15AES111    INTRODUCTION TO AEROSPACE TECHNOLOGY    3003

Unit 1
Visual Content (video) about Atmospheric Dynamics and its Influence on Flying Machines – History of Aviation (visual content) – Types of Flying Machines, Major Components of an Aircraft, and their Functions (visual content) – Aircraft vs Rotorcraft (visual content) – Basic Instruments for Flying (visual content) – Physical Properties and Structure of the Atmosphere: Temperature, Pressure and Altitude Relationships.

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES201    MECHANICS OF FLUIDS    3104

Unit 1

15AES202    INTRODUCTION TO THERMODYNAMICS    2103

Unit 1

Unit 2

Unit 3
Thermodynamic Property Relations: Cyclic Rule, Maxwell Relations, T-D-S Equations – Clausius-Clapeyron Equation – Joule-Thomson coefficient and Inversion Line -

**TEXTBOOKS:**

**REFERENCE:**

**15AES203 MECHANICS OF MATERIALS 2 1 0 3**

**Unit 1**

**Unit 2**

**Unit 3**

**TEXTBOOK:**

**REFERENCES:**
SYLLABI  B. Tech. - Aerospace Engg.  2015 admissions onwards

15AES211  AERODYNAMICS I  3 0 0 3

Unit 1
Importance of Aerodynamics – Classification and Practical Objectives – Aerodynamic Forces – Moments and their Non-dimensionalization – Airfoil Nomenclature – Airfoil Characteristics.

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES212  COMPRESSIBLE FLUID FLOW  2 1 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:
15AES214 INTRODUCTION TO CONTROL THEORY 2 1 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOKS:

REFERENCE:

15AES281 MEASUREMENT AND INSTRUMENTATION LAB. 0 0 2 1

Calibration exercises on general purpose test (GPT) equipment such as Oscilloscope, signal generator, and pressure gauges.

Measurement experiments: Displacement using LVDT, velocity using Pitot tube and anemometer, force using Proving ring and load cell, torque using strain gauges, speed using stroboscope and magnetic pickup, and temperature using thermocouple.

Mini Projects: Interdisciplinary in content based on application of course work completed by the student.

15AES285 MECHANICS OF FLUIDS LAB. 0 0 2 1

Flow Experiments: Calibration of Orificemeter and Venturimeter, V and Rectangular Notches, Pipe Friction, Verification of Bernoulli’s Theorem, Reynold’s Apparatus, Metacentric Height, Jet Impact Studies.

15AES286 MATERIALS TESTING LAB. 0 0 2 1

Tension test on metals, hardness test on metals using the Rockwell and Brinell tests, impact tests on metals using the Charpy and Izod equipments, double shear tests, helical spring tests, static bending and compression tests on wood and deflection test to verify the Maxwell reciprocal theorem.

In addition to the conventional tests, students are assigned to open lab projects that involve experimental studies including fabrication and setting up unconventional testing methods to understand the basic concepts of strength of materials.

15AES301 AERODYNAMICS II 2 1 0 3

Unit 1
Classical Thin Airfoil Theory for Symmetric and Cambered Airfoils: Lift and Moment Coefficients, Center of Pressure, Predicting Zero Lift Angle of Attack, Flapped Airfoils, Effects of Thickness.

Unit 2

Unit 3

TEXTBOOK:

REFERENCE:

15AES302 AEROSPACE PROPULSION 2 1 0 3

Unit 1
SYLLABI B. Tech. - Aerospace Engg. 2015 admissions onwards

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES303 AEROSPACE STRUCTURES II 3 0 0 3

Unit 1
Introduction to theory of elasticity: equilibrium equations, boundary conditions, constitutive relations, plane stress and plane strain conditions, stress and displacement formulations, strain compatibility relation, governing equations, inverse and semi-inverse methods, Airy’s stress function, Torsion in non-circular bars, Prandtl stress function, St. Venant warping function, membrane analogy, torsion in narrow rectangular section.

Unit 2
Euler–Bernoulli and Timoshenko beam theories, bi-directional bending, bending and transverse shear stresses, bending stresses in narrow rectangular section, general symmetric sections, and thin-walled sections, flexural shear flows (FSF), FSF in thin-walled open sections, shear center in open sections.

Unit 3
Torsional shear flows (TSF) in thin-walled open sections, TSF in thin-walled closed sections (single and multiple cells) and warping in open and closed thin-walled sections, FSF in thin-walled closed sections (single and multi-cells) and shear center in closed sections, buckling of non-symmetrical sections and buckling of thin-walled sections.

TEXTBOOK:

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

REFERENCES:

15AES304 AVIONICS 3 0 0 3

Unit 1
Introduction: Importance and Role of Avionics, the Avionic Environment – Air Data Systems: Air Data Information and its Use, Air Data Laws and Relationships, Air Data Sensors and Computations.

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES311 FINITE ELEMENT METHODS FOR AEROSPACE 2 1 0 3

Unit 1
Introduction to FEM - equilibrium condition, strain-displacement relation, linear constitutive relations - domain discretization, types of elements, assembly procedures, boundary conditions - Formulations: Potential energy method, Variational formulation, Weighted residual, Galerkin and Rayleigh-Ritz methods.
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 - Introduction to FE formulation of Plate bending and shell elements - Numerical integration - Solution techniques of the numerical equations - Introduction to FE software - FE modeling of aircraft and spacecraft components - Application of boundary conditions and loadings on FE models - Analysis of subcomponents like wings, fuselage, motor casing, etc.

TEXTBOOK:

REFERENCES:

15AES332 FUNDAMENTALS OF HEAT TRANSFER 3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOK:
SYLLABI  B. Tech. - Aerospace Engg.  2015 admissions onwards

REFERENCES:

15AES342  EXPERIMENTAL AERODYNAMICS  3 0 0 3

Unit 1

Unit 2

Unit 3
Quantitative Characterization: Drag Measurements, Static Probes, Pressure Sensitive Paints (PSP), Velocity Measurements, Pitot-Static Probe, Thermocouple, Thermal Anemometers (Hot Wire and Film Sensors), Laser Velocimetry (LDA), Particle Image Velocimetry (PIV).

TEXTBOOK:

REFERENCES:

15AES352  VIBRATION ANALYSIS  3 0 0 3

Unit 1
Introduction to vibration, undamped vibration, natural frequency, damped vibration, viscous damped system, under, over and critically damped system, logarithmic decrement, Coulomb damping, response to initial condition, response to simple harmonic motion, rotating unbalance, base excitation, whirling of shafts, vibration measuring instruments, response to periodic motion.

Unit 2
Response to non-periodic motions, impulse response, step response, convolution and Du Hamel integrals, Numerical methods: Runge-Kutta method, Normal mode analysis, response to initial conditions, beat phenomenon, response to simple harmonic motion, damped vibration, static and dynamic coupling, principle coordinate, decoupling, Rayleigh’s proportionality damping, vibration absorber.

Unit 3

TEXTBOOK:

REFERENCES:

15AES353  COMPOSITE MATERIALS AND MECHANICS  3 0 0 3

Unit 1
Introduction to Composites: Concept of Composite materials, Classification of Composites, Various types of composites, Classification-based on Matrix Material: Organic Matrix Composites (Polymer matrix composites (PMC) / Carbon Matrix Composites or Carbon-Carbon Composites, Advantages of Composites materials. Reinforcements and Matrices for various types of composites Fibers / Reinforcement Materials, Role and Selection of reinforcement materials. Types of fibers, Mechanical properties of fibers,

Unit 2
Functions of Matrix, Desired Properties of Thermosets and Thermoplastics, Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc. Laminated composites, Lamina and Laminate Lay-up, Ply-orientation definition, Manufacturing processes. Testing of Composites:Mechanical testing of composites, Tensile testing, Compressive testing.

Unit 3
Determination of longitudinal and transverse strengths of lamina, mechanics of short fiber composites, stress-strain relationships of anisotropic lamina with arbitrary orientations, analysis of laminated composites, types of laminates, stress-strain variation in laminates using classical laminate theory, thermal stresses in laminates, different types of failure criteria, introduction to inter-laminar stresses in composites.
SYLLABI


2015 admissions onwards

TEXTBOOK:

REFERENCES:

15AES372 MANUFACTURING PROCESSES

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

Unit 2
Introduction to welding and their types, Welding defects: causes and remedies, Rivet and its types, Definition and concept - production of metal powders - characteristics of metal powders - compaction - sintering - design consideration - process capability - applications.

Unit 3
Abrasive jet machining, ultrasonic machining, Electro-discharge machining, electrochemical machining and laser beam machining, Surface modification processes - diffusion coating - electroplating - anodizing - conversion coating - hot dipping - ceramic and diamond coating.

Rapid Prototyping & Its types, CNC and Types of CNC’s.

TEXTBOOK:

REFERENCES:

15AES381 AERO-STRUCTURES LAB.

Determination of principal axis in unsymmetrical bending of beams, experiment on constant strength beam, determination of shear centre location for open and closed sections, testing of beam with combined loading, measurement of vibrations of beams, Wagner beam - Tension field beam experiments, determination of stresses in thin wall cylinder and finding the buckling strength of column using the Southwell plot test.

In addition to the conventional tests, students are assigned to open lab projects that involve experimental studies including fabrication and setting up unconventional testing methods to understand the basic concepts of thin walled member behavior.
### SYLLABI

**B. Tech. - Aerospace Engg.**

#### 15AES382 AVIONICS LAB.

Control System Exercises using MATLAB / Kits: Open Loop and Closed Loop Responses for Position, Velocity and Temperature Control Systems.

Mini Projects: Related to Avionics

#### 15AES383 PROPULSION LAB.

- Euler’s Turbomachine Equation – Classification of Turbomachines – Velocity Triangles for Turbines and Compressors – Axial Flow Machines.

**TEXTBOOK:**

#### 15AES384 LOW-SPEED AERODYNAMICS LAB.


**TEXTBOOK:**

#### 15AES385 INNOVATIONS LAB.


**REFERENCES:**

### SYLLABI

**B. Tech. - Aerospace Engg.**

#### 15AES390 / 15AES490 LIVE-IN-LAB.

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

#### 15AES401 COMPUTATIONAL FLUID DYNAMICS FOR AEROSPACE

**TEXTBOOK:**

**REFERENCES:**
15AES402 AERO-DESIGN 2 2 2 5

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES403 FLIGHT DYNAMICS AND CONTROL 3 0 0 3

Unit 1

Unit 2

TEXTBOOK:

REFERENCES:
15AES432  AIR BREATHING ENGINES  3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES440  TURBULENT FLOWS  3 0 0 3

Unit 1

Unit 2

TEXTBOOK:

REFERENCES:

15AES441  ADVANCED COMPUTATIONAL FLUID DYNAMICS  3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOKS:

REFERENCES:
SYLLABI

B. Tech. - Aerospace Engg.  2015 admissions onwards

15AES442  HYPersonic FLOW Theory  3 0 0 3

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCE:

15AES450  SURFACE ENGINEERING, COATING AND JOINING TECHNOLOGIES  3 0 0 3

Unit 1

Unit 2
Surface engineering by energy beams: General classification, scope and principles, types and intensity / energy deposition profile. Surface engineering by energy beams: Laser assisted microstructure modification – surface melting, hardening, shocking and similar processes. Surface engineering by spray techniques: Plasma coating (principle and scope of application). Characterization of surface microstructure and properties.

TEXTBOOK:

REFERENCES:

15AES452  ENGINEERING FRACTURE MECHANICS  3 0 0 3

Unit 3

TEXTBOOK:

REFERENCES:
**SYLLABI**  
**B. Tech. - Aerospace Engg.**  
2015 admissions onwards

**TEXTBOOK:**  

**REFERENCES:**  

15AES453  
**AERO-ELASTICITY**  
3 0 0 3

**Unit 1**  
Free vibration analysis of basic structural members with different boundary conditions, analytical and approximate solutions, response of basic structural members to periodic and non-periodic forces, mode synthesis, approximate solutions.

**Unit 2**  
Static aero-elasticity, divergence of a typical airfoil section, aileron reversal, divergence of one dimensional structures: straight and swept wings, aileron reversal of one dimensional straight wing.

**Unit 3**  
Aeroelastic flutter, stability characteristics, aeroelastic analysis of a typical airfoil section: single degree and two degree freedom, classical flutter analysis, classical unsteady aerodynamic theory, engineering solution for flutter, U-g and p-k methods, response to gust loads.

**TEXTBOOK:**  

**REFERENCES:**  

15AES454  
**ADVANCED COMPOSITE STRUCTURES**  
3 0 0 3

**Unit 1**  
Concept of aviation and space environments. Ionizing and non ionizing radiation at Low Earth Orbit (LEO) and Geo Synchronous Earth Orbit (GEO). Charged plasma and atomic oxygen in space. Different thermosetting and thermoplastic polymers and their applications as structural and semi structural components for aviation and spacecraft.

**TEXTBOOK:**  

**REFERENCES:**  

15AES460  
**SPACE FLIGHT MECHANICS**  
3 0 0 3

**Unit 1**  

**Unit 2**  

**Unit 3**  
Time-of Flight and Eccentric Anomalies for Elliptic, Parabolic And Hyperbolic Orbits – Kepler’s Problem and Solution Algorithm – Gauss Problem: General Methods of
SYLLABI  
2015 admissions onwards

Solution – Intercept and Rendezvous with Examples – Ballistic Missile Trajectories:  
Effect of Earth Rotation – Interplanetary Trajectories: Spheres of Influence and the  
Patched Conic Approximation, Synodic Periods – Satellite Attitude Dynamics: Torque  
Free Motion, Stability of Torque Free Motion, Spin Stabilization, Gyroscopic Attitude  
Control, Gravity Gradient Attitude Control.

TEXTBOOKS:
1. Roger R Bate, Donald D Mueller, Jerry E White and William W Saylor, “Fundamentals of  

REFERENCES:

15AES461 PRINCIPLES OF AIRPORT MANAGEMENT 3 0 0 3

Unit 1 Introduction
History of Aviation - Development of Air transportation in India - Major players in Airline  
Industry - Swot analysis in Airline Industry - Market potential of Indian Airline Industry  
- Current challenges in Airline Industry - Completion in Airline Industry - IATA & ICAO.

Airport management:
Airport planning - Operational area and Terminal planning, design, and operation -  
Airport operations - Airport functions - Organization structure of Airline and Airports  
sectors - Airport authorities - Global and Indian scenario of Airport management –  
DGCA – AAI.

Unit 2 Air transport services:
International trends - Emerging Indian scenario – PPP - Public Private Participation  
in Indian Airports - Environmental regulations - Private participation in International  
developments - Environment regulations - Regulatory issues - Meteorological  
services for Aviation - Airport fees, rates, and charges.

Airline operations:
Airline Terminal Management - Flight Information Counter / Reservation and Ticketing  
- Check In/Issue of Boarding pass - Customs and Immigration formalities - Co- 
ordination - Security Clearance - Baggage and Handling of Unaccompanied minors  
and Disabled Passengers - Handling of Stretcher Passengers and Human Remains  
- Handling of CIP, VIP & VVIP - Co-ordination of Supporting Agencies / Departments.

SYLLABI  
2015 admissions onwards

Unit 3
Logistics and air cargo management:  
Concept of Logistics - Role of Ware Housing - trend in material handling - Global  
Supply Chain - Quality concept and Total Quality Management - improving Logistic  
performance - Air Cargo Concept - Cargo Handling - Booking of Perishable Cargo  
and Live Animals - Industry Relation - Type of Air Cargo - Air Cargo Tariff, ratios  
and Charges - Airway Bill, Function, Purpose.

TEXTBOOKS:

15AES462 HELICOPTER THEORY 3 0 0 3

Unit 1
Historical development, configurations of helicopters, rotor system, flight control  
and mechanism, hovering theory, momentum theory for hover and vertical flight,  
blade element theory for hover and vertical flight, combined blade element momentum  
(BEM) theory.

Unit 2
Momentum theory for forward flight, various non-uniform inflow models, blade  
element theory for forward flight, non-dimensional hub forces and moments,  
estimation of power for forward flight.

Unit 3
Idealization of rotor blades, flap-lag and torsional dynamics of the blade, rotor  
blade flapping motion: A simple model, helicopter trim analysis.

TEXTBOOK:

REFERENCES:

15AES470 STATE SPACE TECHNIQUES 3 0 0 3

Unit 1
Concepts of Matrix Algebra and Vector Spaces (revision) – Solution of Simultaneous  
Equation for Squares – Under-Determined and Over-Determined Systems –  
Concepts of Basis Vector Transformations; Similarity and Adjoint Transformation –  
Eigen Values and Eigen Vectors: Canonical Forms, Jordon Forms, Characteristic  
Equations, Analytical Functions of Square Matrices, Cayley-Hamilton Theorem.
SYLLABI  B. Tech. - Aerospace Engg.  2015 admissions onwards

Unit 2
Concepts of State, State-Space and State-Vector – Mathematical Modes in the State Space Form – State Equation and High-Order Differential Equations – State Space Form for Aerospace Systems, for e.g., Dynamic Behavior of Aircraft, Missile, Satellites, INS., etc. – Solution of Homogenous State Equations.

Unit 3

TEXTBOOKS:

15AES471  MULTIDISCIPLINARY DESIGN OPTIMIZATION  3 0 0  3

Unit 1

Unit 2

Unit 3

TEXTBOOK:

REFERENCES:

15AES481  UAV LAB.  0 0 2 1

Flight testing using a 3.5 Kg UAV or simulator, to determine following:
Glide performance;
Climb rate;
Range and endurance;
Turn rate;
Short period and Phugoid mode;
Roll subsidence.

15AES495  PROJECT PHASE I  2 cr

Various project titles based on areas covered up to 7th semester are allotted to batches of 3 to 4 students.

Preliminary studies and investigations on the allotted topic.

15AES499  PROJECT PHASE II  10 cr

To achieve objectives and to carry out detailed investigation towards the outcome of each allotted project.

15AVP201 / AMRITA VALUES PROGRAMME I /  1 0 0 1
15AVP211 / AMRITA VALUES PROGRAMME II /  1 0 0 1

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

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

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

Courses offered under the framework of Amrita Values Programmes I and II

Message from Amma’s Life for the Modern World
Amma's messages can be put to action in our life through pragmatism and attuning
of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

**Lessons from the Ramayana**
Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

**Lessons from the Mahabharata**
Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

**Lessons from the Upanishads**
Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

**Message of the Bhagavad Gita**

**Life and Message of Swami Vivekananda**
Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

**Life and Teachings of Spiritual Masters India**
Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

**Insights into Indian Arts and Literature**
The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

**Yoga and Meditation**
The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

**Kerala Mural Art and Painting**
Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

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

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

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

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

15CHY100 CHEMISTRY 3 0 0 3
Unit 1 Chemical Bonding
Review of orbital concept and electronic configuration, electrovalency and ionic bond formation, ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan's rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - coordinate covalent compounds and their characteristics, molecular orbital theory for H2, N2, O2 and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds - inter and intra molecular hydrogen bond - van der Waals forces.

Unit 2 Thermodynamic Parameters
Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations - Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity - Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff relation (integrated form) - bond enthalpy and bond order - Problems based on the above.

REFERENCES:
Physical chemistry, Puri and Sharma
Inorganic chemistry, Puri and Sharma

15CHY181 CHEMISTRY LAB. 0 0 2 1
1. Acid base titration (double titration)
2. Complexometric titration (double titration)
3. Redox (permanganometry) titration (double titration)
4. Conductometric titration
5. Potentiometric titration
6. Ester hydrolysis

15CHY231 ADVANCED POLYMER CHEMISTRY 3 0 0 3
SYLLABI

2015 admissions onwards

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 antioxidants and the mechanism of their stabilization.

Unit 3

TEXTBOOKS:

REFERENCES:
3. Jayadev Sreedhar and Govariker, "Polymer Chemistry".

15CHY233  
CATALYTIC CHEMISTRY  
3 0 3

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

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

Unit 2
Catalysis by macromolecules, Phase transfer catalysis.

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

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

SYLLABI

2015 admissions onwards

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:

15CHY232  
BIOMATERIALS SCIENCE  
3 0 0 3

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

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

Unit 2
Chemical and biochemical degradation of polymers - degradation of metals and ceramics - calcification of biomaterials.
Unit 3
Catalysis in polymer gels, bifunctional and multifunctional catalysis, porous polymers, Applications of polymer catalysis.


TEXTBOOKS:

REFERENCES:

15CHY234 CHEMISTRY OF ADVANCED MATERIALS 3 0 0 3

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


Unit 2

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

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


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

TEXTBOOKS:

REFERENCES:

15CHY235 CHEMISTRY OF ENGINEERING MATERIALS 3 0 0 3

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


Unit 2

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

Photochemistry in Electronics: Photochemical reactions - laws of absorption (Grothers-Draayer law - Stark-Einstein’s law) - Quantum efficiency - photochemical decomposition of HI and HBr - and Quantum yield.
Unit 3
Florescence and Phosphorescence - chemiluminescence - photo sensitization.

Chemistry of Toxic Materials and Toxicology: Principles of Toxicology - Volatile poisons - Gases CO, hydrocyanic acid - H2S - PH3 - CO2 - SOx - NOx - Heavy metals - lead, arsenic, mercury, antimony, barium, bismuth, selenium, zinc, thallium - Pesticides - Food poisoning - Drug poisoning - barbiturates - narcotics - ergot - LSD - alkaloids - Radioactive Toxicology - Radiation hazards.

TEXTBOOK:

REFERENCE:

15CHY236 CHEMISTRY OF NANOMATERIALS 3 0 0 3

Unit 1
Introduction: Introduction to Nanomaterials: Size dependence of properties - Surface to volume ratio and Quantum confinement. Microscopic techniques to study nano structures - SEM, AFM - TEM and STM - Raman spectroscopy.

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

Unit 2
Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling.

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

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

Unit 3
Fabrication and applications of conducting polymer nanotubes, TiO2 and metallic nanotubes.

15CHY237 CHEMISTRY OF TOXICOLOGY 3 0 0 3

Unit 1
Introduction to Toxicology: Definition - scope - history - relationship to other sciences - dose-response relationship - sources of toxic compounds - Classes of Toxicants - broad overview of toxicant classes such as metals, agricultural chemicals, food additives - contaminants, toxins, solvents, drugs, and cosmetics - history, exposure route, and toxicity of the non-essential metals - cadmium, lead, and mercury - medical treatment of metal poisoning - classes of agricultural chemicals - Toxins - source, including microbial, fungal, algal, plant and animal - examples - Brief discussions - food additives and contaminants - solvents - therapeutic drugs - drugs of abuse - combustion products - cosmetics.

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

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


TEXTBOOK:

REFERENCES:

15CHY238 COLLOIDAL AND INTERFACIAL CHEMISTRY 3 0 0 3

Unit 1
Introduction to surfaces, interfaces and colloids: Molecular origin, Surface phenomena and structure of interfaces, Surfactants structure, colloids in action - shapes and size distribution, Types of interaction forces - Physical and Chemical interaction, Classification of physical forces - Vander Waals force, electrostatic forces.


Unit 2
Interfaces between Condensed Phases - Wetting, The interfaces between condensed phases in two-component systems, Adsorption at interfaces between condensed phases.

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Thermodynamics - Adsorption, energy consideration of physical adsorption vs chemisorptions, Gibbs adsorption equation, Langmuir isotherm, BET isotherm, adsorption at solid-liquid interfaces. Emulsions - formation and stability, HLB number, PIT (Phase Inversion Temperature) foams, aerosols, Microemulsions, vesicles, micelles and membranes - applications of various colloidal systems.

Unit 3
Characterization of Colloids, Rheological properties - Classification, Interfacial rheology, Interfacial tension, Electrochemistry of interfaces - Electric double layer.

Stability of charge stabilized colloids, DLVO theory, Hamaker constant, Boltzmann distribution, Debye length, specific ion adsorption, stem layer, electrostatic, steric and electrosteric stabilization, zeta potential, surface tension, wetting and spreading, contact angle - Young's modulus, practical application- solid surfaces- surface mobility, characteristics and formation.

TEXTBOOKS:

REFERENCES:
2. J. W. Goodwin, "Colloids and Interfaces with Surfactants and Polymers", John-Wiley and Sons Ltd, 2004

15CHY239 COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING 3 0 0 3

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.

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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.

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

TEXTBOOKS:

REFERENCES:
### 15CHY242  ENVIRONMENTAL CHEMISTRY  3 0 0 3

#### Unit 1

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

**Water and water pollution (hydrosphere):** Physical and chemical properties of water - microbiological processes - carbon, nitrogen cycles - Water pollution - polluting agents - indices of pollution, heavy metal pollution and toxicity - BOD and COD determination - suspended solids - determination of other ions by photometric methods - Chemistry of anaerobic process, use of Effective Microorganisms.  

#### Unit 2

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

**Industrial Pollution and its control:** Industrial pollution and waste waters from various types of industries - environmental pollution due to paper mills, textile mills etc., 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).  

### 15CHY243  FUELS AND COMBUSTION  3 0 0 3

#### Unit 1

**Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.**
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Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.


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

Flue gas analysis by chromatography and sensor techniques.

Unit 3
Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:

REFERENCES:

15CHY245  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, teriphrthalic acid etc. phase behaviour and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

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

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

15CHY245  INSTRUMENTAL METHODS OF ANALYSIS  3 0 0 3

Unit 1

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

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

Electroanalytical techniques: Potentiometry - Potentiometric titration - determination of equivalence point - acid base, complexometric, redox and precipitation titrations
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- 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:

15CHY246 MEDICINAL ORGANIC CHEMISTRY 3 0 0 3

Unit 1

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

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

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

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

TEXTBOOKS:

REFERENCES:

15CHY247 MODERN POLYMER COMPOSITES 3 0 0 3

Unit 1

Unit 2

Unit 3
Composite precursors: SMCs, DMCs, BMCs prepreg materials and their choice in specific applications. Fabrication processes for FRP Composites: hand layup, spray up, vacuum bag moulding, compression moulding, filament winding, braiding,
pultrusion, RTM, RIM, RRIM, RFI, autoclave moulding, injection moulding etc. Room temperature and hot curing of composites, Nanocomposites: Introduction; Nanoscale Fillers – Clay, POSS,CNT, nanoparticle fillers; Processing into nanocomposites; Modification of interfaces; Properties. Applications. Joining composite elements and repairs, Recycling of polymer composites.

**TEXTBOOKS:**

**REFERENCES**

**15CHY248 ORGANIC REACTION MECHANISMS 3 0 0 3**

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

Reaction of nucleophiles and bases: Nucleophilic substitution - SN1 and SN2 reactions, nucleophilic substitution at aliphatic sp2 carbon and aromatic carbon - nucleophilic addition to carbonyl compounds - addition of grignard and organolithium reagents - reactions of nitrogen containing nucleophiles with aldehyde and ketones - aldol condensation.

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

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

**TEXTBOOK:**

**REFERENCES:**

**15CHY249 ORGANIC SYNTHESIS AND STEREOCHEMISTRY 3 0 0 3**

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

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

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

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

**Unit 3**
Asymmetric synthesis: Stereo selective - Stereo specific - Regioselective and Regiospecific reactions. Principle of protection of alcohol, amine, carboxyl and
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carbonyl groups - Functional group inter conversions - Disconnection approach -
Reversal of polarity - reagents in synthesis.

TEXTBOOKS:

REFERENCES:

15CHY250  POLYMER MATERIALS AND PROPERTIES  3 0 0 3

Unit 1
Structure of polymers – thermoplastic, thermoset, rubber - Linear, branched, 
crosslinked, and network polymers – polymerization types – addition, condensation, 
mechanism, methods – bulk, solution, suspension and emulsion - crystalline,
amorphous, orientation – molecular weight – intermolecular forces, solubility 
parameter - glass transition temperature.

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

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

TEXTBOOK:
Kiichi Takemoto, Raphael M. Ottenbrite, Mikiharu Kamachi, “Functional Monomers and Polymers”, 

REFERENCES:
1. A B Kaiser, “Electronic properties of conjugated polymers - basics, models and applications”, 

15CHY251  POLYMERS FOR ELECTRONICS  3 0 0 3

Unit 1

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

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

Unit 3

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

TEXTBOOK:

REFERENCES:

15CHY252  SOLID STATE CHEMISTRY  3 0 0 3

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

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


Unit 3

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

REFERENCES:

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reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

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

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

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

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.


TEXTBOOKS:

15CHY332 CORROSION SCIENCE 3 0 0 3

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

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

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

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

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

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


TEXTBOOKS:

REFERENCES:

15CSE100 COMPUTATIONAL THINKING AND PROBLEM SOLVING 3 0 2 4

Unit 1

TEXTBOOK:

REFERENCES:
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15CSE180 COMPUTER PROGRAMMING LAB. 0 0 2 1
Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while, for), programs using user defined functions and library functions, programs on Files, arrays, matrices (single and multi-dimensional arrays), programs using DMA, programs on strings, structures.

REFERENCE:

15CUL101 CULTURAL EDUCATION I 2 0 0 2
Unit 1
Introduction to Indian Culture; Introduction to Amma’s Life and Teachings; Symbols of Indian Culture.

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

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

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

15CUL111 CULTURAL EDUCATION II 2 0 0 2
Unit 1
1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

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

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

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

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

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

15CUL230 ACHIEVING EXCELLENCE IN LIFE - AN INDIAN PERSPECTIVE 2 0 0 2
OBJECTIVES: The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.

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

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

Experiencing life through its Various Stages
Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);
Unit 2
Personality Development
What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)
Art of Relaxed Learning; Art of Listening; Developing 'Shraddha' – a basic qualification for obtaining Knowledge;

Communication Skills - An Indian Perspective;

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

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

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

REFERENCE BOOKS:
1. Awaken Children (Dialogue with Sri Mata Amritanandamayi) Volumes 1 to 9
2. Complete works of Swami Vivekananda (Volumes 1 to 9)
3. Mahabharata by M.N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)
4. Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Volumes 1 to 3)
7. Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
8. Will Power and its Development- Swami Budhananda published by Advaitha Ashram, Kolkata
10. Yoga In Daily Life - Swami Sivananda – published by Divine Life Society
12. All about Hinduism – Swami Sivananda - Published by Divine Life Society
13. The Mind and its Control by Swami Budhananda published by Advaitha Ashram, Kolkata
15. Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi

REFERENCE BOOKS:
17. Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.
18. Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telies, published by Swami Vivekananda Yoga Prakashana, Bangalore.

15CUL231 EXCELLENCE IN DAILY LIFE 2002

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

Unit 2
4. The play of the mind. Emotions – convert weakness into strength.
5. The indispensible role of the intellect. How to achieve and apply clear thinking?
7. Increase Productivity, reduce stress... work patterning.

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

REFERENCES:
The Bhaja Govindam and the Bhagavad Gita.
SYLLABI


2015 admissions onwards

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.

15CUL233

YOGA PSYCHOLOGY

2 0 0 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

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

Patanjali Yoga Sutra – 4

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

Patanjali Yoga Sutra – 6

Patanjali Yoga Sutra – 7

Unit 3
Patanjali Yoga Sutra – 8

Patanjali Yoga Sutra – 9

Patanjali Yoga Sutra – 10
Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

Report review
Conclusion

REFERENCES:
- The course book will be "The four chapters of Freedom" written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
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- "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, Uttarajal.
- 'Hatha Yoga Pradipika' Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

15EEE180 WORKSHOP B 0 0 2 1

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

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

15ENG111 COMMUNICATIVE ENGLISH 2 0 2 3

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

Unit 1
- Reading: Different styles of communication – Reading Comprehension - critical thinking and analysis – Note-making – Any two pieces from the text.

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

Unit 3
- Practical sessions (Listening & Speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – Listening comprehension and Note-taking - Any two pieces from the text.
- Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews, etc.

Text: Language through Reading: Compilation by Amrita University for internal circulation

Poems:
- i. The Poplar Field by William Cowper
- ii. Telephone Conversation by Wole Soyinka

Prose:
- i. Higher Mathematics by R. K. Narayan
- ii. Wings of Fire by Abdul Kalam (Part III.11)

Short Stories:
- i. Best Investment I Ever Made by A. J. Cronin
- ii. Death of an Indian by Krishna Charan Das

15ENG230 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.
SYLLABI  
2015 admissions onwards

Unit 1

Unit 2
Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

Unit 3
Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques.

Activities
Case studies & role-plays.

BOOKS RECOMMENDED:

15ENG231 INDIAN THOUGHT THROUGH ENGLISH 1 0 2 2

OBJECTIVES: To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about the societal changes in the recent past.

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

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

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

REFERENCES:

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

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

Unit 1 Poems

Unit 2 Short Stories

Unit 3 Prose

Practicals:
Role plays: The Proposal, Chekov / Remember Caesar, Gordon Daviot / Final Solutions, Mahesh Dattani ; Book reviews, Movie reviews.

SUGGESTED READING:The Old Man and the Sea, Hemingway / Any one of the novels of R. K. Narayan, etc.

15ENG233 TECHNICAL COMMUNICATION 1 0 2 2

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

Unit 1
SYLLABI B. Tech. - Aerospace Engg.  2015 admissions onwards

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

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

REFERENCES:

15ENG234  INDIAN SHORT STORIES IN ENGLISH  1 0 2 2

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

Unit 1

Unit 2

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

TEXT:

REFERENCE:

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

15ENV300  ENVIRONMENTAL SCIENCE AND SUSTAINABILITY  3 0 0 3

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

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

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

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

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

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

Unit 3

Schools of Engineering Amrita Vishwa Vidyapeetham S 69

Schools of Engineering Amrita Vishwa Vidyapeetham S 70
Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes /Green buildings, Sustainable communities, Sustainable Cities.

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

TEXTBOOKS / REFERENCES:

15FRE230 PROFICIENCY IN FRENCH LANGUAGE (LOWER) 1 0 2 2

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

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

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

15FRE231 PROFICIENCY IN FRENCH LANGUAGE (HIGHER) 1 0 2 2

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

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

Unit 3 University Restaurant
Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).
Grammar - Partitif (expressing quantity) (du, de la, pas de…); Comparison (plus...que, moins...que, autant ...que); Interrogation (continuation), inversion, Est-ce que, qu'est-ce que?.
Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

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

Numbers till 1000. Saying a year.
Alphabets – spelling a word.

Filling up an application form; In the restaurant – making an order.

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

Vocabulary: Food items

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

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

Vocabulary: Furniture and currencies.

15GER231 GERMAN FOR BEGINNERS II 1 0 2 2

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

Grammar: Dative of personal pronouns. Imperative form.

Vocabulary: Consumables and measurements;

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

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

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

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

Some useful websites will be given.

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

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

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

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

Some German culture. Films.

15HIN101 HINDI I 1 0 2 2

OBJECTIVES: To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.
Unit 1
Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindi language, Devanagari script and Hindi alphabet.

Shabda Bhed, Roopanthar ki Dristhi se - Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed- Sangya ke Roopanthar - kriya.

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

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

Unit 4

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

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

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

Unit 2

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

REFERENCES:
GLIMPSES INTO THE INDIAN MIND: 2002
THE GROWTH OF MODERN INDIA

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

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

Unit 3
Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Swami Vivekananda; Sri Aurobindo; Sri Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharmapal; Raja Rao; V.S. Naipaul.

Conclusion.

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

GLIMPSES OF ETERNAL INDIA 2002

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

Unit 2
India’s contribution to the world: spirituality, philosophy and sciences
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.

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

Unit 3
Women in Indian society
The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadaranyak Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya’s Arthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

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

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

REFERENCES:
17. Aurobindo, Sri. The Indian Renaissance / India's Rebirth / On Nationalism.
25. Danino, Michel. The Invasion That Never Was.

Schools of Engineering
Amrita Vishwa Vidyapeetham
S 79

SYLLABI
2015 admissions onwards

15HUM233 GLIMPSES OF INDIAN ECONOMY AND POLITY  2 0 0 2

Unit 1
Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.

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

Unit 2
Classical India: 600B.C. – 1200 A.D.
The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthasastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Dvijayija: 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;
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 Portbunder, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations – division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947

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

Conclusion

REFERENCES:
1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
2. Arthasastra.
TEXTBOOKS:
B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.

REFERENCE BOOKS:
WHO Report on Adolescent Health: 2010

15HUM235 INDIAN CLASSICS FOR 2002
THE TWENTY-FIRST CENTURY

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

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

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

REFERENCE:
The Bhagavad Gita, Commentary by Swami Chinmayananda

15HUM236 INTRODUCTION TO INDIA STUDIES 2002

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.

15HUM237 INTRODUCTION TO SANSKRIT LANGUAGE AND LITERATURE 2002

OBJECTIVES: To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit; to help students appreciate and imbibe India's ancient culture and values.

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

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

TEXTBOOK:
Material given by the Faculty

BACKGROUND LITERATURE:
1 Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
2 Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
3 Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
4 Outlines of Indian Philosophy, M. Hiriyanna, MLBD.
5 An Advanced History of India, R. C. Majumdar et al, Macmillan.
6 India Since 1526, V. D. Mahajan, S. Chand & Company
7 The Indian Renaissance, Sri Aurobindo.
8 India’s Rebirth, Sri Aurobindo.
9 On Nationalism, Sri Aurobindo.
12 Universal Message of the Bhagavad Gita, Swami Ranganathananda, Advaita Ashrama.
13 Awaken Children: Conversations with Mata Amritanandamayi
14 Indian Aesthetics, V. S. Seturaman, Macmillan.
15 Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.
16 Web of Indian Thought, Sister Nivedita
17 Essays on Indian Nationalism, Anand Kumaraswamy
18 Comparative Aesthetics, Volume 2, Kanti Chandra Pandey, Chowkhamba, Varanasi
19 The Invasion That Never Was, Michel Danino
20 Samskara, U. R. Ananthamurthy, OUP.
21 Hayavadana, Girish Karnard, OUP.
22 Naga-Mandala, Girish Karnard, OUP.
**Unit 1**

**Unit 2**
Language Studies - Role of Sanskrit in Indian & World Languages.

**Unit 3**

**Unit 4**

**Unit 5**
Indology Studies – Perspectives and Innovations.

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

**15HUM238 NATIONAL SERVICE SCHEME 2 0 0 2**

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

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

**15HUM239 PSYCHOLOGY FOR EFFECTIVE LIVING 2 0 0 2**

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

**Unit 2**
The Nature and Coping of Stress

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

2015 admissions onwards

TEXTBOOKS:

REFERENCE BOOKS:

15HUM240 PSYCHOLOGY FOR ENGINEERS 2002

Unit 1
Psychology of Adolescents: Adolescence and its characteristics.

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

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

TEXTBOOKS:

REFERENCE BOOKS:

15HUM241 SCIENCE AND SOCIETY – AN INDIAN PERSPECTIVE 2002

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.

REFERENCES:
18. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.
SYLLABI B. Tech. - Aerospace Engg. 2015 admissions onwards

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

15HUM242 THE MESSAGE OF BHAGWAD GITA 2 0 0 2

Unit 1
Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha.


Unit 2
Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma.

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

Unit 3


TEXTBOOKS / REFERENCES:

15HUM243 THE MESSAGE OF THE UPANISHADS 2 0 0 2

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

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

TEXTBOOKS / REFERENCES:
1. The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama
3. Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press
4. Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore
5. Upanishads in Daily Life, Sri Ramakrishna Math, Mysore.
7. Upanishad Ganga series – Chinmaya Creations

15HUM244 UNDERSTANDING SCIENCE OF FOOD AND NUTRITION 1 0 2 2

Unit 1 Food and Food Groups
Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food safety standards.

Cookery Practicals - Balanced Diet

Unit 2 Nutrients and Nutrition
Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

Practicals - Traditional Foods

Unit 3 Introduction to Food Biotechnology
Future foods - Organic foods and genetically modified foods, Fortification of foods value addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

Schools of Engineering Amrita Vishwa Vidyapeetham S 89

Schools of Engineering Amrita Vishwa Vidyapeetham S 90
SYLLABI B. Tech. - Aerospace Engg. 2015 admissions onwards

Practicals - Value added foods

**TEXTBOOKS:**

**REFERENCE BOOKS:**

15JAP230 PROFICIENCY IN JAPANESE LANGUAGE (LOWER) 1 0 2 2

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

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

15JAP231 PROFICIENCY IN JAPANESE LANGUAGE (HIGHER) 1 0 2 2

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

Students will be given detailed lectures on Calligraphy.

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

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.
OBJECTIVES: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

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

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

Unit 3

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

Unit 5
Essay writing: Argumentative & Analytical
Précis writing

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

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

REFERENCES:
SYLLABI

B. Tech. - Aerospace Engg. 2015 admissions onwards

Unit 1
Ancient poet trio: Kalayana sougandhikam, (kallum marangalun... namukkennarika vnikodara) Kunjan Nambiar - Critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Transilated by Attor Krishna Pisharody).

Unit 2

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

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

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

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

REFERENCES:

SYLLABI

B. Tech. - Aerospace Engg. 2015 admissions onwards

Unit 2

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


TEXTBOOKS:

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

TEXTBOOK:

REFERENCE BOOKS:

15MAT202 LINEAR ALGEBRA 2 1 0 3

Unit 1

Unit 2
Change of basis - Orthogonal complements - Projection on subspace - Least Square Principle. Linear Transformations: Positive definite matrices - Matrix norm and condition number – QR - Decomposition

Unit 3
Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Change of basis - Nilpotent transformations - Similarity of linear transformations - Diagonalisation and its applications - Jordan form and rational canonical form.

TEXTBOOK:

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

Unit 2
Sturm-Liouville problems - Hamilton's principle - Lagrange's equations - Generalized dynamical entities - Constraints in dynamical systems - Applications in dynamics of particles, vibrating string, vibrating membranes, theory of elasticity - The variational problem of a vibrating elastic plate – Direct methods in calculus of variations - The Rayleigh-Ritz and finite difference methods. (Book-1)

Unit 3
Numerical Integration and Differentiation. (Book-2: Sections: 19.1-19.5)

TEXTBOOK:

REFERENCE BOOK:

15MEC100  ENGINEERING DRAWING - CAD  2 0 2 3


TEXTBOOK:

REFERENCES:

15MEC102  ENGINEERING MECHANICS  3 0 0 3

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 dimension: Moment of a force about a point - moment of a couple - equivalent force - couple system. Rigid body equilibrium: Beams - support reactions.

Unit 2
Centroid of lines, areas - composite areas. Second Moment of area - polar moment of inertia - mass moment of inertia - radius of gyration.

Unit 3
Dynamics of particles: Kinematics of particles-rectilinear motion - relative motion - position, velocity and acceleration calculations in cylindrical coordinates.
Dynamics of rigid bodies: General plane motion-translation and rotation of rigid bodies - Chasle’s theorem.

TEXTBOOKS:

REFERENCES:

15MEC180  WORKSHOP A  0 0 2 1

1. Product Detailing Workshop
Disassemble the product of sub assembly - Measure various dimensions using measuring instruments - Free hand rough sketch of the assembly and components - Name of the components and indicate the various materials used - Study the functioning of the assembly and parts - Study the assembly and components design for compactness, processing, ease of assembly and disassembly - Assemble the product or subassembly.
2. Pneumatics and PLC Workshop
Study of pneumatic elements - Design and assembly of simple circuits using basic pneumatic elements - Design and Assembly of simple circuits using Electro-pneumatics.

Study of PLC and its applications - Simple programming using ladder diagrams.

3. Sheet Metal Workshop
Study of tools and equipments - Draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray etc.) Fabrication of components using small shearing and bending machines - Riveting and painting practice.

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

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

REFERENCE:
Concerned Workshop Manual

15PHY100 PHYSICS 3 0 0 3

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


Unit 2 Atomic Structure and Quantum Mechanics

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

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

Unit 3 Statistical Mechanics and Solid State Physics


TEXTBOOK:

REFERENCE BOOK:
"Principles of Physics" by Halliday, Resnick and Walker, 9th edition

15PHY181 PHYSICS LAB. 0 0 2 1

Young's Modulus – Non Uniform Bending
Newton's Rings
Laser - Determination of Wavelength and Particle Size Determination
Spectrometer
Carey Foster’s Bridge
Rigidity Modulus - Tensional Pendulum
Viscosity of Liquid by Stokes’s method
Ultrasonic Interferometer
Hysteresis – B H curve

15PHY230 ADVANCED CLASSICAL DYNAMICS 3 0 0 3

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

Unit 2 Central field problem
Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Schools of Engineering  Amrita Vishwa Vidyapeetham  S 101

Schools of Engineering  Amrita Vishwa Vidyapeetham  S 102
Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.

Unit 3
Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems
Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneuvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

**TEXTBOOKS:**

**REFERENCE BOOKS:**

### 15PHY233 BIOPHYSICS AND BIOMATERIALS 3 0 0 3

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

**Unit 1**

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

**TEXTBOOKS AND REFERENCES:**

### 15PHY234 INTRODUCTION TO COMPUTATIONAL PHYSICS 3 0 0 3

**Unit 1**
Differentiation: Numerical methods, forward difference and central difference methods, Lagrange's interpolation method.

Integration: Newton - cotes expression for integral, trapezoidal rule, Simpsons's rule, Gauss quadrature method.

**Unit 2**

Unit 3

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

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

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

15PHY239 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3

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

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

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

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

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

TEXTBOOK:
SYLLABI
B. Tech. - Aerospace Engg.  2015 admissions onwards

15PHY240  ELECTRONIC MATERIALS SCIENCE  3 0 0 3

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

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

Unit 3

TEXTBOOK:

REFERENCE:

15PHY241  LASERS IN MATERIAL PROCESSING  3 0 0 3

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

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

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

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

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

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

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

**REFERENCES:**

**15PHY245 NUCLEAR ENERGY: PRINCIPLES AND APPLICATIONS 3 0 0 3**

**Unit 1**

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

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

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

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

**TEXTBOOK:**

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

**15PHY247 PHOTOVOLTAICS 3 0 0 3**

**Unit 1**
Introduction to semiconductors: Semiconductors: concept of electron and holes, conduction in semiconductors and concentration of charge carriers in semiconductors. Direct and indirect band gap semiconductors (quantum mechanical treatment). Extrinsic semiconductors: n-type, p-type & compensation doping, carrier concentration; PN junction - concept of bands at PN junction, junction under forward and reverse biases (conceptual).
SYLLABI
B. Tech. - Aerospace Engg. 2015 admissions onwards

Unit 2


Unit 3

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

TEXTBOOK:

REFERENCES:

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

Unit 2
Properties of LASERS
Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of \( \Delta \omega \), 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:

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

15PHY250 QUANTUM PHYSICS AND APPLICATIONS  3 0 0 3

Unit 1

Unit 2
Bosons and Fermions - symmetric and antisymmetric wavefunctions - elements of statistical physics: density of states, fermi energy, Bose condensation - solid state physics: Free electron model of metals, elementary discussion of band theory and applications to semiconductor devices.

Einstein coefficients and light amplification - stimulated emission - optical pumping and laser action.

Unit 3

Nuclear physics: nuclear properties - binding energy and mass formula - nuclear decay with applications - theory of alpha decay - nuclear forces – fission - principle of nuclear reactor - elementary discussion of band theory and applications to semiconductor devices.

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

REFERENCES:

15PHY331 ASTRONOMY  3 0 0 3

Unit 1
Astronomy, an Observational Science: Introduction - Indian and Western Astronomy – Aryabhatta - Tycho Brahe's observations of the heavens - The laws of planetary motion - Measuring the astronomical unit - Isaac Newton and his Universal Law of Gravity - Derivation of Kepler’s third law - The Sun - The formation of the solar system - Overall properties of the Sun - The Sun’s total energy output - Black body radiation and the sun's surface temperature - The Fraunhofer lines in the solar spectrum and the composition of the sun - Nuclear fusion - The proton–proton cycle - The solar neutrino problem - The solar atmosphere: photosphere,

TEXTBOOK:

REFERENCES:

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

Unit 3

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

REFERENCE BOOK:

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


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

Unit 3

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

REFERENCE BOOK:
15PHY335  MEDICAL PHYSICS  3 0 0 3

Unit 1
Ultrasonics - production methods and properties - acoustic impedance - Doppler velocimetry - echo cardiography – resolution – speckle - ultrasound imaging - therapeutic use of ultrasound - use in diagnostics of cardiac problems.


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

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

Unit 3

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

15PHY338  PHYSICS OF SEMICONDUCTOR DEVICES  3 0 0 3

Unit 1
Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects.
15PHY532  
ASTROPHYSICS  
3 0 0 3  

Unit 1  
Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.  
Celestial mechanics - Kepler’s laws - and derivations from Newton’s laws.  
Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.  

Unit 2  
Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.  

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

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

15PHY535  
EARTH’S ATMOSPHERE  
3 0 0 3  

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

Unit 2  

Unit 3  
Air masses, fronts, and mid-latitude cyclones. Weather forecasting: acquisition of weather information, forecasting methods and tools, forecasting using surface charts. Thunderstorms: ordinary (air-mass) thunderstorms, mesoscale convective complexes, floods and flash floods, distribution of thunderstorms, lightning and thunder. Tornadoes: severe weather and Doppler radar, waterspouts.  

Unit 4  
Hurricanes (cyclones, typhoons): tropical weather; anatomy, formation, dissipation and naming of hurricanes. Air pollution: a brief history, types and sources, factors that affect air pollution, the urban environment, acid deposition. Global climate: climatic classification; global pattern of climate.  

Unit 5  
Climate change: possible causes; carbon dioxide, the greenhouse effect, and recent global warming. Light, colour, and atmospheric optics: white and colours, white clouds and scattered light; blue skies and hazy days, red suns and blue moons; twinkling, twilight, and the green flash; the mirage; halos, sundogs, and sun pillars; rainbows; coronas and cloud iridescence.
SYLLABI          B. Tech. - Aerospace Engg.          2015 admissions onwards

TEXTBOOK:

REFERENCE:

15PHY536 EARTH'S STRUCTURE AND EVOLUTION 3 0 0 3

Unit 1
Introduction: geologic time; earth as a system, the rock cycle, early evolution, internal structure & face of earth, dynamic earth. Matter and minerals: atoms, isotopes and radioactive decay; physical properties & groups of minerals; silicates, important nonsilicate minerals, resources. Igneous rocks: magma, igneous processes, compositions & textures; naming igneous rocks; origin and evolution of magma, intrusive igneous activity, mineral resources and igneous processes.

Unit 2
Volcanoes and volcanic hazards: materials extruded, structures and eruptive styles, composite cones and other volcanic landforms, plate tectonics and volcanic activity. Weathering and soils: earth’s external processes; mechanical & chemical weathering, rates; soils, controls of formation, profile, classification, human impact, erosion, weathering and ore deposits. Sedimentary rocks: the importance and origins of sedimentary rocks; detrital & chemical sedimentary rocks, coal, converting sediment into sedimentary rock; classification & structures, nonmetallic mineral & energy resources. Metamorphism and metamorphic rocks: metamorphic textures, common metamorphic rocks, metamorphic environments & zones.

Unit 3

Unit 4
Shorelines: coastal zone, waves & erosion, sand movement, shoreline features & stabilization; erosion problems along U.S. coasts, hurricanes, coastal classification.

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

15PHY540 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.
**SYLLABI**  
**B. Tech. - Aerospace Engg.**  
2015 admissions onwards

### Dynamical Systems Theory
- Two-dimensional equilibrium and their stability, saddle points, contraction and expansion, non-chaotic three-dimensional attractors, stability of two-dimensional maps, chaotic dissipative flows.

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

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

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

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

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

- Nonlinear prediction and noise-reduction: linear predictors, state-space prediction, noise reduction, Lyapunov exponents from experimental data, false nearest neighbours.

- Fractals: Cantor sets, curves, trees, gaskets, sponges, landscapes.

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

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

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

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

**TEXTBOOK:**

**REFERENCES:**

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

**Unit 1**
- Properties of semiconductors: Electron and photon distribution: density of states, effective mass and band structure, effect of temperature and pressure on band gap, recombination processes.

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

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

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

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

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

**REFERENCES:**
SYLLABI  B. Tech. - Aerospace Engg.  2015 admissions onwards


15SAN101  SANSKRIT I  1 0 2  2

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

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

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

Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi - karthariprayoga

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

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

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

ESSENTIAL READING:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
2. Sanskrit Reader I, II and III, R.S. Vadyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally

15SAN111  SANSKRIT II  1 0 2  2

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

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

Unit 2

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

Unit 4
Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas- Bhagavad Gita – chapter -II verse 47, chapter - IV verse 7, chapter - VI verse 5, chapter - VIII verse 6, chapter -XVI verse 21, Kalidasa’s Sakuntala act IV –verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14- 120, Neetisara chapter - III

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

ESSENTIAL READING:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R.S. Vadyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalingananasanam by Aamarasimha published by Travancore Sanskrit series
15SSK221  SOFT SKILLS I  1 0 2 2

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

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

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

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

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

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

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

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

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

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

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

15SSK321  SOFT SKILLS II  1 0 2 2


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

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

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

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

Data sufficiency: Concepts and problem solving.
Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous. Spatial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

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

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

**15SSK331 SOFT SKILLS III 1 0 2 2**

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

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

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

**SYLLABI**

**B. Tech. - Aerospace Engg. 2015 admissions onwards**

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
   www.englishpage.com- online teaching resources and other useful websites.

**15SWK230 CORPORATE SOCIAL RESPONSIBILITY 2 0 0 2**

**Unit 1**

Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy, CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.
### Unit 2
CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

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

### REFERENCES:

### Unit 1

### Unit 2

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

### REFERENCES:
3. Canadian Mental Health Association, Ontario "Workplace mental health promotion, A how to guide
6. Mental Health Act 1987 (India) www.tnhealth.org/mha.htm
7. Persons with disabilities Act 1995 (India) socialjustice.nic.in
8. The Factories Act 1948 (India) www.caara.in/Image/19ulabourlawshb.pdf

### 15TAM101
**TAMIL.I**

Objectives: To introduce the students to different literature - Sangam literature, Fipics, Bhakthi literature and modern literature. To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

### Unit 1
Sangam literature : Kūṟṟuntokai (2, 6,8,40 āṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟrowCount) – tirukkural (74,112,184,162 paṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟ tamil

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Schools of Engineering  
Amrita Vishwa Vidyapeetham  
S 131
Unit 2

Epic literature: cēlapattikāram maturāik kārtaṃ (valakkuvaikkāthāi 50-55)
Spiritual Literature: tiruppāvai (3,4) – vēgāram (mācivēdiyūram)
Medieval Literature: bāratiyār kāṟṇāṟā pāṭṭu (ēṟ vilaiyāṭṭu pīḷḷai) – bāratiyācār
kaṭāmpavālakku (tāyirialāṭṭu).

Unit 3

Novel: Jeyakāntaṉ “kumi pīṭṭam”
Essay: Aṟṟā “ē tāḷāta tāmilaṭṭam”

Unit 4

Tirukkāṭṭa campanar – tirunāvukkaracar – cunrār – māṇiṇka vācakar – āṟṟāl –
tirunīḻar – kulacakkamālāvēr – cētalai cēṭṭapār thōṟṟapāṟ vēyikāl, māṟṟukal māṟṟum
ceṭṭuppu peykal.

Unit 5

Tamil Grammar: Col vakaikal - vēṟṟumai urupukal - valluṟum mikumīṟum
mikkirēṟam - cēnti(puṭṭarcei) - ilakkaṭṭuvaikkippu.
Practical skills. Listening, speaking, writing and reading.

Textbooks:
- Aṟṟa “ē tāḷāta tāmilaṭṭam” nakkattu pāppalēṟṟant.
- Cēṭṭam samrupamāṭṭu “nallā kāṭṭonkai māḷamum maraiyām”
mollai potippokka, 7008.
- Pāṭṭiṟu kēḷvēṟu “kāṭṭonkai māḷamum maraiyām” cēṭṭo potippokka, 2010.

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

Unit 1

The history of Tamil literature: Nāṭṭupuṭṭapāṭṭalkal, kataikkal, pāḷamoljika-
cēṭṭokkita māḷamum vāṟṟam, cēṭṭakaraiyakkal. Kāṭṭikaitup pāḷḷi (pōṟṟi pāṭṭiyu) - mukkāṟa pāḷḷi 35.
Kāṭṭiyakkal: Cēḷappattikāram – māṇiṇika laṇaiyiyal āṟṟu māṟṟum aḻirmperum –
aiṭcēṟu kāḷṭiyakal kāṭṭāṟa pāṭṭalkal.

Unit 2

tīṟṟi anikaṭṭuvaikkippum - pāṭṭiṟuvaikkakkakkum mūṟṟu kāṭṭāṟa pāṭṭalkal pirā
ceṭṭikai - tirukkāṭṭa (aṟṟpu, pāṭṭu, kalvi, cēḷkkam, pāṭṭu, vāṟṟumai, kēḷvi, cēṇṇi,
periyaraiṭṭuvaikkakkal, vilppuvaikru pēṟṟa atikarattu uḷḷa ceṭṭikai.
Aṟṟumolākkal: Uḷḷukkai (1-5) – ēḷḷi (1,3,6). - Cēṭṭalkal: Kāṭṭuva_ARRU cēṭṭalkal
(āṟṟumolākkal – 1,4,6,7,8), māṟṟum akappū cēṭṭalkal pāṭṭalkal (1-5).

Unit 3

tāṁḷaṭṭakam: Vēḷikkai vakaikal – tāṇṟiṇai pīṭṭam – nēṟṟakkāṟi ayarkṟtu

Unit 4

tāṁḷaṭṭakal aṟṟumolākkal tāṁḷaṭṭa camuṟṟa caṟṟum: Pāṟṟatīyār, pāṟṟatīcār,
peṟṟukkūṟai kāḻyāṟaṟṟantam, eṟṟutur, ēṟṟāṟu, cēḷpp, mēṭṭu, aṟṟuṟuṟu māṟṟum,
na. Pāṟṟcīṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟṟооружuvaikkakkal.

Unit 5

tāṁḷ mōṟṟi ayvāl kāṇṭṟi pāṟṟIPPu. - Karuttu pāṟṟippuvaikkippum - vēḷampa
moṟṟippuvaikkippum – pēcču - nāṟṟkam pāṟṟippum - cēḷkusēṟu, kaiṭa, putiṟṟum pāṟṟippum.
Textbooks:

- M. Varadarajan “tamil Ilakkiya varavai” vahitya akal:ami pahākārā, 2012
- nā. Vairamāmalai “pāvaihastakam, pāvaihjikālam” niyā ceicuri
  puttaka veivyākam, 1980,2008
- nā. Vairamāmalai, “tarmēkā rāpppākkētakēl” niyā ceicuri puttaka veivyākam
  1964,2006
- pōr marimātē “akār tami Ilakkarēm ”akār pāvaih karē, valkivēr,