLS II 1 0 2 2


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.

15SSK331 SOFT SKILLS III 1 0 2 2

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

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

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

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

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

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

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

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

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

15SWK230 CORPORATE SOCIAL RESPONSIBILITY 2002

Unit 1
Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2
CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3
Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

REFERENCES:

15SWK231 WORKPLACE MENTAL HEALTH 2002

Unit 1
Mental Health – concepts, definition, Bio-psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person. Work place – definition, concept, prevalence of mental health issues in the work...
place, why invest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

Unit 2
Mental Health Issues in the Workplace: Emotions, Common emotions at the workplace, Mental Health issues - Anger, Anxiety, Stress & Burnout, Depression, Addictions – Substance and Behavioural, Psychotic Disorders - Schizophrenia, Bipolar Disorder, Personality disorders. Crisis Situations - Suicidal behavior, panic attacks, reactions to traumatic events. Stigma and exclusion of affected employees. Other issues – work-life balance, Presenteeism, Harassment, Bullying, Mobbing, Mental Health First Aid - Meaning, Case Study, Activity.

Unit 3
Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being, corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals talking about mental health, making reasonable adjustments, Resources and support for employees – Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations, Case Study, Activity.

REFERENCES:
3. Canadian Mental Health Association, Ontario “Workplace mental health promotion, A how to guide” www.mhnp.cn/hamontario.ca/
6. Mental Health Act 1987 (India) www.mhacte.org/india.htm
7. Persons with disabilities Act 1995 (India) socialjustice.nic.in
8. The Factories Act 1948 (India) www.caca.in/Image/19ulabourlawsb.pdf
SYLLABI  

2015 admissions onwards

1. **Objectives:** To learn the history of Tamil literature. To analyze different styles, language training, to strengthen the creativity in communication, Tamil basic grammar, Computer and its use in Tamil language.

**Unit 1**

**Unit 2**
tīṭāi ciṟukkiyamam nityaịciṟukkiyamam - patṭukulkaṇakku nuikal toṭarāṟṟa pīṟa ceytikal - tirukkulal (aṇṇu, paṭṭu, kalvi, oḷkkiṇam, naṭṭu, vāymai, kēlvī, ceynaṇṭī, periyaṭṭattirukkal, vilippuṇṭarve pēṇṇa atikāṟṟaṇi vilā ceytikal
Aṉūnkal: Ulakani (1-5) - ēḻait (1,3,6). - Cittakal: Kaṭuvelu cittar pāṭtalika (āṇṭakal ciṟippu –1,4,6,7,8), maṭṟum akappēy cittar pāṭtalika (1-5).

**Unit 3**
tamil ilakkaṇum: Vakkia vakaikal - taṉiyai pīṟiṇai - nēṟkāṟṟu ayarkkuṭṟu

**Unit 4**