<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AES211</td>
<td>INTRODUCTION TO AEROSPACE TECHNOLOGY</td>
<td>3 0 0 3</td>
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<tr>
<td></td>
<td><strong>Unit 1</strong></td>
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<tr>
<td></td>
<td>History of aviation, types of flying machines, major components of an aircraft and their functions. Fundamental aerodynamic variables, aerodynamic forces, lift generation, airfoils and wings, behavior of lift and drag forces, high lift devices.</td>
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<td><strong>Unit 2</strong></td>
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<td></td>
<td>Moments produced by aerodynamic forces, aerodynamic center, criteria for longitudinal stability, role of the elevator in control. Mechanism of thrust production, propellers, jet engines and their operation, elements of rocket propulsion. Loads acting on an aircraft, load factor for simple maneuvers, v-n diagrams, methods of construction of the wing and fuselage.</td>
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<td><strong>Unit 3</strong></td>
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<td></td>
<td>The solar system and the Copernican model, Kepler’s laws, orbital motion, orbital maneuvers and interplanetary transfer, satellite orbits, earth’s outer atmosphere, the rocket equation, multistage rockets.</td>
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<tr>
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<tbody>
<tr>
<td>AES221</td>
<td>MECHANICS OF FLUIDS</td>
<td>3 1 0 4</td>
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<tr>
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<td><strong>Unit 1</strong></td>
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<td></td>
<td>Concept of a fluid; thermodynamic and secondary properties; Hydrostatics; Control volume; formulation of basic equations: Reynold's transport theorem, derivation of governing equations for mass, linear and angular momentum, energy in integral form, Bernoulli’s equation.</td>
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<td><strong>Unit 2</strong></td>
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<tr>
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<td>Differential form of the basic equations. Boundary conditions, Eulerian and Lagrangian methods of describing fluid motion. Basic flow analysis techniques</td>
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</table>
AES232 INTRODUCTION TO CONTROL THEORY 3 0 0 3

Unit 1 Basics of transducers, signals, block diagrams, feedback, signal flow graphs, mathematical modeling, examples of electrical, mechanical and electro-mechanical models. Review of Laplace transforms. Linear systems, impulse and step responses.

Unit 2 Definition of stability, transfer functions and modeling of systems using block diagrams, response vs. pole locations, time domain specifications, system type and steady-state errors, PID controllers. Root-Locus design method - guidelines for sketching root-locus, dynamic compensation (Lead/Lag) using root-locus, Routh's stability criterion.

Unit 3 The frequency response design method - Bode plot techniques, stability, Nyquist criterion, stability margins (gain and phase), introduction to dynamic compensation, robust stability and robust performance. Introduction to state space design - state-space equations, controllability and observability. Introduction to state-feedback and estimator design.

TEXTBOOKS:

REFERENCES:
Ogata, K. Modern Control Engineering. 3rd ed. Prentice Hall

AES241 MECHANICS OF MATERIALS 3 1 0 4

Unit 1 Introduction - deformation, strain, stress, stress-strain relation, elasticity and plasticity, Hooke's law, shear stress and shear strain, allowable stresses and loads. Axially loaded members - prismatic bars, normal stresses and strains, Poisson's ratio, bulk modulus, volumetric strain, modulus of rigidity, thermal stresses, relation between elastic constants, principal of super-position, Saint-Venant's principle, stress concentration, compound bar, varying cross sectional properties.

Unit 2 Introduction to energy methods - strain energy, potential energy, Castigliano's first and second theorems, principal virtual work, principal complementary virtual work, resilience, stresses due to suddenly applied and impact loads. Beams and bending - pure bending of symmetric beams, study of normal, bending and shear stresses, composite beams - introduction, shear force and bending moment diagrams for various types of beams.

Unit 3 Deflection of beams, analysis of deflection and slope of beams - by McCaulay's method, Area-moment method, Conjugate-beam method and strain energy method. Bi-axial stresses - stresses in thin walled cylindrical, spherical and conical vessels, stresses at a point on a plane, principal plane stresses, von-Mises stress, Mohr's circle of stress for 2D problems, failure criteria.

TEXTBOOK:

REFERENCES:
SYLLABI
2010 admissions onwards

TEXTBOOKS:

REFERENCES:

AES291 MATERIALS TESTING LAB. 0 0 3 1
Tension test on materials, double shear test, static bending test on wood, compression test on wood, tensile test on thin wires, deflection test on beams, Rockwell hardness test, Brinell hardness test, spring test, impact test - Charpy and Izod.

AES292 MECHANICS OF FLUIDS LAB. 0 0 3 1
Flow experiments: Calibration of orifice meter, Venturimeter, V and rectangular notch, pipe friction. Verification of Bernoulli’s theorem; Reynold’s apparatus; Metacentric height; jet impact studies.

AES294 INSTRUMENTATION LAB. 0 0 3 1
Calibration exercises: Dead weight pressure gauge tester, dead weight vacuum gauge tester. Measurement experiments: Torque, power using dynamometer; speed using stroboscope and magnetic pickup; temperature using thermocouple; Resistance and temperature detectors. Force using proving ring, vibration using piezo electric accelerometer. Strain gauges.

AES312 FLIGHT MECHANICS AND STATIC STABILITY 3 1 0 4
Unit 1
Equations of motion, forces acting on the aircraft, aerodynamic characteristics of the wing, compressibility effects, drag contribution from components, propulsion systems and their performance characteristics. Airplane performance in steady flight, power available and maximum speed, climb, effect of altitude, performance and service ceiling, range and endurance, accelerated flight, load curves, take-off and landing performance.

TEXTBOOK:
REFERENCES:

AES322 COMPUTATIONAL AERODYNAMICS 3 0 3 4
(Pre-requisite: AES222)

Unit 1
Review of governing equations of fluid dynamics and relevant PDE theory, classification of PDE’s and physical implications, special cases of Navier-Stokes and their classification. Introduction to numerical methods, properties of numerical solution methods: errors, consistency, accuracy, stability, convergence, conservation. Lab components: Introduction to MATLAB and ANSYS Fluent.

Unit 2
Panel methods, finite wing theory, simplified horseshoe vortex, Prandtl’s lifting line theory, swept and delta wings, computational methods for finite wings. Introduction to the finite difference and finite volume discretization approaches. Lab components: Computing panel methods and finite wing theory.

Unit 3
Introduction to grid generation, body conforming grids, algebraic and elliptic grids; 2D unstructured grids. Solution methods for incompressible flows; Solution methods for compressible flows. Examples: Incompressible Couette flow, numerical solutions of quasi - 1D nozzle flows, numerical solution of a two dimensional supersonic flow (Prandtl-Meyer expansion wave). Lab components: Simulation of incompressible and compressible flow over external objects such as flow over cylinder, flow over airfoil, flow over nose cone based on Navier Stokes equation.

TEXTBOOKS:

REFERENCES:
AES344  FINITE ELEMENT ANALYSIS  3 0 3 4

Unit 1
Introduction to finite element method (FEM) - basic principles of structural mechanics: Equilibrium condition, strain-displacement relation, linear constitutive relations - basic steps in linear FEM formulations: domain discretization, types of elements, assembly procedures, boundary conditions - formulations: Potential energy method, variational formulation, weighted residual, Galerkin and Rayleigh-Ritz methods, weak formulations.

Unit 2
Coordinate systems, convergence criteria, 1D elements: Axial elements basic formulations, formations of shape functions, problems using 1D elements, beam (bending) element: formulations and formation of shape function and problems – 2D elements: Plane stress and plane strain element formulation, shape function development, problems using 2D elements - axi-symmetric elements- iso-parametric formulation of elements.

Unit 3
3D element formulations - FE formulation of plate bending and shell elements - numerical integration - solution techniques of the numerical equations, FEM application to heat transfer, dynamics - problems in solid mechanics, heat transfer and vibration analyses using FEM software.

TEXTBOOKS:

REFERENCES:

AES351  BOUNDARY LAYER THEORY  4 0 0 4

(Pre-requisite: AES221)

Unit 1
Fundamentals of boundary layer theory, field equations for flows of Newtonian fluids, general properties of the equation of motion, exact solution for the Navier-Stokes equations.

Unit 2
Laminar boundary layer: Approximate methods for solving the boundary layer equations for steady plane flows, unsteady boundary layer, extension to Prandtl boundary layer theory. Laminar-turbulent transition: Fundamentals of Stability theory, Instability of the Boundary layer.

Unit 3
Turbulent boundary layer: fundamentals of turbulent flows, internal flows, axisymetric and three-dimensional turbulent boundary layers, unsteady turbulent boundary layers, turbulent free shear flows. Numerical integration of boundary layer equations.

TEXTBOOKS:

REFERENCE:

AES352  TURBULENT FLOWS  4 0 0 4

(Pre-requisite: AES221)

Unit 1
Governing equations; Averaging and correlations; Reynolds equations and Reynolds stresses. Free shear flows, turbulent jet, turbulent length and time scales, turbulent kinetic energy and kinetic energy dissipation and kinetic energy budget.

Unit 2
Kolmogorov’s hypothesis and energy spectrum; Wall bounded flows, channel flow and boundary layer, viscous scales and law of the wall.

Unit 3
Turbulence modeling, gradient transport and eddy viscosity, mixing length model, two-equation models, Reynolds-stress model, and large-eddy simulation.
SYLLABI
B. Tech. - Aerospace Engg. 2010 admissions onwards

Textbooks:

References:

AES356 HEAT TRANSFER 4004

Unit 1
Basic modes of heat transfer, one dimensional steady state heat conduction, composite medium, critical thickness, effect of variation of thermal conductivity in solids, extended surfaces, unsteady state heat conduction, lumped system analysis, heat transfer in semi infinite and infinite solids, application of numerical techniques.

Unit 2
Fundamentals of convection, physical mechanism, free convection in vertical flat plate, empirical relation in free convection, forced convection, laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe, applications of numerical techniques in problem solving. Introduction to physical mechanism, radiation properties, radiation shape factors, heat exchange between non black bodies, radiation shields.

Unit 3
Boiling and condensation, condensation heat transfer, classification of heat exchangers, temperature distribution, over all heat transfer coefficient, heat exchange analysis, LMTD method and E-NTU method. Heat transfer in gas turbine combustion chambers, rocket thrust chambers, cryogenic systems, spray combustion, ablative heat transfer.

Textbooks:

References:

Schools of Engineering Amrita Vishwa Vidyapeetham S11

AES357 ROCKET AND SPACECRAFT PROPULSION 4004
(Pre-requisite: AES331)

Unit 1
Principle of rocket propulsion, the rocket equation, development of thrust, nozzle design, effect of atmosphere, thermodynamic thrust equation, characteristic velocity, performance parameters.

Unit 2
Liquid propellant rocket engine, basic configuration, types of propellants, propellant feed systems, combustion of liquid propellants, injectors and thrust chambers, combustion instability. Solid propellant fundamentals, types of solid propellants, propellant processing and manufacture, grain configuration, igniter hardware, combustion of solid propellants, hybrid rocket engines.

Unit 3
Electric propulsion, electrothermal and electromagnetic thrusters, applications of electric propulsion, electric power generation, nuclear propulsion - operational issues, Practical approaches for single stage to orbit vehicles

Textbooks:

AES361 ANALYSIS OF AERO-STRUCTURES 4004
(Pre-requisite: AES242)

Unit 1
Design of rivets and bolted, welded connections, design of springs, design of thick cylinder and spherical shells, analysis of statically indeterminate beams.

Unit 2
General structural design of aircraft, load factors, V-n diagram, stress resultants for swept and unswept wings, application of the following to aircraft design: modified beam theory, wing stress analysis methods, yield and failure under combined loading: initial buckling and failure loads for columns, plates and stiffened panels.

Unit 3
Airworthiness requirements; factors affecting wing design, constituents of wing structures, rib spacing; preliminary layout of wing, estimate of wing element cross-
textbook:

REFERENCES:

AES362 ENGINEERING FRACTURE MECHANICS 4 0 0 4
(Pre-requisite: AES241)

Unit 1
Singular fields at a stationary crack tip, stress intensity factors for simple models of loading, weight function theory, elastic bimaterials crack tip analysis.

Unit 2

Unit 3
Micromechanics of fracture - fracture at elevated temperature in metals and ceramics; fracture in cyclic deformation – introduction to fracture in composites and polymers.

TEXTBOOK:

REFERENCE:

AES363 VIBRATION ANALYSIS 4 0 0 4

Unit 1
Introduction to vibrations: Elementary parts of vibrating systems, degree of freedom, discrete and continuous system. Classifications of vibrating systems. Single degree freedom of system: Free undamped vibrations, torsional vibrations, free damped vibrations and forced vibrations.

AES391 CONTROL LAB. 0 0 3 1

Control system exercises in MATLAB, open loop and closed loop responses in temperature, flow and level control systems, PID control, servo control, single axis stabilized platform, pendulum on a cart.

AES392 PROPULSION LAB. 0 0 3 1

Propeller Testing
Estimation of static performance of a propeller, variation of thrust as a function of rpm, estimating the figure of merit of the propeller-motor assembly.

Nozzle Testing
Effect of area ratio on thrust produced by a Laval nozzle, effect of back pressure on the flow inside a Laval nozzle.

Flame speed measurement
Measurement of flame speed using a flame tube apparatus, study of dependence of flame speed on the mixture ratio.

Study of free jet
Study of characteristics of a free jet, estimation of the jet velocity profile and a study of the entrainment process.

AES393 AERO-STRUCTURES LAB. 0 0 3 1

Testing of columns for buckling and axial strength for various end conditions. Unsymmetrical bending of beams.
Plotting of stress-strain curves for various materials and finding the Young’s modulus yield and ultimate strengths.

AES394  LOW-SPEED AERODYNAMICS LAB.  0 0 3 1

Wind tunnel – similarity considerations – pressure and velocity measurements – force and moment measurements – hot-wire measurements – experiments designed to cover the above.

AES397  SEMINAR  0 0 3 1

AES411  FLIGHT DYNAMICS  3 1 0 4

Unit 1
Static and dynamic stability, concept and Introduction, Body axis, stability Axis, earth axis - advantages, Euler angles, transformation between axis, advantages of axis, aircraft equation of motion.

Unit 2
Small perturbation theory - linear equations of motion - stability derivatives, longitudinal and lateral modes, concept and physics, characteristic equation - transfer function approach, state space modeling and application to modes.

Unit 3
Rocket motion and performance: Rocket equation, multistaging, parallel staging, optimal staging, sensitivity ratios, vertical ascent trajectories, gravity turn trajectories, re-entry vehicles.

TEXTBOOKS:

REFERENCE:
SYLLABI  B. Tech. - Aerospace Engg.  2010 admissions onwards

TEXTBOOKS:

REFERENCES:
1. T.J. Chung, "Computational Fluid Dynamics", Cambridge University Press, 200.2

AES456  AIR-BREATHING ENGINES  4 0 0 4
(Pre-requisite: AES331)

Unit 1
Classification of jet engines, thrust equation, the Brayton cycle, ideal cycle analysis, components of a jet engine and how they affect the engine performance.

Unit 2
Euler's turbo machinery equations, analysis of axial and centrifugal compressors, velocity diagrams, stage parameters, axial and centrifugal turbines, compressor turbine matching, surge control, thermal limits of blades and vanes, blade cooling.

Unit 3
Subsonic and supersonic inlets, inlet sizing, inlet performance, the combustion process, stability, length scaling, fuels, types of burners, combustor performance, afterburners, flame stabilisation, nozzles, thrust vectoring, nozzle performance.

TEXTBOOKS:

AES461  COMPOSITE MECHANICS AND MATERIALS  4 0 0 4

Unit 1
Composite materials and its characteristics, types of composites, manufacturing process of composites, micro and macro mechanical behavior of lamina, behavior of unidirectional composites, short fiber composites.

Unit 2
Analysis of laminated composites, physical and mechanical properties: Elastic modulus, tensile strength, elongation, fatigue and creep.

REFERENCES:

AES462  AERO-ELASTICITY  4 0 0 4
(Pre-requisite: AES312)

Unit 3
Testing of composites, failure criteria, application of composites in different fields, design of composites: determination of stresses and strains.

TEXTBOOKS:

REFERENCES:

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

Unit 3
Testing of composites, failure criteria, application of composites in different fields, design of composites: determination of stresses and strains.

REFERENCES:

REFERENCES:
AES463 MATRIX METHODS IN STRUCTURAL ANALYSIS 4 0 0 4

Unit 1
Basic concepts in indeterminacy (static, kinematics), generalized measurements, degrees of freedom, behavior of structures, principle of superposition, stiffness and flexibility matrices in single, two and multi coordinates, structures with constrained coordinates, stiffness and flexibility coefficients.

Unit 2
Transformation of information: Determinate and indeterminate structures, transformation of element matrices to structures matrices, orthogonal transformations, flexibility method: Flexibility method applied to statically determinate and indeterminate structures (only 2-D structures - beams, trusses, frames subjected to external load only), choice of redundant.

Unit 3
Stiffness method: Development of the method, application to symmetrical structures, basic stiffness method and direct stiffness method, static condensation technique – computer programs for simple problems in 2-D beams, trusses and frames.

TEXTBOOK:

REFERENCE:

AES471 ADVANCED AVIONICS 2 0 0 2

(Pre-requisite: AES332)

Unit 1
Instrument landing system, microwave landing system, radio magnetic indicator, horizontal situation indicator, very high frequency OMNI range, automatic direction finder: ADF concept, principles of electromagnetic wave propagation, ADF theory.

Unit 2
Distance measuring equipments: DME concepts, pilot’s perspective, electronic navigation, transponder, traffic alert and collision avoidance, long range navigation: theory of navigation, LORAN receiver, Omega navigation system (ONS).

Unit 3
Autopilots & flight management system: Autopilots, flight management systems, avionic system Integration: Introduction and background, data bus systems,
SYLLABI
B. Tech. - Aerospace Engg.  2010 admissions onwards

AES473  FLIGHT CONTROL SYSTEMS  2 0 0 2
(Pre-requisite: AES411)

Unit 1
Review of classical control theory and state space methods, longitudinal/Lateral modes; single, 2- and 3-degree approximations; flying and handling qualities.

Unit 2
Autopilots, stability - augmentation system (longitudinal and lateral control), fly-by-wire aircraft, active control system, control configured vehicles.

Unit 3
Introduction to relaxed static stability, gust load alleviation, smart airplanes, introduction to digital control and stability.

TEXTBOOKS:

REFERENCE:

AES476  MANUFACTURING PROCESSSES  4 0 0 4

Unit 1
Casting, rolling, forging, extrusion, drawing and sheet metal working - types of defects and remedies.

Unit 2
Fusion, resistance and solid state processes and their applications. Welding defects: causes and remedies.

Definition and concept – production of metal powders - characteristics of metal powders - compaction - sintering – design consideration - process capability - applications.

Unit 3
Rapid prototyping & Its types, CNC and types of CNC’s.

TEXTBOOKS:

REFERENCE:

AES477  MULTIDISCIPLINARY DESIGN OPTIMIZATION  4 0 0 4

Unit 1

Unit 2
Constrained optimization - Karush-Kuhn-Tucker optimality criteria, direct methods, indirect methods, penalty function methods. Linear programming - introduction, geometry of linear programming problems, solution of a system of linear simultaneous equations, simplex method, two phases of simplex method, revised simplex method, duality in linear programming, transportation problems.

Unit 3
Global optimization: Simulated annealing, Nelder-Mead simplex, genetic algorithm, multiobjective optimization: Pareto optimality, global function / weighted sum, “Gaming” approach (e-constraint), Min-Max, goal attainment, Kreisselmeier-Steinhauser function, recent MDO techniques: Approximations, response surface methodology in MDO, collaborative optimization.

TEXTBOOKS:

REFERENCE:
AES491  AERO-DESIGN LAB.  2 1 3 4


TEXTBOOKS:

AES493  FLIGHT TESTING LAB.  0 0 3 1
(Pre-requisite: AES312)

Online measurement of flight dynamics parameters. Evaluation of glider drag polar. Evaluation of cruise and climb performance of a small aircraft. Determination of static and maneuver stability and control characteristics. Requires visits to institutes with flight testing facilities.

AES498  PROJECT - Phase I  3 cr

AES499  PROJECT - Phase II  9 cr

CHY100  CHEMISTRY  3 0 0 3

Unit 1


TEXTBOOKS:

REFERENCES:
1. Estimation of Hardness of sample water.
2. Estimation of alkalinity of sample water.
4. Estimation of HCl and CH$_3$COOH by conductometric titration.
5. Estimation of Fe$^{2+}$ by potentiometric titration.
6. Phase diagram of two component system.
7. Determination of Corrosion rate and Inhibitor efficiency by weight loss method.
10. Adsorption by Activated charcoal method.

(Any 9 experiments of the above list)

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

**CHY250 CHEMISTRY OF ENGINEERING MATERIALS**

Unit 1

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

**Nanomaterials:** Nanotubes and Nanowires, Carbon nanotubes, single walled and multiwalled, aligned carbon nanotubes, doping with boron – applications - Nanostructured polymers.

Unit 2


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

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

Unit 3

**Florescence and Phosphorescence - chemiluminescence - photo sensitization.**

**Chemistry of Toxic Materials and Toxicology:** Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H$_2$S - PH$_3$ - CO$_2$ - SO$_2$ - NO - 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.
SYLLABI  
2010 admissions onwards

TEXTBOOK:

REFERENCE:

CHY252  CHEMISTRY OF ADVANCED MATERIALS  3 0 0 3

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

Unit 2

Unit 3
Functional electro active polymers: Conjugated polymers - synthesis, processing and doping of conjugated polymers: polycrylylethene, polyaniline, polythiophene, poly (p-phenylenevinylene) - ionically conducting polymers - applications of conjugated polymers. Semi-conducting, poly ferrocene - photo resist optical fibers and sensors, photo chromic & thermo chromic materials.


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

TEXTBOOKS:

SYLLABI  
2010 admissions onwards

REFERENCES:

CHY253  ADVANCED POLYMER CHEMISTRY  3 0 0 3

Unit 1

Unit 2
Solid-state irradiation polymerization - Atom transfer radical polymerization - Plasma Polymerization - Zwitterionic Polymerization - Isomerization polymerization - Polymer supported solid phase reactions - Merrifield method.
Polymer degradation and stabilization: Mechanism of different types of degradation - Commonly used antidegradants and the mechanism of their stabilization.

Unit 3

TEXTBOOKS:
4. Jayadev Sreedhar and Govariker, “Polymer Chemistry”.

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S 27  
S 28
SYLLABI
B. Tech. - Aerospace Engg. 2010 admissions onwards

CHY254 POLYMERS FOR ELECTRONICS 3 0 0 3

Unit 1

Unit 2
Photoconductive polymers: Charge carriers, charge injectors, charge transport, charge trapping. Polymers for optical data storage - principles of optical storage, polymers in recording layer. Nonlinear optics: NLO properties and NLO effects, wave guide devices, polymer optical fibers - through plane modulators.

Unit 3

TEXTBOOK:

REFERENCE:

CHY255 CHEMISTRY OF TOXICOLOGY 3 0 0 3

Unit 1
Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of 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.

TEXTBOOK:

REFERENCES:

CHY256 CHEMISTRY OF NANOMATERIALS 3 0 0 3

Unit 1
Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nano structures - SEM, AFM - TEM and STM - Raman spectroscopy. Synthesis of Nanomaterials: Synthetic approaches: Colloidal Self-Assembly (Self-assembled monolayers - SAMs) and electrochemical self-assembly, electrochemical methods, sol-gel deposition

Unit 2
Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.
Carbon nanostructures: Carbon Clusters: Fullerenes, structure, synthesis, alkali doped C_{60} - superconductivity in C_{60}, applications of fullerenes. Carbon nanotubes: Classification, properties, synthesis, characterization, and potential applications, growth mechanism of carbon nanotubes.

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

Unit 3
Fabrication and applications of conducting polymer nanotubes, TiO_{2} and metallic nanotubes.

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

TEXTBOOKS:

REFERENCES:

CHY257 BIOMATERIALS SCIENCE 3 0 0 3

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

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

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

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

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

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

TEXTBOOK:

REFERENCES:

CHY258 ENVIRONMENTAL CHEMISTRY 3 0 0 3

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

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).

REFERENCES:

TEXTBOOKS:

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

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

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

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

Unit 3

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

TEXTBOOKS:

REFERENCES:

CHY260 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3

Unit 1
Nomenclature of Organic compounds: Polynes, 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.

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B. Tech. - Aerospace Engg.  2010 admissions onwards

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

Unit 3


TEXT BOOKS:


REFERENCES:


CHY261 UNIT PROCESSES IN ORGANIC SYNTHESIS  3 0 0 3

Unit 1


Unit 2


Unit 3

Sulphonation and sulfation: Sulphonating and sulphating agents – their principal applications – chemical and physical factors in sulphaonation and sulphation – kinetic, thermodynamics and mechanism – the desulphonation reaction.

SYLLABI

B. Tech. - Aerospace Engg.  2010 admissions onwards


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

TEXTBOOK:


REFERENCES:


CHY262 MEDICINAL ORGANIC CHEMISTRY  3 0 0 3

Unit 1


Unit 2

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

Medicinal agents from natural products: Natural products as therapeutic agents, medicinal plants, animal products as medicine, isolation methods of alkaloids, terpenes, anti-oxidants.

Unit 3

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

TEXTBOOKS:

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


REFERENCES:

CHY263  ORGANIC REACTION MECHANISMS  3 0 0 3

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

Reaction of nucleophiles and bases: Nucleophilic substitution - S_N_1 and S_N_2 reactions, nucleophilic substitution at aliphatic sp2 carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organo lithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.

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

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

Unit 3
Radical and radical ions: Formation of radicals, radical chain processes, radical addition, reaction with and without cyclisation - fragmentation reaction - rearrangement of radicals - S_N_1 reaction - radical ions - Birch reduction - Hofmann-Loffter-Freytag reaction - Barton reaction - McMurry reaction.

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


TEXTBOOK:

REFERENCES:

CHY264  GREEN CHEMISTRY AND TECHNOLOGY  3 0 0 3

Unit 1
Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.,

Unit 2
Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behavior and solvent attributes of supercritical CO_2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO_2 fixation, green plastics, green oxidations, etc.

Unit 3
Processes involving solid catalysts – zeolites, ion exchange resins, Naion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.
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REFERENCES:
1. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

CHY270 CORROSION SCIENCE  3 0 0 3

Unit 1
Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.
Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2
Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.
Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.
Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

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

TEXTBOOKS:

REFERENCES:

CHY271 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES  3 0 0 3

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

Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc/silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).
Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account) Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3
Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electrolest plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

TEXTBOOKS:

REFERENCES:
### Computational Chemistry and Molecular Modelling

**Unit 1**

**Introduction:** Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle - Energetic - kinetics - Principles of spectra.

**Computational techniques:** Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.


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

**Unit 2**

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

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

**Unit 3**

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

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

**Textbooks:**

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REFERENCES:

CHY274 SOLID STATE CHEMISTRY 3 0 0 3

Unit 1

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

REFERENCES:

CSE100 COMPUTER PROGRAMMING 3 0 0 3

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

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

Unit 3

TEXTBOOK:

REFERENCES:
CSE180  COMPUTER PROGRAMMING LAB.  0 0 3 1

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

CUL101  CULTURAL EDUCATION I  2 0 0 2

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

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

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

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

CUL102  CULTURAL EDUCATION II  2 0 0 2

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

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

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

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

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

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

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

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

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

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

Learning Skills (Teachings of Amma)
CUL152 EXPLORING SCIENCE AND TECHNOLOGY 1022 IN ANCIENT INDIA

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

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

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

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

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

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

CUL153 EXCELLENCE IN DAILY LIFE 1022

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

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

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

REFERENCES:
The Bhaja Govindam and the Bhagavad Gita.

CUL154 YOGA PSYCHOLOGY 1 0 2 2

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

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

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

Patanjali Yoga Sutra – 1

Patanjali Yoga Sutra – 2

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

Patarjali Yoga Sutra – 4
Introduction to Samadhi - Samprajnata-Samadhi - Reasoning in Samprajnata-Samadhi
- Reflection in Samprajnata-Samadhi - Bliss in Samprajnata-Samadhi - Sense of Individuality in Samprajnata-Samadhi.

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

Patanjali Yoga Sutra – 6

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 Vidya Bhavan.
- Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttaraji.
- ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India.

ECE100 ELECTRONICS ENGINEERING 3 0 0 3

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

Unit 1

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

Rectifiers and diodes: half wave, full wave and Bridge rectifiers. Filters, choke input filter, capacitor input filter, PIV and surge current, Zener diode, loaded Zener regulator, LED, photo diodes, Schottky diode, Varactor diode.

Unit 2

Basics of amplifiers: Introduction to BJT and FET, BJT characteristic curves and regions of operation, emitter and voltage divider bias of BJT, BJT as a switch, LED drivers, JFET characteristics, JFET biasing in Ohmic and active regions, transconductance, JFET amplifiers, depletion mode and enhancement mode MOSFET, CMOS.

Unit 3

Operational amplifiers and linear ICs: differential amplifier, introduction to Opamps, inverting and non-inverting amplifier, comparators, instrumentation amplifier, summing amplifier, voltage follower.

Oscillators: Theory of sinusoidal oscillations, Wein Bridge oscillator, Colpitts oscillator, Quartz Crystal oscillator, introduction to 555 Timer, astable and monostable operation.

TEXTBOOK:

REFERENCES:

EEE100 ELECTRICAL ENGINEERING 3 0 0 3

Unit 1

Introduction to electrical engineering. System of units. Electric current, Coulomb’s law, Ohm’s law, Faraday’s law of electromagnetic induction, Kirchoff’s laws, Ampere’s law.

Ideal independent current and voltage-sources; Reference directions and symbols, energy and power; R, L and C- parameters; Series and parallel combination of resistances, capacitances and inductances, series-parallel circuits, superposition theorem, conversion of a voltage source to current source and vice versa, voltage divider and current divider rule. Network reduction by star–delta transformation, analysis of dc circuits by Mesh-current and nodal methods.

Unit 2

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

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

Unit 3

Magnetic circuits: MMF, magnetic flux, reluctance, flux density, analogy with electric circuits, analysis of magnetic circuits, self and mutual induced emfs, energy stored in a magnetic circuit.

Transformers; construction and principle of operation of transformers, Emf equation. Three phase Induction motor: Types, construction, rotating magnetic field, principle of operation, slip, rotor induced emf.

Measuring instruments, Different types of instruments to measure voltage, current power and energy.

TEXTBOOK:

REFERENCES:

EEE180 WORKSHOP B 1 0 2 2

Electrical workshop:
Study of safety devices such as fuse, MCB, ELCB & earthing – electrical power distribution in domestic installations, study of tools and accessories used in electrical
wiring – wiring practice for staircase circuit, fluorescent lamp, hospital wiring and godown lighting – study of domestic appliances like Mixer, fan, Electric iron, Air conditioner, Refrigerator – study of different types of electric lamps like Incandescent lamp, Fluorescent, CFL, Metal halide, Mercury vapour, Sodium vapour and halogen lamp.

Personal computer hardware workshop:
Study of basic components in a computer - study of basic components in a network – study of diagnostic tools for system and study of floppy disk controller – study of hard disk controller – drivers for different components – trouble shooting in printer – communication between two computers with null modem – transferring characters from PC to LCD.

Electronics and basic microprocessor workshop:

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

ENG111 COMMUNICATIVE ENGLISH 2023

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

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

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

Unit 3
Practical sessions (listening & speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – listening comprehension and note-taking.
Activities: Short speeches, seminars, quizzes, language games, debates, discussions and book reviews, etc.

ENG112 TECHNICAL COMMUNICATION 2023

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

Unit 1

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

Unit 2

REFERENCES:
ENG250  PROFESSIONAL COMMUNICATION  1 0 2 2

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

Unit 2  
**Work place Communication:** Writing suggestions, recommendations - reports like, incident report, progress report, trip report, feasibility report – resume writing - formal and business letters – memos, circulars, notices - agenda, meetings, minutes.

Unit 3  
**Practical:** Telephonic conversations, interviews, group and panel discussions, and oral presentations.

**REFERENCES:**

ENG251  BUSINESS COMMUNICATION  1 0 2 2

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

Unit 1  

Unit 2  

Unit 3  

**REFERENCES:**
SYLLABI

ENG253 INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE 1 0 2 2
(Pre-requisite: Nil;Equivalent course in 2007 curriculum: Nil)

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

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

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

Unit 3
Essays

ENV200 ENVIRONMENTAL STUDIES 3 1 0 4

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

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

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

TEXTBOOK:

REFERENCE BOOKS:
FRE201  PROFICIENCY IN FRENCH LANGUAGE (LOWER)  1 0 2  2

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

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

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

TEXTBOOK:
Metro St Michel - Publisher: CLE international

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

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

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

Unit 3  University Restaurant
Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste,
preferences; Nutrition, diet, choose a menu or diet, Expression of quantities

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

GER201  PROFICIENCY IN GERMAN LANGUAGE (LOWER)  1 0 2  2

To have an elementary exposure to German language; specifically
1. to have some ability to understand simple spoken German, and to be able to
speak it so as to be able to carry on life in Germany without much difficulty (to be
able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.
(This will not be covered as part of the regular classroom teaching; this is to be
acquired by self-study.)

Some useful websites will be given.

GER202  PROFICIENCY IN GERMAN LANGUAGE (HIGHER)  1 0 2  2

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

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

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

Some German culture. Films.

GER211  GERMAN FOR BEGINNERS I  1 0 2  2

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

Schools of Engineering  Amrita Vishwa Vidyapeetham  S 60
Numbers 1-100; Saying the telephone number.
Countries and Languages.
Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.
Vocabulary: Professions.

Unit 2
Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.
Numbers till 1000. Saying a year.
Alphabets – spelling a word.
Filling up an application form; In the restaurant – making an order.
Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article
Vocabulary: Food items

Unit 3
Number above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.
Grammar: Accusative – definite article. Adjectives and plural forms.
Vocabulary: Furniture and currencies.

GER212 GERMAN FOR BEGINNERS II 1022

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

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

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

HUM250 INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY 1022

Unit 1
Introductory study of the Bhagavad Gita and the Upanishads

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

Unit 3
Goals of human life-existential problems and their solutions in the light of these classics etc.

REFERENCE:
The Bhagavad Gita, Commentary by Swami Chinmayananda

HUM251 INTRODUCTION TO INDIA STUDIES 1022

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
HUM252  GLIMPSES OF ETERNAL INDIA  1 0 2 2

Unit 1
Introduction
A peep into India’s glorious past
Ancient India – the vedas, the vedic society and the Sanatan Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira’s ramarajya; Sarasvati - Sindh 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 Mahamanapadas and the beginning of Magadhan paramounty – Kauṭilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harṣavardhana; 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.

REFERENCES:
17. Aurobindo, Sri. The Indian Renaissance / India’s Rebirth / On Nationalism.
25. Danino, Michel. The Invasion That Never Was.
34. Dharampal. Archival Compilations (unpublished)

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<tr>
<th>HUM253</th>
<th>GLIMPSES INTO THE INDIAN MIND: 1022</th>
</tr>
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<tbody>
<tr>
<td>THE GROWTH OF MODERN INDIA</td>
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Unit 1
Introduction
General Introduction; ‘His + Story’ or ‘History’?; The concepts of ‘nation’, ‘national identity’ and ‘nationalism’; Texts and Textualities: Comparative Perspectives

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B. Tech. - Aerospace Engg. 2010 admissions onwards

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.

HUM254
GLIMPSES OF INDIAN ECONOMY AND POLITY

Unit 1
Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization. Ancient India – up to 600 B.C.
Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prayamandala; 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;

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S 65
S 66
SYLLABI  B. Tech. - Aerospace Engg.  2010 admissions onwards

Sarasvati - Sindhru civilization and India’s trade links with other ancient civilizations;
Towards chiefdoms and kingdoms – transformation of the polity: kingship – from
gopati to bhupati; The mahajanapadas and the emergence of the srenis – states
and cities of the Indo-Gangetic plain.

Unit 2

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

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

Unit 3

Modern India: 1720 - 1947
the Indian market and economy before the arrival of the European traders;
Colonisation and British supremacy (dismantling of everything that was ‘traditional’
or ‘Indian’) – British attitude towards Indian trade, commerce and economy and the
resultant ruining of Indian economy and business – man-made famines – the signs
of renaissance: banking and other business undertakings by the natives (the
members of the early Tagore family, the merchants of Surat and Porbander,
businessmen of Bombay, etc. may be referred to here) – the evolution of the
modern banking system; Glimpses into British administration of India and
administrative models; The National movement and nationalist undertakings in
business and industry; the Tatas and the Birlas; Modern India: the growth of large-
scale industry – irrigation and railways – money and credit – foreign trade; Towards
partition – birth of two new nations – division of property; The writing of the Indian
Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947
India since Independence – the saga of socio-political movements; Indian economy
since Independence – the fiscal system – the five year plans – liberalisation – the
GATT and after; Globalisation and Indian economy; Impact of science and (new/
emerging) technology on Indian economy; Histories of select Indian business houses
and business entrepreneurship.

Conclusion

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

REFERENCES:
1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
4. Sircar, D.C. Studies in the Political and Administrative Systems in Ancient and Medieval
10. Joshi, Mulji Manohar. Science, Sustainability and Indian National Resurgence. Chennai:
Centre for Policy Studies, 2008.
11. Tripathi, Dwijendra. The Oxford History of Indian Business. New Delhi: Oxford University
15. Raychaudhuri, Tapan and Irfan Habib, eds. The Cambridge Economic History of India. Volume
19. Thapar, Romila. The Penguin History of Early India: From the Origins to AD 1300. New Delhi:

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

Unit 1

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

Unit 2

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

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

Conclusion

REFERENCES:

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.

Students will be given detailed lectures on Calligraphy.

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

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.
MAT111  CALCULUS, MATRIX ALGEBRA  3 1 0 4  
AND ORDINARY DIFFERENTIAL EQUATIONS

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

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

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

TEXTBOOKS:  

MAT211  INTEGRAL TRANSFORMS AND COMPLEX ANALYSIS  3 1 0 4

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

Unit 2  

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

TEXTBOOK:  
MAT212 MATHEMATICAL STATISTICS AND NUMERICAL METHODS 3 1 0 4

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

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

Unit 3

TEXTBOOK:

MEC100 ENGINEERING MECHANICS 3 1 0 4

Unit 1
Principles of statics: Introduction to vector approach – free body diagrams - forces in plane – forces in space - concurrent forces – resolution of forces - equilibrium of particle.
Statics of rigid bodies in two dimensions and three dimensions: Moment of a force about a point - moment of a force about an axis - moment of a couple – equivalent force - couple system - rigid body equilibrium – support reactions.

Unit 2
Centroid and centre of gravity: Centroids of lines, areas and volumes – composite bodies.
Second moment of area – polar moment of inertia - mass moment of inertia - radius of gyration.

Unit 3
Dynamics of particles: Kinematics of particles – rectilinear motion – relative motion - position, velocity and acceleration calculations in cylindrical coordinates.

MEC180 WORKSHOP A 1 0 2 2

Product detailing workshop: (Study of simple mechanical and electromechanical system)
Disassemble the product or sub assembly – measure various dimensions using measuring instruments – free hand rough sketch of the assembly and components - name the components and indicate the various materials used – study the functioning of the assembly and parts – study the assembly and components design for compactness, processing, ease of assembly and disassembly – assemble the product or subassembly.

Pneumatics and PLC workshop:

Sheet metal workshop:
Study of tools and equipment – draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray, etc.) – fabrication of components using small shearing and bending machines – riveting and painting practice.

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

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

REFERENCES:
Concerned Workshop Manual
MEC181 ENGINEERING DRAWING 1 0 3 2

Orthographic projections – projection of points; projection of lines; projection of planes; projection of solids.
Section of solids; Intersection of solids; development of surfaces.
Orthographic views of three-dimensional solids.
Isometric projection.

TEXTBOOK:

REFERENCES:

MEC182 COMPUTER AIDED DRAWING 1 0 3 2

Introduction to CAD
Preparation of drawings using CAD Tools
Introduction to VBA / LISP
Introduction to 3D modeling and Surface Modeling

TEXTBOOKS:

REFERENCES:
CADian Manual

MEC220 ENGINEERING THERMODYNAMICS 3 1 0 4

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

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

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

TEXTBOOK:

REFERENCES:
MEC290 
MACHINE DRAWING 
1 1 3 3

Unit 1
BIS codes for practice of machine drawing - dimensioning, sectional views, abbreviations and conventions, welding symbols, surface finish symbols, screws, bolts, nuts and rivets.
Introduction to sketch mode and 2D draft mode in a 3D software package – 2D sketching, relationship/constraints, dimensioning.
Fits and tolerances - geometric tolerances. Machine elements - keys, pin joints, fasteners, hexagonal and square head bolts and nuts, conventional representation of threads.
Introduction to solid modelling using 3D software package - reference planes. Protrusion, revolved protrusion, swept protrusion, round, cutout, revolved cutout, hole, pattern, mirror, thread, chamfer.

Unit 2
Joints - cotter joints - sleeve, spigot and socket, jib and cotter, knuckle joints, couplings - flange coupling, universal coupling, riveted joints - single and multiple rivets - chain, zigzag and structural riveted joints, welded joints.
Advanced feature creations using solid modelling package - rib, thin wall, lip, mounting boss, web etc - editing features, creation of views from 3D model and section views.

Unit 3
Assembly modeling using relations/constraints and conversion of parts and assembly to drafting – creation of bill of material – calculation of mass properties – interference checks between solids.
Automated preparation of part drawings and assembly drawings from 3D of screw jack, connecting rod assembly, crossheads of steam engine.

TEXTBOOKS:

REFERENCES:

MEC461 
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
Introduction to reliability: concepts and definition of reliability – reliability mathematics – failure distributions.

Unit 3

TEXTBOOKS:

REFERENCES:
MEC462 SIMULATION MODELING OF MANUFACTURING SYSTEMS 3 0 0 3

Unit 1

Unit 2

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:

REFERENCE BOOKS:

MNG400 PRINCIPLES OF MANAGEMENT 3 0 0 3

Unit 1


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

**TEXTBOOKS:**

**REFERENCES:**
   Hall of India, 1996.

**PHY100 PHYSICS 3 0 0 3**

**Unit 1**
Special theory of relativity: Frames of reference, postulates of special theory of
relativity, time dilation, length contraction, relativistic mass, relativistic momentum,
mass and energy, Lorentz transformation, velocity addition, Doppler effect.

Physical background for quantum mechanics: Black body radiation,
photoelectric effect, Compton effect, X-ray diffraction, pair production, de-Broglie
waves, uncertainty principle.

**Unit 2**
Quantum mechanics: Wave function, wave equation, Schrodinger equation (time
dependent), expectation values-operators, eigen functions and eigen values,
Schrodinger equation(steady state), particle in a box-finite potential, tunneling effect,
quantum theory of hydrogen atom.

**Unit 3**
Classical and quantum statistics: Statistical distribution, Maxwell Boltzmann’s
statistics, molecular energies in an ideal gas, quantum statistics, Rayleigh Jean’s
formula, Planck’s radiation law, free electron in a metal, electron energy distribution,
specific heat of solids, evolution of stars.

Solid state physics: Crystalline and amorphous solids - ionic crystals - covalent
crystals - Van der Walls bond - metallic bond - Band theory of solids - semiconductor
devices.

**TEXTBOOK:**

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

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

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

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

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

**REFERENCE:**
Delhi,1985.

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

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

Semiconducting materials: Classifying materials as semiconductors, chemical
bonds in Si and Ge and it’s consequences, density of carriers in intrinsic
semiconductors, conductivity of intrinsic semiconductors, carrier densities in n
type semiconductors, n type semiconductors, Hall effect and carrier density.
SYLLABI
B. Tech. - Aerospace Engg.  2010 admissions onwards

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.

**REFERENCES:**

**TEXTBOOK:**

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

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

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

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

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

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


**TEXTBOOKS:**

**REFERENCES:**

**PHY253 ELECTROMAGNETIC FIELDS AND WAVES 3 0 0 3**

Unit 1

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

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

Unit 2

Poisson's and Laplace's equations, uniqueness theorem, examples of the solution of Laplace's equation, solution of Poisson's equation.

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

Unit 3

**Electromagnetic waves:** EM wave motion in free space, wave motion in perfect dielectrics, plane wave in lossy dielectrics, Poynting vector and power consideration, skin effect, reflection of uniform plane waves, standing wave ratio. Transmission line equations, line parameters-examples, dipole radiation, retarded potentials, electric dipole radiation.
SYLLABI
2010 admissions onwards

PHY255  ELECTRONIC MATERIALS SCIENCE  3 0 0 3

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

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

Unit 3

TEXTBOOK:

REFERENCE:

SYLLABI
2010 admissions onwards

PHY260  PHYSICS OF LASERS AND APPLICATIONS  3 0 0 3

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

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

Unit 3
Types of LASERS
Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.
Applications in Communication field:
LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication. Applications of LASERS in other fields:
SYLLABI
B. Tech. - Aerospace Engg. 2010 admissions onwards

REFERENCES:

PHY261 LASERS IN MATERIAL PROCESSING 3 0 0 3

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

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


Unit 2
Laser cutting and drilling: Mechanism for inert gas and oxygen-assisted cutting, factors controlling cut quality and kerf width. Laser assisted drilling.

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

Direct laser fabrication (DLF): Laser sintering & laser rapid manufacturing, comparison with rapid prototyping. Main potential and limitations of DLF for direct fabrication and for the production of novel engineering materials and structures.

Unit 3
Laser forming: Mechanisms involved, including thermal temperature gradient, buckling, upsetting. Applications in alignment and straightening and in rapid production processes.

Scope of application of laser materials processing: focused on industrial application of laser in materials processing including laser welded tailored blanks.

Laser safety: Introduction to safety procedures in the use of lasers, including wavelength effects and laser safety standards.

REFERENCES:

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


PHY262 NON-LINEAR DYNAMICS 3 0 0 3

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

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

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

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

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

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

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

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

Unit 3
Time-series properties: examples, conventional linear methods, a case study, time-delay embeddings.

Nonlinear prediction and noise-reduction: linear predictors, state-space prediction, noise reduction, Lyapunov exponents from experimental data, false nearest neighbors.
Fractals: Cantor sets, curves, trees, gaskets, sponges, landscapes.

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

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

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

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

TEXTBOOK:

REFERENCES:

PHY263 CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY 3 0 0 3

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

Concept of quantum confinement and phonon confinement

Unit 2
Tools for characterization:
Nanoscale materials – properties and applications:
Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

Unit 3

Nanoelectronics and nanodevices:
Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

TEXTBOOKS:
1. , Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan , Nanoscale Science and Technology, John Wiley and Sons Ltd 2004.

PHY264 THIN FILM PHYSICS 3 0 0 3

Unit 1
Defects in thin film: General concepts, nature of defect, microscopic defect and dislocation. Boundary defects. Defect and energy states - donar acceptor levels, trap and recombination centers, excitons, phonons.

Unit 2
Properties of thin film: Optical behaviors: transmission, reflection, refractive index, photoconductivity, and photoluminescence.

Unit 3
Electrical behaviors: sheet resistivity, electron mobility and concentration, Hall effect, conduction in MIS structure.
Mechanical behaviors: stress, adhesion, hardness, stiffness.
Applications of thin films in various fields: Antireflection coating, FET, TFT, resistor, thermistor, capacitor, solar cell, MEMs fabrication of silicon wafer: Introduction. preparation of the silicon wafer media, silicon wafer processing steps.
**PHY270**  
**MEDICAL PHYSICS**  
**3 0 0 3**

**Unit 1**  
**Ultrasonics** - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiography - resolution - speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.  
**X-rays** - production - intensity - hard and soft X-rays - characteristic and continuous X-ray spectrum - attenuation of X-rays by hard and soft tissues - resolution - contrast X-ray imaging - fluoroscopy modes of operation - image quality - fluoroscopy units - radiation dose - computed-aided tomography (CAT).

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

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

**TEXTBOOK:**  

**REFERENCE BOOKS:**  
1. Glasser.O.Medical Physics Vol.1, 2, 3 Book Publisher Inc Chicago, 1980
**PHY272**  QUANTUM PHYSICS AND ITS APPLICATIONS  3 0 0 3

**Unit 1**  

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

**Unit 3**  
Operation of He-Ne laser and Ruby laser - laser in science and industry - Raman effect and applications.  
Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces - fission - principle of nuclear reactor - elementary particles - leptons, hadrons, quarks, field bosons - the standard model of elementary particles.

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

**REFERENCES:**

**PHY273**  COMPUTATIONAL PHYSICS  3 0 0 3

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

**Unit 2**  
**Solution of differential equations:** Taylor series method, Euler method, Runge Kutta method, predictor-corrector method.

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**PHY274**  ASTROPHYSICS  3 0 0 3

**Unit 1**  
**Historical introduction:** Old Indian and western – astronomy - Aryabhatta, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system – satellites, planets, comets, meteorites, asteroids.  
**Practical astronomy** - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.  
**Celestial mechanics** - Kepler’s laws - and derivations from Newton’s laws.  
**Sun:** Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

**Unit 2**  
**Stellar astronomy:** H-R diagram, color-magnitude diagram - main sequence - stellar evolution – red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwartzchild radius - stellar masses Saha–Boltzman equation - derivation and interpretation.  
**Variable stars:** Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds-Nebulae.

**Unit 3**  
**Galactic astronomy:** Distance measurement - red shifts and Hubble’s law - age of the universe, galaxies – morphology - Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.  
**Relativity:** Special theory of relativity - super-luminal velocity - Minkowski space -
introduction to general theory of relativity – space-time metric, geodesics, space-time curvature. Advance of perihelion of Mercury, gravitational lens.

**Cosmology**: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

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

**SSK111**

**SOFT SKILLS I**

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

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

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

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

Prepositions, articles and 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;

**SSK112**

**SOFT SKILLS II**


Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.

Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.
SYLLABI

B. Tech. - Aerospace Engg. 2010 admissions onwards

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level – III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.

Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.

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

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

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

SSK113

SOFT SKILLS III 0 0 3 1

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

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

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

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

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

Problem solving level – IV: Geometry; Trigonometry; Heights and distances; Coordinate geometry; Mensuration.

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

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

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