SEMESTER I


DIFFERENTIAL CALCULUS: Basic concepts - Limits, continuity, differentiation, functions of several variables, partial derivatives, total derivatives, Taylor’s formula for functions of two variables. (8+5)

INTEGRAL CALCULUS: Double integrals - double integrals over rectangles, double integrals as volumes, Fubini’s theorem (concept and statement only), double integrals in polar form, changing the order of integration. (6+4)

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER: Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation, modelling - mixing problems, Newton’s law of cooling. (8+5)

LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER: Homogeneous linear equations of second order, linearity principle, initial value problem, general solution, second order homogeneous equations with constant coefficients, Euler – Cauchy equation, solution by variation of parameters, modelling - free oscillations. (7+5)

VECTOR CALCULUS: Gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field. Integration in vector field – line integrals, work, circulation and flux, path independence, conservative fields, surface integrals. Green’s, Gauss divergence and Stoke’s theorems (concepts and statements only), evaluation of line, surface and volume integrals. (16+11)

TEXT BOOKS:

REFERENCES:

15A102/15M102/15P102 PHYSICS


TEXT BOOKS:

Total L: 45 + T: 30 = 75

Total L: 45
REFERENCES:

15A103/15M103/15P103/15Y103 CHEMISTRY


Total L: 45

TEXT BOOKS:

REFERENCES:

15A104 PROBLEM SOLVING AND C PROGRAMMING

INTRODUCTION TO PROBLEM SOLVING: Program development - Analyzing and Defining the Problem - Algorithm - Flow Chart, (2+2)

PROGRAMMING LANGUAGES: Definition - Types of programming language – Modular Programming - Program Development Environment. (2+2)


CONTROL STATEMENTS: If else - Switch Case - While - Do While - For - Nested loops - break – continue – goto statements. (4+4)

FUNCTIONS: Function prototype - Defining a function – function call - Passing arguments to a function - Storage classes - auto - static - extern and register variables. (4+4)

ARRAYS: Defining an array - Processing an array - Passing array to a function - Multi dimensional array - Arrays & strings. (4+4)

POINTERS: Definition - Pointer Arithmetic - Pointer and arrays – Dynamic memory allocation. (2+2)
STRUCTURES AND UNIONS: Definitions - Processing a structure – Array and structures – Nested structures - Structures and pointers - Structures and functions.

FILES: Need for files – Operations on files - Sequential and Random access file functions - File Handling Functions - Error handling functions.

Preprocessor Directives - Command Line Arguments.

TEXT BOOKS:

REFERENCES:
3. Rama N. Reddy Carol A Ziegler, "C Programming For Scientists And Engineers With Applications", Jones and Bartlett, New Delhi, 2010.

15A105 ENGINEERING MATERIALS


STEELS AND CAST IRONS: Composition, structure and properties of steels - carbon steels, low alloy steels stainless steels, tool steels. Composition, structure and properties of cast irons - grey iron, ductile iron, white iron and malleable iron, commercial grades of materials.


MECHANICAL TESTING OF METALS: Hardness testing - Rockwell hardness test, Brinell hardness test, Knoop and Vickers hardness tests. Impact testing-Charyp and Izod tests. Non-destructive tests – liquid penetrant test, magnetic particle test, radiography test (both x-ray and gamma ray) and ultrasonic test.

ADVANCED MATERIALS: Automotive Light weight materials, Composites, Polymers, Rubbers, Nano structured materials, Smart materials, Elastomers, Plastics, MEMS and NEMS materials. Materials for Intelligent systems and other safety systems.

TEXT BOOKS:

REFERENCES:

15C104 ENGLISH LANGUAGE PROFICIENCY


WRITING PRACTICE

FOCUS ON SPOKEN ENGLISH: Task – based activities with graded levels of difficulty and with focus on language functions
Level 1: Self – expression – Greetings in Conversation, Hobbies, Special interests, Daily routine
Level 2: General Awareness – Expression of Concepts, Opinions, Social Issues, Description of a process / picture/chart, news presentation / review
Level 3: Advanced Skills – Making Short Speeches and Participating in Role Plays.

LISTENING ACTIVITY: Task- based Activities using Language Lab.

TEXTBOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15A110 ENGINEERING GRAPHICS I


PROJECTION OF SOLID GEOMETRY: Projection of points, lines, planes and Solids.

PICTORIAL PROJECTIONS: Principles of pictorial views, isometric view of simple engineering components. Free hand sketching of orthographic views from pictorial views. Free hand sketching of isometric views from given two or three views.

TEXT BOOKS:

REFERENCES:

15A111 PHYSICS LABORATORY I

List of Experiments:
1. Determination of Young’s modulus of a wooden bar – Cantilever method.
2. Determination of coefficient of viscosity of water – Poiseuille’s method.
5. Determination of thermal conductivity of bad conductor using Lee’s disc method

Demonstration:
1. Optical phenomena using He – Ne Laser
2. Ultrasonic cleaning.
3. Thin film deposition using DC/RF sputtering technique.
4. Surface Profilometer

REFERENCES:
1. Physics Practicals, Department of Physics, PSG College of Technology, 2015.
15A112/15M112/15P112 CHEMISTRY LABORATORY I

1. Estimation of strength of an acid by pH -metry.
2. Estimation of acids in a mixture by conductometry.
3. Anodizing of aluminium and determination of thickness of anodic film, sealing and dyeing of anodic film.
4. Determination of total, permanent, temporary, calcium and magnesium hardness of water by EDTA method.

REFERENCE:
1. Laboratory Manual Prepared by the Department.

Total P: 30

15A113 AUTOMOBILE BASICS

Study of the following vehicle systems

2. Engine- petrol, diesel, four and two- strokes.
3. Transmission- clutch, gearbox, transaxle, and transfer case.
4. Axles, final drive, differential, wheels and tyres.
5. Chassis and super structures.
6. Suspension systems, leaf springs, coil springs and shock absorbers.
7. Steering systems, steering gear-box, and its linkages.
8. Brakes types and accelerator mechanisms.
9. Automotive electrical systems.
10. Automotive electronics systems

REFERENCE:
1. Laboratory manual prepared by Department of Automobile Engineering, 2015.

Total P: 30

SEMESTER II

15A201 COMPLEX VARIABLES AND TRANSFORMS

3 2 0 4

COMPLEX VARIABLES: Complex differentiation-Analytic function, Cauchy Riemann equations, harmonic functions.  

COMPLEX INTEGRATION: Cauchy’s integral theorem, Cauchy's integral formula, Laurent series (concept and statement only), singularities and zeros, residue integration method (Residue integration of complex integrals only), linear fractional transformations.

LAPLACE TRANSFORMS: Laplace transform, inverse transform, linearity, s-shifting, transforms of derivatives and integrals, unit step function, t-shifting, Dirac’s delta function, periodic functions, convolution, differentiation and integration of transforms, Method of solving differential equations and integral equations by using Laplace transform technique.


HOMOGENEOUS PARTIAL DIFFERENTIAL EQUATIONS: Basic concepts, modelling – vibrating string, wave equation, solution by separating variables, one-dimensional heat equation, steady state two-dimensional heat equation (Cartesian coordinates only) - solution by Fourier series.

TEXT BOOKS:

REFERENCES:

Total L: 45+T: 30=75
15A202 MATERIALS SCIENCE  


REFERENCES: 

15A203 CHEMISTRY OF ENGINEERING MATERIALS  


BATTERIES AND FUEL CELLS: Batteries: types - characteristics - construction and working of Lechlanche cell, lead-acid battery, nickel-cadmium battery, lithium ion battery. Outline of batteries for special applications such as automobiles, airplanes, satellites, torpedoes. Fuel cells: hydrogen – oxygen, direct methanol and proton exchange membrane fuel cells. 


Total L: 45
TEXT BOOKS:

REFERENCES:

15A204 ENGINEERING THERMODYNAMICS

BASIC CONCEPTS: System and their behavior, properties of a system, state and equilibrium, process and cycles, pure substance and property diagram for phase change process, zeroth law and first law of thermodynamics - Applications, energy and energy transfer - Heat and work interactions, general energy equation and applications to thermal equipments - Turbines, compressors, nozzle and diffuser.


GAS POWER CYCLES: Basic consideration in the analysis of power cycles, Otto, diesel and dual cycles and their performance, Brayton cycle with regeneration, intercooling and reheating - Performance analysis.

VAPOUR POWER AND REFRIGERATION CYCLES: Rankine cycle with reheating and regeneration, open and closed feed water heating system - Performance analysis and comparison with Carnot cycle, cogeneration, refrigeration cycle. vapour-compression and absorption system.

THERMODYNAMIC RELATION: Equations of state, Maxwell relations, Clapeyron equation, Gibbs equation, Joule-Thomson effect, general relation for real gases - internal energy, enthalpy, and entropy. P-V-T relation for gas mixture, generalized charts and conventional tables for thermodynamic properties.

TEXT BOOKS:

REFERENCES:

15A205 ENGINEERING MECHANICS


ANALYSIS OF STRUCTURES: Simple trusses-Method of joints, joints under special loading conditions – space trusses – analysis of frames

CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA: Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.

KINEMATICS: Introduction-plane, rectilinear and rotary motion-time dependent motion-rectangular coordinates-projectile motion.

**IMPULSE AND MOMENTUM:** Concept of conservation of momentum- Impulse-Momentum principle- Impact-Direct central impact- oblique central impact, impact of a moving train on the spring board.

**TEXT BOOKS:**

**REFERENCES:**

**15A210 ENGINEERING GRAPHICS II**

**SECTION OF SOLIDS:** Sections of regular solids, types of sections, BiS conventions, selection of sectional views. Sectional views of simple engineering components. 

**DEVELOPMENT OF SURFACES:** Development of lateral surfaces of regular solids, truncated solids and simple engineering sheet metal components.

**PERSPECTIVE PROJECTION:** Principles of perspective projection, methods, projection of solids.

**COMPUTER GRAPHICS:** Introduction to 3D modeling packages. Drafting practices - modeling of simple engineering components, layout drawing, sections and extraction of 2D drawings.

**TEXT BOOKS:**

**REFERENCES:**

**15A211 PHYSICS LABORATORY II**

**List of Experiments:**
1. Determination of magnetic hysteresis
2. Determination of small thickness by interferometry
3. Determination of IV characteristics of solar cell
4. Measurement of temperature using IC thermal sensor LM35
5. Determination of specific resistance of metal and alloy using Carry Foster’s bridge.

**Demonstration:**
1. Laser micromachining.
2. Crystal Growth system
3. Thin film deposition using electron beam and thermal evaporation.
4. Differential scanning calorimeter (DSC)

**REFERENCES:**
1. Physics Practicals, Department of Physics, PSG College of Technology, 2015.

**15A212 CHEMISTRY LABORATORY II**

1. a. Determination of alkalinity and TDS of water.
   b. Determination of acid value, saponification value and iodine number of oils.
2. Electroplating of nickel & copper and determination of cathode efficiency.
3. a. Determination of Redwood / Saybolt numbers and kinematic viscosity of lubricating oils.
b. Determination of flash and fire point, cloud and pour point of oil.

REFERENCE:
1. Laboratory Manual Prepared by the Department.

15A213 ENGINEERING PRACTICES

2. Welding - Metal arc welding tools and equipment, exercises by Arc welding and TIG welding Processes.
5. Power Tools - Demonstration of tools and operations.
7. Sheet metal work& Soldering - Tools, operations, exercises – Make a Rectangular Tray in Galvanized Iron sheet.

REFERENCE:

SUMMER TERM COURSES

15A215 PROFESSIONAL SKILLS
(4 weeks duration)

UNIT 1 A: HISTORICAL PERSPECTIVE AUTOMOBILE ENGINEERING

UNIT IB: TRAINING IN CAD PACKAGE:
Solid modeling and assembly practice, Extraction of 2D view from 3D modeling, Coloring and shading of 3D models.

UNIT II: SEMINAR PRESENTATION AND TECHNICAL REPORT WRITING
Each student will be required to submit a technical report based on the guidelines provided by the department.

PROJECT PRESENTATION: Each student will be required to make one technical presentation for a minimum 15 minutes duration in this course. Individual topics will be assigned to the students by the department.

PROFESSIONAL COMMUNICATION: ORAL SKILLS: Principles of group communication, interviewing, and making presentations-group discussions, role plays, mock interviews- talking about some visual information- giving and receiving instructions.

REFERENCES:

15A216 INPLANT TRAINING AND TECHNICAL SEMINAR

1. Visit to local industries arranged by the department to study the industrial practices.
2. Lectures by industrial experts will be arranged to gain exposure to the trends in design, manufacturing and quality control.
3. Presentation by students.
SEMESTER III

15A301 NUMERICAL METHODS

ERRORS: Approximations and round-off errors - truncation errors. (2+1)
LINEAR ALGEBRAIC EQUATIONS: Direct methods - Naive Gauss elimination method, Gauss-Jordan method, Cour's method. Iterative methods - Gauss-Jacobi method, Gauss-Seidel method, eigenvalues and eigenvectors - power method, Jacobi method. (5+5)
NONLINEAR EQUATIONS: False-position method, Newton-Raphson method, Bairstow's method, Graeffe's root squaring method. (4+4)
INTERPOLATION AND CURVE FITTING: Newton's forward and backward interpolating polynomials, Newton's divided-difference interpolating polynomials, Lagrange interpolating polynomials, coefficients of an interpolating polynomial, Chebyshev interpolation Curve fitting - least-squares regression. (4+4)
DIFFERENTIATION AND INTEGRATION: Numerical differentiation - equally spaced and unequally spaced data, numerical integration, Newton-Cotes formulae, Trapezoidal rule, Simpson's 1/3 rule. (4+4)
PARTIAL DIFFERENTIAL EQUATIONS: Finite difference: Elliptic equations - Laplace equation, Poisson equation - Liebnmann method, parabolic equations - heat conduction equation - Crank Nicolson's method, hyperbolic equations - vibrating string. (5+6)

Total L:30+T:30=60

TEXT BOOKS:

REFERENCES:

15A302 STRENGTH OF MATERIALS

MECHANICS OF MATERIALS: Stress and strain, elastic limit, Hooke's law-factor of safety - shear stress, shear strain, relationship between elastic constants. Stresses in stepped bars, uniformly varying sections, composite bars due to axial force. Strain energy due to axial force - proof resilience, stresses due to gradual load, sudden load and impact load - Thermal stresses. (6+4)
TWO DIMENSIONAL STRESS: Principal stresses, normal and tangential stresses, maximum shear stress, analytical and graphical method. (4+3)
CHANGES IN DIMENSIONS AND VOLUME: Lateral strain - Poisson's ratio, volumetric strain, changes in dimensions and volume. Hoop-longitudinal stresses in thin cylindrical and spherical shells under internal pressure-changes in dimensions - volume. (5+3)
BENDING MOMENT AND SHEAR FORCE: Shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads, concentrated moments - maximum bending moment and point of contra flexure. (10+7)
TORSION: Theory of torsion and assumptions - torsion equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft. (5+3)
FLEXURE IN BEAMS: Theory of simple bending and assumptions - flexure equation, section modulus, normal stresses due to flexure. (6+4)
COLUMNS AND STRUTS: Columns - behaviour of axially loaded short, medium and long column members – buckling load – Euler's theory – different end conditions – Rankine's formula. (5+3)
DEFLECTION OF DETERMINATE BEAMS: Governing differential equation - Macaulay's method - moment area method. Application in cantilever beams and simply supported beams. (4+3)

Total L: 45+T: 30 = 75

TEXT BOOKS:
REFERENCES:

15A303 KINEMATICS OF MACHINERY

BASICS OF MECHANISMS: Terminology and definitions, degree of freedom, mobility. Grashoff’s law. Kinematic inversions - 4-bar chain, slider crank chain. Mechanical advantage. Transmission angle. Description of common mechanisms, applications of mechanisms. Introduction to 4-bar spatial mechanisms. (2+2)

KINEMATICS: Displacement, velocity and acceleration analysis in four bar and slider crank mechanisms, graphical method, velocity and acceleration polygons. Kinematic analysis by algebraic method, a demonstration, vector approach, Chace equation. (6+6)

KINEMATICS OF CAM: Classifications, displacement diagrams-parabolic, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife edged, roller, mushroom, flat type, derivatives of follower motion, pressure angle and undercutting, jump speed analysis. (6+6)

GEARS: Spur gear terminology and definitions. Fundamental law of toothed gearing and tooth forms. Interchangeable gears, gear tooth action - path of contact, arc of contact, number of pair of teeth in contact, interference and undercutting. Helical, bevel, worm, rack and pinion gears (basics only). Gear trains, epicyclic gear trains-analysis of epicyclic gear train, relative velocity and torque, automotive differential gear trains. (6+6)

MECHANISM FOR CONTROL: Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force – Other Governor mechanisms. (6+6)

GYROSCOPIC COUPLE: Gyroscopic couple and its effect in ship, car, motorcycle, aero planes, gyroscopic stabilization. (4+4)

Total L: 30 + T:30 = 60

TEXT BOOKS:

REFERENCES:
1. Thomas Beven, “The Theory of Machines”, CBS Publishers and Distributors, New Delhi, 2005

15A304 FLUID MECHANICS AND MACHINERY

FLUID PROPERTIES: Specific gravity and weight, viscosity, capillarity and surface tension, compressibility, vapour pressure and gas laws. Conservation of laws - mass, momentum and energy, continuum hypothesis - Newton’s viscosity law-Newtonian Vs Non-Newtonian Fluids. (6+6)

FLUID STATICS: Pressure in fluids at rest-hydrostatic force on submerged surfaces, Buoyancy and stability, Stream function and vortices, potential function, types of flow and significance, Couette flow, Dimensional analysis, significant dimensionless groups, flow similarity and model studies. (6+6)

FLUID DYNAMICS: Motion of a fluid particle – Fluid deformation – Differential analysis of fluid motion – Continuity and Navier Stokes equation, Euler and Bernoulli’s Equation and their applications, Introduction to computational fluid dynamics - necessity, limitations and applications. (6+6)

FLOW THROUGH PIPES AND FLOW MEASUREMENT DEVICES: Boundary layer theory, Hagen-Poiseuille and Darcy’s equations for friction and pressure drop, Helmholtz’s Theorems, Flow through pipes - Major and minor losses through pipes, Measurement of discharge - Venturi and Orifice Meter, Flow Nozzle, Pitot Tubes, Multi-Hole Probe and anemometer. (6+6)

FLUID MACHINERY: Specific speed-Theory of turbo machines-Hydraulic efficiency- Velocity components at the entry and exit of the rotor-Velocity triangle for single stage radial flow and axial flow machines - Centrifugal pumps, turbines, Reciprocating pumps - Working and performance analysis, Rotary pumps - Classification, Work saved by air vessels. (6+6)

Total L: 30 + T: 30 = 60

TEXT BOOKS:
REFERENCES:

15A305 AUTOMOTIVE ENGINES

CONSTRUCTION AND OPERATION: Introduction to IC engines. Thermodynamic cycle’s .Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI engines – construction and working. Valve timing and port timing diagram. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. (9)

FUEL SYSTEMS: Introduction and fuel system circuit. Air fuel ratio requirements. Working of a carburetor and MPFI. Gasoline direct injection systems. Diesel fuel injection systems -Jerk pumps, distributor pumps, types of nozzles, Unit injector and CRDI systems. Engine governor. (9)


COOLING AND LUBRICATION SYSTEMS: Need for cooling, types of cooling systems- air and liquid cooling systems. Water cooling circuit, radiator, water pump and cooling fan. Properties of coolants and additives. Requirements of lubrication systems. Types-mist, pressure feed, dry and wet sump systems. Properties and chemistry of lubricants. Total L: 45

TEXT BOOKS:

REFERENCES:

15C070 ECONOMICS FOR ENGINEERS

INTRODUCTION: Definition – Nature – Scope and Significance of Economics for Engineers. (4+0)


MONEY AND BANKING: Money – Functions – Quantity theory of money – Banking – Commercial Banks – Functions – Central Bank (RBI) – Functions – Role of Banks in Economic Development. (3+3)


Total L: 30 + T: 15 = 45
TEXT BOOKS:

REFERENCES:

15A310 MATERIALS ENGINEERING LABORATORY

STRENGTH OF MATERIALS
1. Tension test on metals - stress strain characteristics.
2. Hardness test on metals - Brinell, Vicker and Rockwell Hardness tests.
3. Impact test on metals - Charpy, izod impact tests.
4. Shear test on metals - direct shear strength, single shear, double shear.
5. Tests on helical springs - compression and tension springs - load deformation characteristics, stiffness, shear stress, modulus of rigidity, energy.
6. Torsion test on beams - torque and angle of twist characteristics, shear stress, modulus of rigidity, energy.
7. Deflection test on beams - load deformation characteristics, Young’s modulus, Maxwell’s reciprocal law verification.

METALLURGY:
1. (a) Specimen preparation for metallographic inspection.
   (b) Study of metallurgical microscope.
2. (a) Study of grey cast iron and SG iron in unetched condition.
   (b) Study of grey and SG irons in the etched condition.
3. (a) Study of white cast iron and malleable cast iron.
   (b) Study of high carbon steel.
4. (a) Study of quenched and tempered steel.
   (b) Study of case carburized steel.
5. (a) Study of Aluminium alloys.
   (b) Study of copper alloys.

REFERENCES:

15A311 THERMAL ENGINEERING AND FLUID MECHANICS LABORATORY

THERMAL ENGINEERING LABORATORY
1. Experimental study on valve timing diagram in 4-stroke engine and 2-stroke cut model.
2. Performance test on constant speed 4-stroke diesel engine.
4. Heat balance test on 4-stroke diesel engine.
5. IC engine performance evaluation using PC interface.

FLUID MACHANICS LABORATORY
7. Model study in wind tunnel.
8. Performance test on pumps.
9. Load test on reaction turbine.

REFERENCE:
1. Laboratory Manual prepared by Department of Automobile Engineering, 2015

15A312 MACHINE DRAWING

CONVENTIONS: Code of practice for engineering drawing-conventional representation of details- drilled and tapped holes, countersunk and counter bored holes, internal and external threads, undercuts, grooves, chamfers, fillet radii and keyways. Conventions to represent standard components-bolts, nuts, washers, screws, cotters, pins, circlips, bearings, gears, springs and flanges.

ASSEMBLY CONCEPTS: Methods and concepts of assemblies-assembly requirements, Bill of materials. Methods of assembly-bolts, nuts, studs, screws and pins. Methods of arresting motion of a member in an assembly. Assembly and dismantling exercise of a typical assembly with emphasis on assembly sequence and appropriate fits. Assembling and dismantling practice in assemblies like pneumatic cylinder, machine vice.


ASSEMBLY DRAWING PRACTICE: Making free hand sketches of typical subassemblies-flange coupling, stuffing box, journal bearings, rolling element bearings, keyed joints, cotter joints, C clamp. Free hand sketching of I.C Engine subassemblies like piston and connecting rod, gear box.

ASSEMBLY USING SOLID MODELING: Modeling and assembly using a CAD software-extracting views and sections. Drawing of assemblies-plummer block, machine vice, stop valve, screw jack, tail stock, cylindrical gear box, simple drilling. Creation of bill of materials, calculation of mass and section properties, interference check between solids.

SEMESTER IV

15A401/15C401/15M40115Y401/15P401 PROBABILITY AND STATISTICS

PROBABILITY: Sample spaces and events, interpretations of probability, addition rule, conditional probability, multiplication and total probability rules, independence, Baye’s theorem.

RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS: Random variables - discrete random variables, probability distributions and probability mass functions, cumulative distribution functions, expectation, binomial, Poisson and geometric distributions - continuous random variables – probability distributions and probability density functions, cumulative distribution functions, expectation, uniform, normal, and exponential distributions.

JOINT PROBABILITY DISTRIBUTIONS: Two dimensional discrete and continuous random variables, marginal and conditional probability distributions, independence, covariance, correlation and linear regression.

POINT ESTIMATION OF PARAMETERS AND SAMPLING DISTRIBUTIONS: Sampling distributions and the central limit theorem, point estimation - unbiased estimators, variance of a point estimator, standard error and mean squared error of an estimator, method of point estimation - maximum likelihood estimation.

HYPOTHESIS TESTING: Statistical hypothesis, tests of statistical hypothesis, one-sided and two-sided hypothesis, confidence intervals, large and small sample tests, inference concerning means, variances and proportions - Chi-Square test for goodness of fit and independence of attributes.

ANALYSIS OF VARIANCE: Introduction, assumptions of analysis of variance, completely randomized design, randomized block design, Latin square design.

REFERENCES:

TEXT BOOKS:

REFERENCES:

TEXT BOOKS:
15A402 MANUFACTURING PROCESSES

CASTING: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, core and core making, casting design considerations. Casting processes - Sand, centrifugal, die, investment, lost foam, gravity, squeeze, shell. Methods of Melting : Crucible melting and cupola operation. (7)


MACHINING: General principles (with schematic diagrams only) of working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine-Universal drilling machine, cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. General principles and applications of the following processes: Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, electron beam machining and laser beam machining. (11)

POWDER METALLURGY: Production of metal powders, mixing and blending, compacting, sintering and secondary operations. Application of Powder Metallurgy in Automobile fields. (6)

Total L: 45

TEXT BOOKS:

REFERENCES:

15A403 AUTOMOTIVE TRANSMISSION

CLUTCH: Role - positive and gradually engaged types - types of clutches, single plate clutch, coil spring type and diaphragm spring type, multiple plate clutch, centrifugal clutch, calculation of torque transmission, over running clutch. (6)

GEAR BOX: Need for a gearbox, types of gear boxes, sliding mesh, constant mesh and synchromesh gear boxes, calculation of gear ratios, epicyclical gearboxes, overdrives, transfer case - auxiliary gearbox, gear shifting mechanisms. (7)


DRIVE LINE: Chain drive, propeller shaft drive, torque reaction and drive thrust , Hotchkiss drive, Torque tube drive, universal joints, trunnion type, ring type, flexible disc type, constant velocity joint type, swinging arm drives. (6)

AXLE: Live and dead axles, front axle and its types, stub axle and its types, rear axle and its types, fully floating, semi-floating and three quarter floating axles, two speed axles, twin axles, swing axles. (6)

FINAL DRIVE AND DIFFERENTIAL: Need for final drive and differential, types of final drives, single reduction and double reduction final drives, differential and its types, conventional and non-slip differentials, differential lock, Inter axle differential transaxle types. (6)

WHEELS AND TYRES: Basic construction of wheel, hub and tyres, tyre requirements, interchangeability, passenger car and commercial vehicle requirements, bias ply and radial ply tyres, tubeless tyres, wheel balancing, tyre inflation, tyre wear and tyre rotation, quick change wheels, special wheels, run flat tyre. (7)

Total L: 45

TEXT BOOKS:

REFERENCES:
15A404 DYNAMICS OF MACHINERY

2 2 0 3

**STATIC FORCE ANALYSIS OF MECHANISM:** Free Body diagram-conditions of equilibrium, two, three and four force members. Static force analysis on four bar and slider crank mechanism, effect of friction. (4+4)

**DYNAMIC FORCE ANALYSIS OF MECHANISM:** Inertia force and D Alembert's principle. Dynamically equivalent two point mass system. Dynamic force analysis of slider crank mechanism. (4+4)

**FLYWHEEL:** Turning moment diagram-fluctuation of energy and speed, weight of flywheel required. (3+3)

**BALANCING:** Balancing of revolving, reciprocating masses in single plane and several planes-primary and secondary forces and couples, balancing of multicylinder inline engine. Balancing of V type of engines, direct and reverse crank technique. Balancing machines- field balancing, single and two planes. (7+7)

**FREE VIBRATION:** Basic features of vibratory systems-elements, degrees of freedom, single degree of freedom system. Undamped free vibration-equation of motion, natural frequency. Damped free vibration, equation of motion, logarithmic decrement, Critical speed of shaft. (4+4)

**FORCED VIBRATION:** Response to periodic forcing-forcing by unbalance, support motion, force and amplitude transmissibility, force transmissibility, vibration isolation. (4+4)

**TORSIONAL VIBRATION:** Torsional vibration of two and three rotor systems, geared systems, critical speed, signature analysis, two degrees of freedom system. (4+4)

**TEXT BOOKS:**

**REFERENCES:**
1. Thomas Beven, “The Theory of Machines”, CBS Publishers and Distributors, New Delhi, 2005

15A405 ENGINEERING DESIGN

3 2 0 4

**INTRODUCTION:** Concepts of design, preferred numbers – basic and derived series – concurrent engineering – static stress equation in axial, bending and torsional loading – criteria for failure – Strength under static and dynamic conditions – factor of safety. (4+2)

**DESIGN AGAINST STATIC AND FLUCTUATING LOAD:** Static loading - Combination of normal stresses - combination of normal and shear stresses - principal stresses - theories of failure – maximum shear stress, maximum principal stress, maximum strain energy, maximum distortion energy. Fluctuating load- Mechanism of fatigue failure, fatigue limit and fatigue strength, S-N curves, Soderberg, Goodman and Gerber equations - stress raisers - stress concentration factor, notch sensitivity factor, factors affecting fatigue limit, equivalent stress, combined variable stress. (10+8)

**DESIGN OF SHAFTS COUPLINGS AND BEARINGS:** Forces on shafts due to gears, belts and chains, estimation of shaft size based on strength and critical speed. Couplings, types – flexible and rigid, design of key. Bearings – Static and dynamic load capacity, cubic mean load, variable load, probability of survival, selection of bearings - (deep groove, angular contact ball bearings and taper roller bearings). (10+6)

**SPRINGS:** Helical springs, stresses and deflection in round wires, concentric springs - accounting for variable stresses. Design of leaf springs - stress and deflection equations. (6+4)

**RIVETED / BOLTED AND WELDED JOINTS:** Strength equations, efficiency, design of riveted joints. Thread forms, initial stress, stresses due to external loads, elastic analysis of bolted joints for pressure vessel flanges. Welded joints - types, weld symbols, strength of welds, centrally loaded unsymmetrical sections, axially loaded and eccentrically loaded joints. (9+6)

**SELECTION OF TRANSMISSION BELTS AND CHAINS:** Transmission belts – V belts - narrow multiple V belts – timing belts – V ribbed belts. Belts for given power and velocity ratio. Selection of roller chain for power and speed ratio. (6+4)

**TEXT BOOKS:**

**REFERENCES:**
15A410 ENGINE TROUBLESHOOTING LABORATORY

1. Dismantling and assemble of engine & component measurements.
2. Radiator pressure test & Thermostat valve test
3. Compression and vacuum test on petrol / diesel engine.
4. Injection system testing and servicing (i) Multi point fuel injector (ii) diesel injector
5. Valve clearance adjustment.
6. Ignition system trouble shooting and servicing.
7. Testing and trouble shooting of alternator, starter motor and Battery.
9. Exhaust gas emission measurement on diesel and petrol engine.
10. Morse test.

REFERENCES:
1. Laboratory Manual prepared by Department of Automobile Engineering, 2015.

15A411 MANUFACTURING PROCESS LABORATORY

LATHE:
1. Study of construction features and manufacturing methods in machine tools.
2. LATHE- Facing, Plain turning
3. LATHE- Facing, chamfering and step turning
4. LATHE- Taper Turning and Knurling
5. LATHE- Step Turning and thread cutting
6. LATHE- Facing and Drilling by using Tail stock.

SPECIAL MACHINE:
1. Shaper-Rectangular Block Machining.
2. Radial Drilling Machine- Drilling, Counter sinking, Counter Boring and Tapping.
3. Milling-Pocket milling and slot milling
4. Gear hobbling- Spur gear machining from gear blank
5. Slotting- Machining an internal spline.

REFERENCE:
1. Lab manual Prepared by Department of mechanical Engineering-2011

15A412 TWO AND THREE WHEELER LABORATORY

1. Two wheeler chain tension test and adjustment.
2. Servicing and adjustment of clutch assembly for two / three wheeler.
3. Servicing and adjustment of brake assembly for two / three wheeler.
4. Dismantling and assembling of two / three wheeler gear box and finding gear ratios.
5. Determination of turning circle radius of three wheelers.
6. Fuel system diagnostics and adjustment.
7. Electrical accessories diagnostics and adjustment for two / three wheeler.
8. Ignition system diagnostics and adjustment.
10. Study of two wheeler chassis dynamometer.

REFERENCE:
1. Laboratory Manual prepared by Department of Automobile Engineering, 2015
SEMESTER V

15A501 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING  3 0 0 3


INDUSTRIAL APPLICATIONS & MEASURING INSTRUMENTS: Motor Selection – factors to be considered – power rating – types of Duty cycle – selection of motors for machine tools applications- Basic principles and classification of instruments - Moving coil and moving iron instruments. (4)

ELECTRONIC DEVICES: Operation of PN junction diodes, VI characteristics, zener diode, BJT-types -CB, CE, CC configurations, input and output characteristics, JFET, difference between FET and BJT-working principle and characteristics. MOSFET- types, principle of operation and characteristics, Opto Electronic Devices-Introduction, types, photo conductive, photo diode, phototransistor, Light emitting diode - Principles and Applications (6)

ELECTRONIC CIRCUITS: (Qualitative analysis only) Half wave and full wave rectifier, capacitive filters, zener voltage regulator, RC- coupled amplifier, frequency response, oscillator, Barkhausen criteria, RC phase shift oscillator (6)

LINEAR INTEGRATED CIRCUITS: Operational amplifiers, Ideal op-amp characteristics, Inverting and Non-inverting amplifier, op-amp applications - Adder- Subtractor, integrator, differentiator, comparator, zero crossing detector – 555 Timer IC – Astable mode-DAC / AD Converters- Pulse width modulation. (6)

DIGITAL ELECTRONICS: Number systems- representation of signed numbers: 1’s complement and 2’s complement, logic gates, Half adder, full adder, parallel adder/subtractor, Flip flops, RS,JK,JK Master slave, D and T type, counters and shift registers. (6)

Total L: 45

TEXT BOOKS:

REFERENCES:

15A502 VEHICLE COMPONENT DESIGN I  2 2 0 3

INTRODUCTION: Selection of engine based on vehicle performance characteristics, (2+2)

CYLINDER AND PISTON: Materials for cylinder and piston. Analysis of forces. Design procedure for cylinder, piston, piston rings and piston pin (7+7)

CONNECTING ROD AND CRANKSHAFT: Materials for connecting rod and crank shaft. Analysis of forces. Design procedure for connecting rod small end, big end bearings and middle portion. Design procedure for crankpin, web and main bearing of crank shaft (7+7)

VALVE AND VALVE ACTUATING MECHANISM: Materials. Design of inlet and outlet valves, valve springs, rocker arm, tappet, Cam, camshaft. (6+6)

FLYWHEEL AND CLUTCH: requirements of flywheel. Design procedure for flywheel. Design of single and multi-plate clutches (8+8)

Total L: 30 + T: 30 = 60

TEXT BOOKS:
REFERENCES:

15A503 PRODUCTION PLANNING

INTRODUCTION: Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect- aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

(6+6)

WORKSTUDY: Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data – Pre determined motion time standards.

(6+6)

PRODUCT PLANNING AND PROCESS PLANNING: Product planning-Extending the original product information-Value analysis- Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing -Analysis of process capabilities in a multiproductsystem

(6+6)


(6+6)

INVENTORY CONTROL AND RECENT TRENDS IN PPC: Inventory control-Purpose of holding stock-Effect of demand on inventories- Ordering procedures. Two bin system -Ordering cycle system - Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

(6+6)

Total L: 30 + T: 30 = 60

TEXTBOOKS:

15A504 AUTOMOTIVE CHASSIS SYSTEM

INTRODUCTION: Requirements -Types of Chassis layout, different cross section and applications- Loads acting on vehicle frame, Constructional details and materials for frames, mounting bracket. Monocoque body construction- material and manufacturing-Recent trends.

(9)

STEERING SYSTEMS: Types of Front Axles and Stub Axles, Front Wheel Geometry, Castor, Camber, King Pin Inclination and Toe-in, Condition for True Rolling, Motion of Wheels during Steering, Ackerman’s and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering gear boxes, Hydraulic Electric power steering and electrohydraulic power steering, steering damper – basic steering system kinematics

(9)


(9)


(8)

BRAKE SYSTEMS: Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, Drum Brake and Disc Brake Theory, Types and Construction of Hydraulic

THINKING IN REACTION.

1. The Automotive Chassis. Reimpbell, Stoll and Betzler, Butterworth and Heinmann 2009

REFERENCES:

15A505 DESIGN FOR MANUFACTURE AND ASSEMBLY

DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY: DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis. (4+4)

TOLERANCE ANALYSIS: Process capability, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law, 6σ concept. (4+4)

SELECTIVE ASSEMBLY: Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples. (4+4)

DATUM SYSTEMS: Degrees of freedom, grouped datum systems - Different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pin and hole, grouped datum system with spigot and recess pair and tongue-slot pair, computation of translational and rotational accuracy, geometric analysis and applications. (4+4)

TRUE POSITION TOLERANCING THEORY: Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples. (4+4)

FORM DESIGN OF CASTINGS AND WELDMENTS: Redesign of castings based on parting line considerations, minimising core requirements, redesigning cast members using weldments, use of welding symbols – Case studies. (3+4)

DESIGN FOR MACHINING: Design features to facilitate machining,datum features - Functional and manufacturing, component design-machining considerations, redesign for manufacture, examples. (3+4)

TOLERANCE CHARTING TECHNIQUE: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples. (4+3)

TEXT BOOKS:

REFERENCES:

15A510 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

3. Mechanical Characteristics of DC Shunt and Compound Motor
4. Load test on Three phase Induction Motor
5. Electric Braking of 3 Phase Induction Motor (Dynamic braking / plugging)
6. Study of Halfwave and Fullwave rectifiers with and without filters
7. RC coupled transistor amplifier
8. Applications of Operational Amplifier: Adder, Subtractor, Integrator and Differentiator
9. Study of logic gates and implementation of binary adder/subtractor
10. Implementation of Modulo-16 Counter.

Total P: 30
15A511 INDUSTRIAL VISIT CUM LECTURE

1. Visit to local industries arranged by the department to study the industrial practices.
2. Lectures by industrial experts will be arranged to gain exposure to the trends in design, manufacturing and quality control in industries.

Total P: 60

15A512 INNOVATION PRACTICES

The innovation laboratory involves the following:
1. Preparing a project brief proposal including
   - Problem identification.
   - A statement of system/process specification proposed to be developed (Block diagram/concept tree).
   - List of possible solutions including alternative and constraints.
   - Cost benefits analysis.
   - Time Line of activities.
2. A report highlighting the design finalization (based on functional requirements & standards (if any))
3. A presentation including the following:
   - Implementation Phase (Hardware/Software/both).
   - Testing & Validation of the developed system.
   - Learning in the Project.

Total P: 60

SEMESTER VI

15A601 VEHICLE DYNAMICS

INTRODUCTION: Earth and vehicle coordinate system. Longitudinal, lateral and vertical vehicle dynamics. Dynamic axle loads. Road loads - Aerodynamic forces and moments, viscosity effects, separation and its control; aerodynamic lift and its control, ground effect, styling for minimum drag. Rolling resistance, grade loads.


RIDE MODE: Degrees of freedom-single, two and multi degrees of freedom system, free, forced and damped vibration, model of an automobile, magnification factor, transmissibility, vibration absorbers, pitch and bounce motion, oscillation centers, active and semi active suspension, orthogonality of mode shapes, modal analysis.

SPRINGING SYSTEM: Requirements, sprung mass and un-sprung mass, wheel hop, shimmy, wheel wobble, choice of suspension spring rate, calculation of effective spring rate. Tyres - mechanics, stability of vehicle on slope, on curve and bankedroad.

HANDLING MODE: Vehicle control-low speed cornering and static steering-Ackerman steering geometry, steady-state cornering - steering factors, vehicle control parameters (under steer, neutral steer and over steer), roll steer, compliance steer, ride steer, slip angle steer, steady state handling-lateral acceleration gain, characteristic speed, yaw velocity gain, critical speed, effect of braking system on handling.

TEXT BOOKS:

REFERENCES:

15A602 AUTOMOTIVE ELECTRICAL SYSTEMS

BATTERIES: Lead acid and alkaline batteries, construction and working, battery rating, battery charging methods, testing and maintenance.
IGNITION SYSTEM: Introduction - Construction and working of magneto coil and battery coil ignition systems, spark plug types, spark advance mechanisms, electronic ignition systems - Transistorized ignition system, solid state ignition systems, capacitor discharge ignition system and distributor less ignition system. (8)

STARTING SYSTEM: Principle, construction and working of starter motor, working of different starter drive units. (8)

CHARGING SYSTEM: Alternators – Principle, construction and working – Regulators, Introduction to Start / Stop system, integrated starter generator (ISA/ISG) (8)

LIGHTING SYSTEM: Details of head light and side light, LED lighting system, head light dazzling and preventive methods. Automatic headlight- daytime running lamps- adaptive brake lights- instrument panel lighting. (7)

ACCESSORIES AND WIRING: Fuses, cables, connectors and selection, multiplexing and de-multiplexing-Automotive Wiring- Insulated and earth return system, Wiring Diagrams, symbols and standards. Horn, wiper system – power window and mirrors, sun roof, defrosters. (7)

TEXT BOOKS:

REFERENCES:

15A603 VEHICLE COMPONENT DESIGN II

FRAME AND SUSPENSION: force analysis, materials and different sections. Design procedure for frame. Suspension system requirements design of leaf spring, coil spring and torsion spring. (6+6)

FRONT AXLE AND STEERING: Force analysis. Design procedure for front axle, king pin and bearings. Determination of steering torque, design of linkages, steering gear box. (6+6)

GEAR BOX: Design of Spur gear, helical and bevel gears. Selection of gear ratios. Design of gear box. (6+6)

DRIVE LINE AND REAR AXLE: Design of propeller shaft and final drive. Design of rear axle and selection of tyres. (6+6)

BRAKING SYSTEM: force analysis, design of drum and disc brakes design of actuating mechanisms – mechanical, hydraulic and pneumatic. Brake shoe materials. (6+6)

TEXT BOOKS:

REFERENCES:

15A604 FINITE ELEMENT ANALYSIS

INTRODUCTION TO FEM: Engineering design analysis-meaning and purpose, Steady state, propagation and transient problems. Basic concepts of FEM. Applicability of FEM to structural analysis, heat transfer and fluid flow problems. Advantages and limitations of FEM. Test for convergence. Element choice. Commercial finite element packages-organization-advantages and limitations. (3+3)


DYNAMIC ANALYSIS: Equations of motion for dynamic problems. Consistent and lumped mass matrices. Formulation of element
mass matrices. Free vibration problem formulation.


DESIGN OF AUTOMOTIVE STRUCTURES: Force distribution on different parts of automotive structure, design of the parts, static, dynamic and thermal analysis of the parts using finite element method. Material redistribution to minimize stresses and deflection. Optimization of location of ribs to maximize rigidity.

TEXT BOOKS:

REFERENCES:

15A610 Design Analysis Laboratory

0 0 4 2

1. Static structural analysis of chassis frame
2. Transient analysis of connecting rod
3. Crash analysis of bumper
4. Thermal analysis of piston
5. Modal analysis of connecting rod
6. Contact stress analysis of leaf springs
7. Stress analysis of composite structure.
8. Vibration analysis of sway bar
10. Coupled field analysis of brake disc.

Total P: 60

REFERENCE:
1. Laboratory Manual prepared by Department of Automobile Engineering, 2015

15A611 Vehicle Performance Characteristics Laboratory

0 0 2 1

1. Determination of centre of gravity (X-axis)
2. Determination of centre of gravity (Y-axis).
3. Determination of centre of gravity (Z-axis)
4. Determination of steady state characteristics of vehicle
5. Determination of drawbar pull.
6. Determination of maximum drawbar pull at different surfaces and coefficient of adhesion.
7. Determination of stopping distance
8. Estimation of natural frequency for automotive components
9. Determination of Steering gear ratio
10. Estimation of rolling resistance.

Total P: 30

REFERENCE:

15A612 Automotive Electronics Laboratory

0 0 4 2

1. Study of 8 bit microcontroller architecture.
2. Study of an integrated development environment.
3. 8 bit arithmetic and logic operations.
4. Code conversion and Waveform (square and rectangle) generation.
5. Display interface using microcontroller.
7. Sensor interface using microcontroller.
9. DC motor interface using microcontroller.
10. Simulation of automotive lighting system.

Total P: 60

REFERENCE:
1. Laboratory Manual prepared by Department of Automobile Engineering, 2015.
SEMESTER VII

15A701 METROLOGY AND QUALITY ENGINEERING  

MEASUREMENT STANDARDS AND COMPARATORS: Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision, introduction to uncertainty in measurement, linear and angular measuring instruments and their applications. Calibration -Concept and procedure, traceability, Gauge R&R. Comparators -Mechanical, Pneumatic, Optical, Electrical (LVDT). Checking all geometrical forms. (5+3)

DESIGN OF GAUGES, INTERFEROMETERS AND SURFACE ROUGHNESS MEASUREMENTS: Design of Gauges: Tolerances, Limits and Fits, Taylor’s principle, Types of gauges and gauge design (numerical). Interferometer: Principle, NPL Interferometer, Laser Interferometer and their applications. Surface Roughness Measurement: Surface texture, Parameters for measuring surface roughness, Contact & non-contact type surface roughness measuring instruments. (5+3)


TEXT BOOKS:

REFERENCES:

15A702 VEHICLE BODY ENGINEERING  

ERGONOMICS: Introduction, seating dimensions, interior ergonomics, ergonomics system design, seat comfort, suspension seats, split frame seating, back pain reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. (5+5)

CAR BODY DETAILS: Types: saloon, convertibles, limousine, estate car, racing and sports car. Visibility - Regulations, driver’s visibility, tests for visibility, methods of improving visibility and space in cars. Car body construction - Design criteria and initial tests. (5+5)

TRUCK AND SPECIALITY PASSENGER VEHICLES: Commercial vehicle body technology, trends, special goods vehicle, special haulage vehicles cab body. Buses and coaches PSV (Passenger Specialty Vehicle) structural design, low floor and articulated buses, three wheelers and light weight trailers. (5+5)

VEHICLE BODY ANALYSIS: Introduction, criteria for vehicle body design, sheet metal representation, curved panels, equation for flexure, torsion, twist and differential bending, beam idealization and flexural axis, instability of thin walled structures. Unit load method and structural deflection, torsional stiffness car body idealization, symmetric bending and torsional loading, closed integral car structure, bus body idealization for analysis, bus body in torsion. (7+7)

DESIGN, SAFETY AND FATIGUE ASPECTS: Design for press working, design for spot welding, adhesives and sealants, goods vehicle structure design, chassis frame configuration, structural properties of chassis frame members. Crash tests, forces in roll over, head on impact, plastic collapse and analysis, fatigue and vibration, structural vibration. (8+8)

Total L: 30 + T: 30 = 60
TEXT BOOKS:

REFERENCES:

15A703 AUTOMOTIVE EMISSION, NOISE VIBRATION AND HARSHNESS CONTROL

EMISSIONS FROM SI AND CI ENGINES: Emission formation in SI and CI engines – factors influencing emission, effect of pollution on environment and human health. Emission norms - Euro & Bharat norms, effect of fuel properties and additives, emissions from alternate fuels. (9)

EMISSION TESTING: Emission test cycles, constant volume sampling method, non-dispersive infrared (NDIR) analyzer, flame ionization detectors (FID), chemiluminescence analyzer, smoke meters, gas chromatography. (9)

EMISSION CONTROL TECHNIQUES: Air fuel ratio (A/F) control, crank case emission control, fuel evaporation & control, EGR, SCR, catalytic converters, Particulate traps. Effect of engine combustion modification and control technologies. (9)

NOISE AND NOISE CONTROL: Introduction to sound, noise measurements control of air borne and structure borne noise - use of absorber, criteria for the selection of materials. Engine noise and control, Brake noise and control, tyre noise and control, gear noise and control, clutch noise and control, transmission noise, resonators, mufflers, anechoic chamber. (9)

VIBRATION MEASUREMENT AND CONTROL: Introduction, elements of vibration, source of vibration, types of vibration, measurement of vibration - FFT analyzer, quarter car model analysis. Methods of vibration control – passive, active, semi active control, vibration isolation, engine and drive train vibrations. (9)

TEXT BOOKS:

REFERENCES:

15A710 VEHICLE SERVICING LABORATORY

1. Inspection and servicing of different types of clutches.
2. Inspection and servicing of different types of gear boxes.
4. Servicing of transaxle assembly.
5. Servicing of different types of rear axle assembly.
6. Servicing of steering gear boxes and verification of Ackerman steering geometry.
7. Head light beam alignment, tuning of electric horn system and wind screen wiper system.
8. Brake system troubleshooting and servicing.
9. Electrical system diagnostics.
10. Wheel balancing and wheel alignment

Assignment: Study and layout of an automobile repair, service and maintenance shop. Also prepare different statements / records required for repair and maintenance works. (Two wheeler / Three Wheeler / LMV / HMV).

REFERENCES:
1. Service Manuals of reputed vehicles.
15A720 PROJECT WORK I

1. Identification of a real life problem in thrust areas
2. Developing a mathematical model for solving the above problem
3. Finalisation of system requirements and specification
4. Proposing different solutions for the problems based on literature survey
5. Future trends in providing alternate solutions
6. Consolidated report preparation of the above

Total P: 60

SEMESTER VIII
15A820 PROJECT WORK II

The project work involves the following:
- Preparing a project brief proposal including
  - Problem identification
  - A statement of system / process specification proposed to be developed (Block diagram / concept tree)
  - List of possible solutions including alternative and constraints
  - Cost benefit analysis
  - Time Line of activities
- A report highlighting the design finalization (based on functional requirements & standards (if any))
- A presentation including the following:
  - Implementation Phase (Hardware / Software / both)
  - Testing & Validation of the developed system
  - Learning in the Project
- Consolidated project report preparation

Total P: 240

LANGUAGE ELECTIVES

15C080 COMMUNICATION SKILLS FOR ENGINEERS

COMMUNICATION CONCEPTS: Process of Communication – Inter and Intrapersonal Communication – Essentials for effectiveness  (4)


BUSINESS CORRESPONDENCE: Writing Emails, Preparing Resumes, Memos, Technical and Business Proposals (7)

TECHNICAL COMMUNICATION: Seminars, Process Description and Group Discussions, Use of Visual Aids (10)

Total L: 45

TEXTBOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15C081 BASIC GERMAN

INTRODUCTION: German Culture, Tradition, Universities and Companies , Alphabets, Greetings, Countries, Nationalities and Languages. (3)
VOCABULARY: Context related to School, University, Professions, Family, Supermarket, Food and Beverages, Entertainment, Celebrations, Weather. (4)


GENERAL USAGE: Number system, Question words, Statements and Questions, Negation: nicht/kein. Imperatives Simple dialogues, Exercises. (5)

SYNTAX: Word order and sentence formation. Practice with mini dialogues. (4)

COMMUNICATION SKILLS: Conversing in formal and informal situations, Dialogue writing, Letter writing, Email writing, Invitations and Telephone conversations. (7)

PRACTICALS: Listening, Speaking, Reading and Writing. (6)

TEXT BOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15C082 BASIC FRENCH

INTRODUCTION (2)


TEXT BOOK:

REFERENCES:

15C083 BASIC JAPANESE

Orientation Session, Geographic & Socio, economic perspective to Japan, Japanese people and culture and Basic greetings and responses. (3)

Basic script, Method of writing hiragana and katakana, and Combination sounds and simple words. (3)


Asking for and telling the time, Particle "ni (at)" for time, kara (from) ~ made (until), Particle "to (and)". Time periods: Days of the week, months, time of day, Verbs (Present / future and past tense) and Telephone enquiry: Asking for a phone no. And business hours

Destination particle "e", Particles "de (mode of transportation)" and "to (with) and Japanese train station: Asking for Fare and track no. / types of trains

Direct object particle "o", Particle "de (place of action)". Verbs (¬masen ka, ¬mashou) and "Ohanami" Cherry blossom viewing

Particle "de (by means of)", Particle "ni (to)", , Aaemasu (give) and Moraimasu (receive) and Visiting a Japanese house

Adjectives ("i" and "na" type), Adjectives (Positive and negative usage), Particle "ga (however, but)”, “Dore which?” and Leaving a room, thanking some one for hospitality

Likes and dislikes, Potential verbs (wakarimasu and dekimasu), “Kara ( ¬ because)”, Adverbs and Asking some one out over the phone

Verbs denoting presence: "Imasu" and “arimasu”, Particle "ni (in)", “Dare (who?)” , Adverbs ("Chikaku ni ~"). Particle “dare mo (negative ¬ no one)”, Dare ka (anyone), dare ga (who), Nani ka (anything), nani ga (what) - ¬ya (and) ¬ nado (etc.) and Asking for directions

Counters and Counting suffixes

Introduction to Adjectives (na and ii type), Different usages of adjectives, Comparison, Likes and dislikes and Going to a trip

Need and desire (ga hoshii), Wanting to … (Tabeti desu), Going for a certain purpose (mi –ni ikimasu) and Choosing from a menu

Verb groups, I, II and III and Exercises to group verbs

Please do (te kudasai), Present continuous tenses (te imasu), Shall I? ( ¬ mashou ka) and Describing a natural phenomenon (It is raining)

To grant permission (~te mo ii desu), Asking for permission (~ te mo ii desu ka) and Should not do (~ te wa ikemasen)

Describing a continuing state and Describing a habitual action

Roleplays in Japanese

A demonstration on usage of chopsticks and Japanese tea party

**TEXT BOOK:**

**REFERENCE:**
OPEN ELECTIVES
MATHEMATICS

15OH01 ADVANCED LINEAR ALGEBRA  

VECTOR SPACES: General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space.  

INNER PRODUCT SPACES: Inner products, length and angle in inner product spaces, orthonormal bases, Gram- Schmidt process, orthogonal matrices, QR decomposition, best approximation- least square.  

LINEAR TRANSFORMATIONS: General linear transformation - kernel and range, matrices of linear transformations, change of basis, rank and nullity.  

EIGENVALUES AND EIGENVECTORS: Eigenvalues and eigenvectors, diagonalization, orthogonal diagonalization, quadratic forms, application of conic sections, quadratic surfaces - discrete dynamical systems.  

TEXT BOOKS:  

REFERENCES:  

15OH02 ALGEBRAIC STRUCTURES  

GROUPS: Groups, subgroups, permutation groups, cosets and Lagranges’s theorem, normal subgroups and quotient groups, homomorphisms, isomorphisms, Cayley’s theorem.  

CODING THEORY: Group codes, the communication model and basic notions of error correction, generation of codes by using parity checks - error recovery in group codes.  

RINGS: Rings, sub-rings, properties of rings, integral domain, ideals and quotient rings, polynomial rings.  

FIELDS: Fields, roots of polynomials, construction of straightedge and compass.  

TEXT BOOKS:  

REFERENCES:  

15OH03 CALCULUS OF VARIATIONS AND TENSOR ANALYSIS  

CALCULUS OF VARIATIONS: Basic concepts, method of variations in problems with fixed boundaries - variation and its properties, Euler equation.  

FUNCTIONALS: Functional involving first and higher order derivatives, functionals dependent on the functions of several independent variables, variational problems in parametric form – applications: vibrating string and membrane.  

VECTOR ANALYSIS: Basic concepts – gradient, directional derivative, divergence, curl, potential vector field, solenoidal vector field, Laplacian vector field, Green’s theorem, Stoke’s theorem and Gauss divergence theorem (statement and concepts only)  

TENSOR ANALYSIS: Concepts of a tensor field – Ostrogradski’s theorem, field of tensor of rank 2 - flux, divergence and derivative in a direction of tensor field. Integral theorems - theorems related to Ostrogradski’s theorem – applications: equation of motion of a liquid, Archimedes’ law.  

Total L: 45
15OH04 GRAPH THEORY AND ITS APPLICATIONS 3 0 0 3

GRAPHS AND DIGRAPHS: Common families of graphs, degree sequence, handshaking lemma, Havel-Hakimi theorem (statement and concepts). Walk, trail and path, connected graph, distance, radius and diameter. Graph isomorphism. Representations of graphs – adjacency and incidence lists – adjacency and incidence matrices. (10)

SPANNING TREES: Cayley’s formula: Prüfer encoding-decoding algorithm. Matrix tree theorem (statement and problems only). Depth-first and breadth-first search algorithms, minimum spanning tree – Prim’s and Kruskal’s algorithms, shortest-path problem – Dijkstra’s algorithm. (9)

EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs – Konigsberg bridge problem; Eulerian tour algorithm, characterization of Eulerian graph, optimal postman tour. Hamiltonian graphs - non Hamiltonian graphs, sufficient conditions for Hamiltonian graphs (only statements and concepts). Travelling salesman problem - nearest neighbour algorithm. (10)

VERTEX-COLORING: Vertex-coloring - chromatic number of a graph, vertex coloring algorithms – sequential vertex coloring, largest degree first algorithm, applications - scheduling problem, assignment of radio frequencies, fast register allocation for computer programming. (8)


Total L: 45

TEXTBOOKS:

REFERENCES:
2. Narsingh Deo, Graph Theory with Applications to Engineering And Computer Science, Prentice Hall , New Delhi 2010.

15OH05 MATHEMATICAL FINANCE 3 0 0 3

FINANCIAL MATHEMATICS: Basic terminology, assumptions, derivative securities. (6)

FORWARD AND FUTURES CONTRACTS: Forward contract, forward price formula, value of a forward contract, futures contract, futures pricing. (12)

OPTION PRICING: Definition and preliminaries, behavior of option prices with respect to variables, pay-off curves, single period and multi period binomial lattice models for option pricing, pricing American options: a binomial lattice model, Black-Scholes formula. (12)

RISK FREE ASSETS: Time value of money, Simple interest, periodic compounding, streams of payments, continuous compounding. Money market: zero coupon bonds, coupon bonds, money market account. (9)

PORTFOLIO MANAGEMENT: Risk and return, expected return standard deviation as risk measure, two securities, risk and expected return on a portfolio. (6)

Total L: 45

TEXTBOOKS:

REFERENCES:
15OH06 MATHEMATICAL MODELING AND SIMULATION 3 0 0 3

SYSTEM MODELS AND STUDIES: System - continuous and discrete system, system modeling, types of models - static physical, dynamic physical, static mathematical, dynamic mathematical models, principles in modeling, corporate model, environment, production, management segment, system analysis – corporate model, system design – message processing in a computer, system postulation – function of liver in the human body. (10)

SYSTEM SIMULATION: Technique of simulation, Monte Carlo Method – area under a curve, estimate of π, comparison of simulation and analytical methods, distributed lag models – national economy, cobweb Models – supply and demand, exponential growth and decay models, logistic curves, simple system dynamics diagrams – population, multi-segment models – product sales, representation of time delays, feedback in socio-economic systems, host and parasite fluctuation. (12)

STATIC SIMULATION: Basics and components of the simulation study, simulation as an analysis tool, static simulations - model for profit on a sale promotion, a financial model for an office building. Random number generation - linear congruential generator, Blum-Blum generator, random variates generation - Bernoulli, uniform, triangular, normal, exponential random variates, a model for loss ratio for an insurance agency. (15)

DYNAMIC SYSTEMS SIMULATION: Financial models and @risk - a model for the price of a stock, dynamic financial models of stock prices, correlated asset values, fitting a distribution to date. (8)

TEXT BOOKS:

REFERENCES:
1. Brian Albright, Mathematical Modeling with Excel, JonesBartlett publishers, Singapore 2010

15OH07 NUMBER THEORY FOR COMPUTING 3 0 0 3

DIVISIBILITY AND DIOPHANTINE EQUATIONS: Theory of divisibility - Basic concepts and properties of divisibility, fundamental theorem of arithmetic, Euclid’s algorithm, continued fractions. Diophantine equations - Linear Diophantine equations (8)

ARITHMETICAL FUNCTIONS AND DISTRIBUTION OF PRIME NUMBERS: Multiplicative functions – functions φ(n), σ(n) and s(n) - functions ψ(n), and μ(n). Prime distribution function π(x), prime number theorem, the nth prime. (10)

THEORY OF CONGRUENCES: Basic concepts and properties of congruences — linear congruences — Fermat’s Little theorem, Euler’s theorem, Chinese remainder theorem, Legendre and Jacobi symbols, primitive roots. (7)

COMPUTATIONAL NUMBER THEORY: Primality testing: Fermat’s pseudoprimitivity test, strong pseudoprimitivity test, integer factorization : trial division and Fermat method, quadratic and number field sieves. (10)

APPLICATIONS TO CRYPTOGRAPHY: Random number generation - linear congruential generator, basics of cryptography, public key cryptography: discrete logarithm based cryptosystems - RSA public-key cryptosystem. (10)

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH08 OPERATIONS RESEARCH 3 0 0 3


GAME THEORY: Two person zero sum game, pure and mixed strategies, dominance principle, graphical solution, linear programming solution. (7)
NON-LINEAR PROGRAMMING: Constrained NLPP - Lagrange’s multipliers method, convex NLPP- Kuhn-Tucker conditions, Quadratic programming-Wolfe’s method.

QUEUING THEORY: Elements of queueing model, relationship between exponential and Poisson queueing models, (M/M/1), (M/M/1/N), (M/M/c), (M/M/c/N) and self-service model.

REPLACEMENT THEORY: Replacement of items that deteriorate, replacement of items that fail, group replacement.

TEXT BOOKS:

REFERENCES:

15OH09 RELIABILITY AND QUALITY CONTROL

STATISTICAL PROCESS CONTROL: Chance and assignable causes of quality variation, statistical basis of the control charts - basic principles, choice of control limits, analysis of patterns on control charts.

CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES: $\bar{X}$ chart, R chart, $s^2$ chart, np chart, c chart, and u chart.

ACCEPTANCE SAMPLING: Types of sampling plans, lot formation, single sampling plans for attributes, double, multiple and sequential sampling plans, acceptance sampling by variables, chain sampling, continuous sampling, skip lot sampling plans.

BASIC RELIABILITY MODELS: The failure distribution, the reliability function, mean time to failure, Hazard rate function, bathtub curve, conditional reliability. Constant failure rate model: Exponential reliability function. Time - dependent Weibull failure model, Time - dependent normal failure model.

RELIABILITY OF SYSTEMS: Serial configuration, parallel configuration, combined series, parallel systems - k out of n: system - system structure function, minimal cuts, minimal paths, common mode failures, three state devices.

TEXT BOOKS:

REFERENCES:

15OH10 SOFT COMPUTING

FUZZY SETS: Basic concepts, membership functions, basic operations on fuzzy sets, properties of fuzzy sets, fuzzy relations. Propositional logic and predicate logic, fuzzy If-then rules, fuzzy mapping rules and fuzzy implication functions.

NEURAL NETWORKS: Basic concepts, neural network architectures - single layer, multilayer, recurrent networks, learning methods, back propagation network.

GENETIC ALGORITHMS: Basic concepts, encoding, fitness function, reproduction, inheritance operators, cross over, inversion and deletion, mutation operator, bit-wise operators, generational cycle.


TEXT BOOKS:
REFERENCES:

15OH11 STOCHASTIC MODELS

STOCHASTIC PROCESSES: Definition, Markov chains: Classifications of states, absorption probability, period, Chapman-Kolmogorov equations, steady state probabilities.


BROWNIAN MOTION: First passage time distribution, maximum of a Brownian motion, zeros of Brownian motion, Brownian motion with drift, Geometric Brownian motion, applications to finance.

QUEUEING MODELS: Basic definitions, steady-state solution: M/M/1, M/M/1/K, M/M/c, M/M/c/c, M/M/c/k Models, queues with unlimited service.

TEXT BOOKS:

REFERENCES:

PHYSICS

15OH20 ANALYTICAL TECHNIQUES FOR MATERIALS CHARACTERIZATION


ELECTRON AND ION SPECTROSCOPIC TECHNIQUES: Mass spectroscopy and X-ray emission spectroscopy (Principle and limitations) - Quadrupole mass spectrometer. Special surface techniques: X ray photoelectron spectroscopy (XPS or ESCA)-photoelectron process of spectrum- elemental analysis-Instrumentation and applications, Auger electron spectroscopy (AES)-Basic principles-Information in Auger spectra-methods for surface and thin film characterization, Secondary ion mass spectrometry(SIMS) - Dynamic and static SIMS-common modes of analysis, Rutherford Backscattering Spectrometry (RBS), Field Ion Microscopy (FIM).

SURFACE STRUCTURE ANALYSIS: The need for surface study. Surface chemical composition: The extension of bulk techniques to surface studies - Unit meshes of five types of surface nets - diffraction from diperiodic structures. Surface methods using electron, low energy electron diffraction (LEED), reflection high energy electron diffraction (RHEED).


SANNING PROBE MICROSCOPY : Instrumentation, Scanning Tunnelling Microscopy, Tunneling current, probe tips and working environments, operational modes, typical applications, atomic force microscopy, near field forces, force sensors, operational modes, applications, image artifacts.

TEXTBOOKS:
REFERENCES:

15OH21 LASER TECHNOLOGY

 LASER CHARACTERISTICS: Einstein coefficients - negative absorption, shape and width of spectral lines, spontaneous and stimulated emission. Laser resonators, types of resonators, stability diagram. Spatial and temporal coherence. (9)


 DYER LASERS: Liquid lasers, dye lasers, fabrication and excitation mechanisms. Concept of Q-switching and mode-locking, second harmonic generation, theory and experiment, materials for optical SHG. (9)

 INDUSTRIAL APPLICATIONS: Laser cutting, drilling & Piercing. Laser welding, operating characteristics and applications. medical. Spectroscopic (qualitative), laser Raman effect, stimulated Raman effect - Brillouin scattering. (9)


Total L: 45

TEXTBOOKS:

REFERENCES:

15OH22 MICRO ELECTROMECHANICAL SYSTEMS


 SCALING LAWS AND MINIATURIZATION: Introduction. Scaling in geometry. Scaling in rigid body dynamics. The trimmer force scaling vector – scaling in electrostatic forces, electromagnetic forces, scaling in electricity and fluid dynamics, scaling in heat conducting and heat convection. (9)


 MICROMACHINING METHODS: Bulk micromachining. Isotropic and anisotropic etching. Wet etchants, etch stops, dry etching comparison of wet and dry etching. Dry etching – physical etching – reactive ion etching, comparison of wet and dry etching. Surface micromachining – process in general, problems in surface micromachining. The LIGA process – description, materials for substrates and photoresists, electroplating, the SLIGA process. (9)

 MICROSYSTEM PACKAGING: The three levels of microsystem packaging – die level, device level and system level. Essential packaging technologies – die preparation – surface bonding, wire bonding and sealing. Three dimensional packaging. Assembly of Microsystems – selection of packaging materials (9)

Total L: 45

TEXTBOOKS:

REFERENCE:

15OH23 NANOMATERIALS AND APPLICATIONS

 INTRODUCTION AND CLASSIFICATION: Atoms, Clusters and Nanomaterials-Classification of nanostructures, nanoscale architecture – Effects of the nanometre length scale – Changes to the system total energy, changes to the system structures,
vacancies in nanocrystals, dislocations in nanocrystals – Effect of nanoscale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties.

**NANOMATERIALS SYNTHESIS AND PROCESSING:** Top-down processes: Ball Milling, lithography, machining process; Bottom-up processes: i) Wet chemical synthesis of nanomaterials- sol-gel, liquid solid reactions; ii) Gas phase synthesis of nanomaterials- Furnace, Flame assisted ultrasonic spray pyrolysis; iii) Gas condensation processing; iv) Chemical vapour deposition (CVD)-plasma-assisted deposition process, MBE and MOVPE-Preparation, safety and storage issues -STM and AFM Techniques.  

**SEMICONDUCTOR NANOSTRUCTURES:** Quantum confinement in semiconductor nanostructures - Quantum wells, quantum wires, quantum dots, superlattices, band offsets and electronic density of states – Fabrication techniques – Requirements, epilaxial growth, cleared edge overgrowth – Growth on vicinal substrates, strain-induced dots and wires, electrostatically induced dots and wires, quantum well width fluctuations, thermally annealed quantum wells and self-assembly techniques.


**REFERENCES:**

**15OH24 PHYSICS FOR SOLAR PV SYSTEMS AND SOLID-STATE LIGHTING SYSTEMS**


**TYPES OF SOLAR ENERGY CONVERTORS:** Thermal and PV systems. Advantages of PV systems. Semiconductor PV systems. IV characteristics. Other electrical parameters. Conditions for maximum power transfer. Conversion efficiency.

**PHYSICS OF SEMICONDUCTOR JUNCTIONS:** Elemental and compound semiconductors. Band structure of silicon p-n junctions and III-V compound semiconductor junctions. light emission and absorption. Creation and recombination of electron hole pairs. Lattice mediated recombination conservation of momentum. Direct and indirect band gap semiconductors. Structure of Solar PV devices and solid state lighting devices- LEDS. Factors limiting efficiency of conversion of light energy to electrical energy (PV) and vice versa (Lighting) High power LEDS


**TEXT BOOKS:**

**REFERENCES:**
15OH25 SENSORS FOR ENGINEERING APPLICATIONS

3 0 0 3

STRAIN AND PRESSURE MEASUREMENT: Resistance strain gauge, piezoelectric pressure gauge, characteristics. Electronic circuits for strain gauge, load cells. Interferometer, Fibre-optic methods. Pressure gauges Aneroid capacitance pressure gauge, ionization gauge, Using the transducers for applications (9)

MOTION SENSORS: Capacitor plate sensor, Inductive sensors, LVDT Accelerometer systems, rotation sensors drag cup devices, piezoelectric devices. Rotary encoders. (9)

LIGHT RADIATION: Color temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber-optic applications, light transducer, solid-state ,transducers liquid crystal devices. (9)

HEAT AND TEMPERATURE: Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, thermistors, PTC thermistors, bolometer, Pyroelectric detector. (9)

ELECTRONIC SENSORS: Proximity detectors – Inductive and capacitive, ultrasonic, photo beam detectors Reed switch, magnet and Hall-effect units, Doppler detectors, liquid level detectors, flow sensors, smoke sensors. (9)

TEXTBOOKS:

REFERENCES:

15OH26 THIN FILM TECHNOLOGY

3 0 0 3


DEPOSITION MONITORING AND CONTROL: Microbalance, Crystal oscillator thickness monitor, optical monitor, Resistance Monitor. Thickness measurement: Multiple Beam Interferometer, Fizeau (Tolansky) technique - Fringes of equal chromatic order (FECO) method - Ellipsometry (qualitative only). (7)

ELECTRICAL PROPERTIES: Sheet resistance - size effect - Electrical conduction in thin metallic films. Effect of ageing and annealing - Oxidation - Agglomeration. (5)

DIELECTRIC PROPERTIES: DC conduction mechanism - Low field and high field conduction. Breakdown mechanism in dielectric films - AC conduction mechanism. Temperature dependence of conductivity. (5)


TEXTBOOKS:

REFERENCES:
15OH27 NONLINEAR SCIENCE AND ENGINEERING APPLICATIONS


Total L: 45

TEXT BOOKS:

REFERENCES:

15OH28 NONLINEAR FIBER OPTICS


OPTICAL SOLITONS AND DISPERSION MANAGEMENT: Soliton Characteristics - Soliton Stability - Bright and Dark Solitons – Other kinds of Solitons - Effect of Birefringence in Solitons - Solitons based Fiber Optic Communication System (Qualitative treatment) – Demerits - Dispersion Managed Solitons (DMS).


Total L: 45

TEXT BOOKS:

REFERENCES:


TEXT BOOKS:

REFERENCES:

CHEMISTRY

15OH36 CORROSION SCIENCE AND ENGINEERING

THERMODYNAMICS OF CORROSION: Mechanism of electrochemical corrosion – galvanic and concentration cells. Free energy criteria for corrosion reaction – thermodynamic Vs kinetic considerations- emf and galvanic series - Pourbaix diagram of Fe. (9)


FORMS OF CORROSION: Atmospheric corrosion, galvanic corrosion, crevice corrosion, pitting corrosion, inter granular corrosion. Mechanically assisted corrosion-erosion corrosion, cavitation corrosion, fretting corrosion, corrosion fatigue, environmentally induced cracking, stress corrosion cracking and hydrogen embitterment. (9)

CORROSION MONITORING AND TESTING: Classification, weight loss method, salt spray test. Electrochemical polarization techniques, Tafel extrapolation, linear polarization, AC impedance methods. Application of - NDT techniques - outline of on stream and off stream corrosion monitoring methods. (9)


TEXT BOOKS:

REFERENCES:
150H37 ENERGY STORING DEVICES AND FUEL CELLS

BATTERIES: Types-battery characteristics - voltage, current, capacity, electricity storage density, power, discharge rate, cycle life, energy efficiency, shelf life. Primary cells: Fabrication, performance aspects, packing and rating of zinc-carbon, alkaline-manganese, silver oxide cells. Lithium primary batteries. (9)

SECONDARY BATTERIES: Fabrication, performance aspects and rating of lead acid and sealed lead acid battery, nickel-cadmium, Ni-metal-hydride lithium ion batteries, Rechargeable Zinc alkaline batteries and thermal batteries. (9)

ADVANCED BATTERIES: Metal / air, zinc-bromine, sodium-beta alumina and lithium / iron sulphide batteries. Photogalvanic cells. Battery specifications for cars, heart pacemakers, torpedo batteries, satellite batteries. (9)

FUEL CELLS: Classification, working principle, components, applications and environmental aspects of alkaline, phosphoric acid, solid oxide, molten carbonate, direct methanol and proton exchange membrane fuel cells. (9)


TEXT BOOKS:

REFERENCES:

Total L: 45

150H41 POLYMER SCIENCE AND TECHNOLOGY

INTRODUCTION TO POLYMERS: Classification, functionality of monomers, degree of polymerization, molecular weight of polymers. - number average and weight average, molecular weight distribution. Polymerisation reactions – chain – free radical, ionic, co-ordination polymerisations – condensation polymerisation, ring opening polymerisation. Polymerisation techniques - Addition polymerisation - bulk, solution, suspension and emulsion techniques. Condensation polymerisation - melt, solution and interfacial techniques. (9)


ADDITIVES AND PROCESSING: Degradation mechanisms – thermal, mechanical and photo degradations. Fillers, plasticizers, anti aging additives, UV stabilizers, colouring agents, flame retardants, blowing agents, crosslinking agents and lubricants. Polymer processing - compression, injection, extrusion & blow moulding, calendaring, film casting, foaming and thermoforming. (9)


TEXT BOOKS:

Total L:45
REFERENCES:

COMPUTER APPLICATIONS

15OH46 COMPUTER GRAPHICS AND VIRTUAL REALITY

3 0 0 3


BASICS OF ANIMATION: Key frame animation - sequence - motion control methods - morphing - warping.


VR PROGRAMMING: VRML, defining and using nodes and shapes - VRML browsers - Java 3D – visual object definition by shape 3D instances - ColorCube class - Geometric utility classes.

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH47 DATA AND FILE STRUCTURES

3 0 0 3


ARRAYS: Representation of linear and multi dimensional arrays – Operations - Applications.

STACKS: Representation - Operations - implementation - Applications: Recursion handling; Evaluation of expressions.

QUEUES: Representation - Operations - sequential implementation – Circular Queues-Priority Queues - Deque – Applications: Job Scheduling systems.


FILES: File Types – Basic file operations – Heap Organization- Sequential file organization – Indexed Sequential File – Direct file organization


Total L: 45

TEXT BOOKS:

REFERENCES:
15OH48 DATABASE MANAGEMENT SYSTEM


DATAMODELING: Introduction to Hierarchical data model - Network data model- ER model: Entities, Attributes, relationships – Weak and strong entity types – Design of Entity Relationship data models.

RELATIONAL MODEL: Relational data model basics - properties of Relations- Domains and Key concept – Enforcing data integrity constraints - Relational algebra operations.

RELATIONAL DATABASE MANIPULATION: Introduction to Structured Query Language(SQL) – SQL commands for defining database – Manipulations on database – Basic data retrieval operations - aggregate function- order by/group by clause- sub queries-in-any-all-views in SQL.

DATA BASE DESIGN THEORY: Functional dependencies - Normal forms – Normalization: 1NF to 5NF- Domain Key Normal Form – losses join and dependency preserving decomposition.

DATABASE TRANSACTION & SECURITY: - Transaction processing – properties - Concurrency control mechanism - security and integrity threats - Defense Mechanism.

TEXT BOOKS:

REFERENCES:

Total L : 45

15OH49 HIGH PERFORMANCE COMPUTING


PARALLEL COMPUTERS: Parallel architectures -Trends in architectures, CMPs, GPUs, and Grids, Multiprocessors, Multicomputers, Multithreading, Pipelining- Data access optimization - Balance analysis and lightspeed estimates - Storage order - Taxonomy of parallel computing paradigms - Shared memory computers - Distributed memory computers - Hierarchical systems - Networks - Basics of parallelization- Parallelism – Parallel scalability.


PRINCIPLES OF PARALLEL ALGORITHM DESIGN: Preliminaries - Decomposition techniques - Characteristics of tasks and interactions - Mapping techniques for load balancing - Methods for containing interaction overheads - Parallel algorithm models – Basic communication operations.


TEXT BOOKS:

REFERENCES:

Total L: 45
15OH50 MAINFRAME SYSTEMS

**EVOLUTION OF MAINFRAME:** Overview of Computer Architecture - Classification of Computers - micro, mini, mainframes and super computer - key features – benefits. (6)

**MAINFRAME SYSTEM:** Attributes of Mainframes - Reasons for opting Mainframes - Users of Mainframes - Difference between Centralized and Distributed computing - Batch processing - Online/Interactive transactions. (9)

**MAINFRAME WORKLOADS:** Concept - strategy and benefits of the z/OS environment - Application enablement in z/OS - Overview of e-business support in z/OS - Connectivity to the z/OS environment - Security support provided by z/OS. (9)

**SYSTEM MANAGEMENT:** Scalability - availability - backup and recovery features in z/OS - z/OS system services - zSeries processor configurations. (6)

**COBOL:** Introduction to COBOL - Program Structure - Procedure Division - Table Handling - File Handling. (9)

**CASE STUDY:** z/VM – Linux – zVSE – zTPF. (6)

**TEXT BOOKS:**

**REFERENCE:**

15OH51 MOBILE APPLICATION DEVELOPMENT

**INTRODUCTION:** Open Source Platform – Mobile Devices – Open Handset Alliance – Mobile Applications. (4)

**ANDROID:** Features of android – Development Framework – Android SDK – Native Libraries – Application framework – ADK – Android and Java. (5)

**BASIC WIDGETS:** Android Components – Android activity life cycle – Layouts and controls – Event Handling – creating and starting an activity - using controls. (6)

**BUILDING USER INTERFACES:** Fundamental Android UI design – Layouts – Fragments – Creating Views – List view – Grid View control – View pager control. (6)

**USING RESOURCES AND MEDIA:** Resources Types – Creating Resources – Using Drawable resources – Playing Audio – Playing Video – Displaying progress. (6)

**BUILDING MENUS:** Menus and types – Creating menus through XML – Creating menus through coding – Using the ActionBar – Drop-down List ActionBar. (6)

**DATABASES:** Android databases – SQLite – introduction – creating, opening, querying the database – Extracting values from a cursor – Creating content providers – Using Content providers. (6)

**PUBLISHING ANDROID APPLICATIONS:** Setting versioning information – Signing and publishing the applications – Distributing applications - Monetizing the applications. (6)

**TEXT BOOKS:**

**REFERENCE:**

15OH52 MULTICORE PROGRAMMING

**BASICS OF MULTICORE:** Definition - hybrid architectures - The software developer’s viewpoint - single core - multicore – Types: multicore designs. (7)

**CHALLENGES:** Sequential model – Concurrency – software development - Processor architecture - Operating systems role,(10)
MULTIPROCESSING: Process creation - Working with process environment variables - Killing a process - Process resources - Synchronous and a asynchronous processes - Multithreading - Comparing threads to processes - Architecture - Creation and management of threads. (10)

COMMUNICATION AND SYNCHRONIZATION: Thread strategy approaches - Decomposition and encapsulation of work - Approaches to application design - PADL and PBS. (9)

UML: Modelling the structure of a system - UML and concurrent behavior - Basic testing types - Defect removal for parallel programs - Standard software engineering tests. (9)

TEXT BOOK:

REFERENCES:

15OH53 OBJECT ORIENTED PROGRAMMING 3 0 0 3


FUNCTIONS IN C++: Function Prototyping - Call by Reference - Return by reference - Inline functions – Default - Const Arguments (6)

CLASSES AND OBJECTS: Data members - Member functions - Nesting of Member functions - Private member functions - Memory allocation for Objects - Static data members - Static Member Functions - Arrays of Objects - Objects as Function Arguments - Friend Functions - Returning Objects. (7)

CONSTRUCTORS: Parameterized Constructors - Multiple Constructors in a Class - Constructors with Default Arguments – Dynamic Initialization of Objects - Copy and Dynamic Constructors – Destructors. (6)

INHERITANCE: Defining Derived Classes - Single Inheritance - Making a Private Member Inheritable - Multiple Inheritance – Hierarchical Inheritance - Hybrid Inheritance - Virtual Base Classes - Abstract Classes - Constructors in Derived Classes. (8)

POLYMORPHISM: Compile and Run Time Polymorphism – Operators Overloading - Unary and Binary Operators Overloading - Function Overloading. (8)

TEXT BOOKS:

REFERENCE:

15OH54 PROGRAMMING IN PYTHON 3 0 0 3

BASICS: Python - Variables - Executing Python from the Command Line - Editing Python Files - Python Reserved Words - Basic Syntax-Comments - Strings and Numeric Data Types - Simple Input and Output. (8)


FUNCTIONS: Definition - Passing parameters to a Function - Variable Number of Arguments - Scope - Passing Functions to a Function - Mapping Functions in a Dictionary - Lambda - Modules - Standard Modules – sys – math – time - dir Function. (9)

ERROR HANDLING: Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories. (10)


Total L: 45

REFERENCES:

15OH55 RESPONSIVE WEB DESIGN


CASCA DING STYLE SHEETS: Introduction - Levels of Style Sheets - Style Specification Formats – Style Classes - Properties and Property Values - Color - The span and div Tags. (7)

HTML5: Media Queries supporting different viewports – Syntax - Fluid Layouts- Fluid Images- Serving Different Images for different screen sizes - HTML 5 for responsive designs - semantic elements in HTML5 – Embedding Media in HTML5. (10)

CSS3: Selectors - Typography and Color Modes – Aesthetics with CSS3 – Text shadows - Box shadows - Background Gradients – patterns - Multiple Background images Transitions - Transformations and Animations Forms with HTML5 and CSS3. (12)


TEXT BOOKS:

REFERENCES:

15OH56 SOCIAL WEB MINING


SOCIAL NETWORK DATA AND REPRESENTATION: Structural – composition-affiliation variables-modes-boundary specification and sampling- type of networks- measurement and collection - Review of graph theory- Data set- Tools-Pajek, Netdraw, UCInet (10)

STRUCTURAL PROPERTIES OF SOCIAL NETWORKS: Notions of centrality - cohesiveness of subgroups - roles and positions - structural equivalence - equitable partitions. (12)

WEB CONTENT MINING: Boolean model - vector space model - web search – feature enrichment of short texts- - automatic topic extraction from web document - opinion search and opinion spam. (5)

WEB LINKAGE MINING : Hyperlinks- co-citation and bibliographic coupling- page rank and HITS algorithm – web community discovery – web graph measurement and modelling - using link information for webpage classification. (9)

TEXT BOOKS:

REFERENCES:
15OH57 SOFTWARE ENGINEERING

INTRODUCTION: Software Characteristics-Comparison with other Engineering disciplines-Software Crisis and Myths-Software life cycle models-Selection of process models for projects- Agile methods- Software Engineering paradigms. (8)

REQUIREMENTS GATHERING: Requirements gathering tasks – Requirements Engineering Process - Qualities of good requirements-Types of Requirements-Requirements elicitation- Requirements documentation- Analysis Documentation. (7)


PROGRAMMING STANDARDS: Structured programming coding standards-Maintainability of code. (5)

SOFTWARE TESTING FUNDAMENTALS: Black-Box and White-Box testing – Basis Path testing – Requirements phase testing - Design phase testing - Program phase testing - Desk debugging and program peer view test tools - Evaluating test results - Installation phase testing - Acceptance testing – Testing GUI – Testing Web Applications (8)


TEXT BOOKS:

REFERENCES:

15OH58 JAVA PROGRAMMING

INTRODUCTION: Features of Java – Java Development Environment – Java Virtual Machine- byte codes in java - Naming conventions and Data Types - Operators - Control Structures - Arrays and Strings. (3+3)

OBJECT ORIENTED CONCEPTS: Classes and objects- creation- access specifiers- constructors – Methods - static- Inheritance - Composition-polymorphism -nested classes–wrapper classes- Abstract classes. (5+6)

PACKAGES AND INTERFACES: - Packages - Access protection - Importing packages - Interface - Defining and Implementing Interface. (3+3)

EXCEPTION HANDLING: Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses - Nested try statements - throw - throws - Java Built-in Exception - Creating user defined exceptions- Assertions. (4+4)

INPUT/OUTPUT: Files – Stream classes – Byte Streams – Character Streams – Serialization. (3+3)

MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Synchronization - Interthread Communication. (4+4)

GUI PROGRAMMING: AWT-Swing classes - Components - Labels, Buttons, Check Boxes, combo box- Controls Menus – Frames Event delegation model –listener and listener methods –Event classes- Applets. (5+4)

DATABASE CONNECTIVITY: Architecture – connect RDBMS – Exploring java.sql package. (3+3)

TEXT BOOKS:

REFERENCES:
15OH59  GEOGRAPHIC INFORMATION SYSTEM  203


DATA MANAGEMENT AND OUTPUT: Import / Export – Data Management functions - Raster to Vector - Vector to Raster Conversion - Data Output - Map Compilation - Chart/Graphs – Multimedia – Enterprise Vs Desktop GIS - Distributed GIS. 


TEXT BOOKS:

REFERENCES:

15OH60  PROGRAMMING FOR ROBOTICS  203


WORKING WITH ROBOTIC SENSORS: Working with ultrasonic distance sensors - Working with the IR proximity sensor - Working with Inertial Measurement Unit.

PYTHON AND ROS: Introduction to OpenCV, OpenNI, and PCL - Programming Kinect with Python using ROS, OpenCV, and OpenNI - Working with Point Clouds using Kinect, ROS, OpenNI, and PCL.


TEXT BOOKS:

REFERENCE:
HUMANITIES

15OH61 AN INTRODUCTION TO INDIAN CONSTITUTION

PREAMBLE AND ITS PHILOSOPHY: Introduction and Evolution of Indian Constitution preamble and its Philosophy. (4)

CENTRE-STATE RELATIONS: Directive Principles of State Policy, Fundamental Rights and Duties, Centre-State Relations. (6)

UNION GOVERNMENT: Powers, Functions and Position of President, Vice-President and Council of Ministers. (6)


JUDICIARY: The Union Judiciary - Supreme Court and High Court. (6)

PUBLIC SERVICES: All India Services, Central Civil Services, State Services, Local Services and Training of Civil Services. (5)

INTERNATIONAL POLITICS: Foreign Policy of India, Foreign Policy of USA, International Institutions like UNO, WTO, SAARC and Environmentalism. (5)

TEXT BOOKS:

REFERENCES:

Total L: 45

15OH62 ENTREPRENEURSHIP

INTRODUCTION TO ENTREPRENEURSHIP: Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. Seminar in R5 & R6. (5)


DEVELOPING AN EFFECTIVE BUSINESS MODEL: The Importance of a Business Model – Starting a small scale industry - Components of an Effective Business Model. (5)

APPRaisal OF PROJECTS: Importance of Evaluating Various options and future investments- Entrepreneurship incentives and subsidies – Appraisal Techniques. (8)

FORMS OF BUSINESS ORGANIZATION: Sole Proprietorship – Partnership – Limited liability partnership - Joint Stock Companies and Cooperatives. (4)


THE MARKETING FUNCTION: Industry Analysis – Competitor Analysis – Marketing Research for the New Venture – Defining the Purpose or Objectives – Gathering Data from Secondary Sources – Gathering Information from Primary Sources – Analyzing and Interpreting the Results – The Marketing Process. (5)

INTELLECTUAL PROPERTY PROTECTION AND ETHICS: Patents – Copyright - Trademark- Geographical indications – Ethical and social responsibility and challenges. (4)

TEXT BOOKS:

REFERENCES:

Total L: 45
15OH63 HUMAN RESOURCE MANAGEMENT

NATURE AND SCOPE OF HUMAN RESOURCE MANAGEMENT: Meaning and Definition of HRM, Objectives and Functions of HRM, Models of HRM, HRM in a changing Environment, Human Resource Management in the wake of Globalization. (6)

TRAINING AND DEVELOPMENT: Principles of Learning, Objectives, Types and Training Methods, Management Development: Its Meaning, Scope and Objectives. (6)

WAGE AND SALARY ADMINISTRATION: Principles and Techniques of Wage Fixation, Job Evaluation, Incentive Schemes. (5)


INTERNATIONAL HRM: Model, Variables that outline difference between local and International HRM approaches to IHRM, Linking HRM to International Expansion Strategies. (6)

TRENDS IN HR: HR Outsourcing – HRIS – Management of Turnover and retention – Workforce Rationalization – Managing Separation and Rightsizing – Case studies in Trends in Employee Engagement and Retention. (6)

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH64 INDUSTRIAL PSYCHOLOGY

INDUSTRIAL PSYCHOLOGY: Introduction – Concept and Meaning – Characteristics and Scope. (3)


PERCEPTION AND ATTITUDE: Importance of Perception – Need for Shaping Perception – Workplace Attitude. (3)


INTERPERSONAL RELATIONSHIP: Managing emotions – Emotional Intelligence – Building Interpersonal Relations– Managing the Boss – Dealing with Subordinates. (6)

STRESS: Dynamics – Types – Signs – Causes – Workplace Stress and Coping Strategies. (4)

ORGANISATION CULTURE: Meaning – Types – Importance – Changing Organizational Culture and Matching People with Organizational Culture – Working Environment. (5)

INDUSTRIAL FATIGUE BOREDOM: Types of Industrial Fatigue – Symptoms – Causes and Remedies of Industrial Fatigue Industrial Boredom – Causes – Effective Ways to Reduce Boredom. (6)

JOB SATISFACTION: Job Satisfaction – Consequences – Tips for Reducing Job Dissatisfaction. (3)

PERFORMANCE MANAGEMENT: Concept – Objectives – Process – Methods of Performance Evaluation. (3)

Total L: 45

TEXT BOOKS:
REFERENCES:

15OH65 PRINCIPLES OF MANAGEMENT

PRINCIPLES OF MANAGEMENT: Meaning, Definition and Significance of Management, Basic Functions of Management – Planning, Organizing, Staffing, Directing and Controlling. (5)

ENGINEERS AND ORGANIZATIONAL ENVIRONMENT: Social, Economic, Technological and Political. Social Responsibility of Engineers. (3)

MANAGEMENT CONCEPTS: MBO, Theory Z, Kaizen, Six Sigma, Quality Circles and TQM. (Case Study) (5)

BUSINESS PROCESS REENGINEERING: Need for BPR, Various phases of BPR, Production and Productivity in six sigma and TQM – Factors Influencing Productivity. (7)

ORGANISATIONAL BEHAVIOUR: Significance of OB, Role of Leadership, Personality and Motivation, Stress, Attitudes, Values and Perceptions at work (7)

INDUSTRIAL AND BUSINESS ORGANIZATION: Growth of Industries (Small Scale, Medium Scale and Large Scale Industries), Forms of Business Organizations. Resource Management – Internal and External Sources (6)

MANAGING INFORMATION: Why Information Matters – Strategic Importance of Information – Cost of Useful Information – Getting and Sharing Information. (6)


TEXT BOOKS:

REFERENCES:

15OH66 BUSINESS STATISTICS

STATISTICS INTRODUCTION: Definition, Types of Statistics, Types of Variables, Descriptive Measures, Basic Definition and Rules of Probability, Independence of Events. (9)

DESCRIPTIVES MEASURES: Measures of central tendency, dispersion, Probability Distributions. (6)

SAMPLING: Definition, Selection of Statistical tools, Sampling Methods, Sampling Frame determining the sample size. (6)

HYPOTHESIS TESTING: ANOVA- Independent sample t test, Paired t test. (4)

PARAMETRIC TEST: Concept, Chi square tests for Association and homogeneity, One sample t test. (4)

CORRELATION AND REGRESSION: Karl Pearson Correlation, Linear regression (Both manual and software applications), Components, Trend-Method of least squares and moving averages, seasonal variation-Simple average method only. (10)

STATISTICAL DECISION THEORY: Uncertainty and risk and Decision tree analysis (6)

TEXT BOOKS:

REFERENCES:
15OH67 DISASTER MANAGEMENT 3 0 0 3

INTRODUCTION: Disaster – Definition, Factors and Significance, Difference between Hazard and Disaster, History of Disasters and Types, Disaster Aids. (4)

NATURAL DISASTERS: Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. (5)

MAN MADE DISASTERS: Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster.- Forest Fire-Oil fire –accident in Mines. (8)

GEOSPATIAL TECHNOLOGY: Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping. (8)

RISK ASSESSMENT AND MITIGATION: Hazards, Risks and Vulnerabilities. -Disasters in and India „Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. (8)

DISASTER MANAGEMENT: Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism. (8)

GLOBAL PERSPECTIVE: Study of Environmental Impacts Induced by Human Activity, Industrial Accidents, Outbreaks of Disease and Epidemics, War and Conflicts. (4)

TEXT BOOKS:

REFERENCES:

Total L: 45

15OH68 FINANCIAL AND MANAGERIAL ACCOUNTING 3 0 0 3

INTRODUCTION TO ACCOUNTING: Meaning, Definition and significance of Accounting, Accounting Principles, Concepts and Conventions, Classifications of Accounts. (9)

BASIC ACCOUNTING: Journal Entry, Ledger, and Trial Balance Sheet, preparation of final accounts: Trading, Profit & Loss Account, Balance sheet. (9)

BASIC FINANCIAL STATEMENTS: Meaning – Types of Financial Analysis Income Statement, common analysis, trend analysis, ratio analysis, corporate cash flow, DuPont Model. (9)

COST ACCOUNTING: Accounting for overheads, Cost sheet, Marginal and Absorption costing, Break even analysis, Effect on profits, Activity Based Costing system. (9)

ACCOUNTING FOR DECISION MAKING: CVP Analysis -Relevant Costs and Revenue for Decision Making, Pricing Decisions, Operational Decisions, Exploring New markets, Make or buy decisions. (6)

ACCOUNTING FOR PLANNING AND CONTROLLING: Budgets, Budgetary Control -Variance Analysis - Cost and Financial Variances. (6)

TEXT BOOKS:

REFERENCES:

Total L: 45
15OH69 MARKETING MANAGEMENT


MARKETING STRATEGY: Formulating Marketing Strategy, Key Drivers of Marketing Strategy, Marketing Strategies- Marketing Mix Components. (7)

COMPETITOR ANALYSIS: Analysis of Consumer & Industrial Markets, Building Competitive Advantage. (6)


MARKETING RESEARCH & TRENDS IN MARKETING: Marketing Information System, Marketing Research Process & Purpose, Ethics in Marketing, Online Marketing Trends. (7)

TEXT BOOKS:

REFERENCES:

15OH70 DEFENCE PRACTICES AND DISASTER MANAGEMENT

HISTORY & ENVIRONMENTAL AWARENESS: NCC- Army, Navy, Air force; Aim and Motto; Ranks and Equivalent Ranks; Honors and Awards; Organization; Training – Nation Building; Civil affairs; Social Service & Needs; Environment & Ecology; Pollution; Rain Water Harvesting; Law and Order; Corruption. (7)

WEAPONS: Introduction; Types of Weapons; Armed Forces Fighting Arms; Service Corps; Section Formation & Types; Firing Order; Judging Distance; Types of Land; Working Principle of Rifle, Tank, Missiles; Characteristics of supporting Rifle and its ammunition; Field Craft and Battle Craft; Fighting - Role of Fighting Arms and map reading. (7)

DISASTER MANAGEMENT: Definition; Types of Disaster; Elements of Disaster Management, Foundations of Disaster Studies- Review of Concepts, Organizations – NDMA, NIDM, NDMRT, NEC, Disaster Mitigation, Disaster Preparedness, Disaster Relief, Reconstruction Planning, Economic and Social Rehabilitation, Globalization and Disaster Studies, Social Science and Domains Approach. (7)

LIFE SKILL MANAGEMENT: Introduction; Concept of Life Skills; Internalizing of Life Skills; Self awareness and Empathy; Knowing Myself; Self care; Empathizing with others; Creative Thinking & Critical Thinking; Practicing Decision making & Problem Solving; Effective Communication – Inter Personal Relationship; Coping with Emotions & Stress; Facilitation skills – Verbal & Non verbal; Training Methodologies. (7)

HEALTH AND HYGIENE: Anatomy, Physiology, Microbiology – Personal and Mental Health; Infectious and Contagious Diseases; its prevention; First Aid in common Medical Emergencies; Basics of Home Nursing; Treatment and care of Wounds and Fractures. (7)

FIELD TRAINING: Foot Drill; Handling-Inspection Training; MapReading; Physical Proficiency Training; Introduction to Yoga. (10)

TEXT BOOKS:

REFERENCES:
4. http://nccindia.nic.in/
ENGLISH

15OH75 ENGLISH AND SOFT SKILLS FOR EMPLOYABILITY

SELF MANAGEMENT AND ATTITUDES: Self Concept, Stress management, Positive attitude, Influential Skills, Initiative, Empathy, Social Etiquette (5)

COMMUNICATION STYLES: Presentation Skills, Interpersonal Communication Skills, Interviewing Skills, Verbal and Nonverbal (body language) skills, Active Listening, Professional Writing, Effective email writing (16)

TEAM WORK: Inter team cooperation, Intra team cooperation, Diversity, Productivity, Goal Setting and action (4)

LEADERSHIP SKILLS: Empowerment, Planning, Establishing Credibility, Vision & direction, Supervision, Mentoring, Decision-making, Creativity, Flexibility, Team problem solving (5)

MANAGING TIME AND PRESSURES: Managing Change, Time management, Effective meetings (5)

EFFECTIVE AND EXCELLENT CUSTOMER SERVICE: Communication with the customer- telephonic and online services, Managing conflicts or Challenging communication, Setting and resetting customer expectations, Building customer confidence, Growing customer relationship, Opportunity management, Developing team approach to meet customer needs. (10)

TEXTBOOK:
1. Monograph prepared by the Faculty, Department of English, 2015.

REFERENCES:

15OH76 ENGLISH FOR COMPETITIVE EXAMINATIONS

READING COMPREHENSION: Focus on different levels of Comprehension- Literal, Inferential, Analytical and Critical reasoning (7)
Identifying key words and signal words, decoding the building blocks of a passage, understanding jargons and double distractors (2)

LISTENING COMPREHENSION: Micro skills and Macro skills of Listening (4)
Identifying tone and purpose, eliminating distracters in objective type questions (2)

SPEAKING : Sub skills of speaking- Genre-specific oral communication (4)

VERBAL ABILITY: Word formation and expansion, Selecting and ordering words - Identifying and correlating synonyms and antonyms - Collocations (5)
Sentence Completion (5)
Verbal analogies (3)
Spotting and correcting errors (4)

WRITING : Mapping ideas, developing points and employing Variety in sentence types (3)
Referencing, Ellipsis and substitution in writing – Skillful paragraphing (unity, coherence and cohesion) (3)
Register and Tone in Critical, Analytical writing - Useful Language for describing graphs - Expressing strong opinions (3)

TEXTBOOK:
Monograph prepared by the Faculty, Department of English, 2015

REFERENCES:
15OH77 GERMAN LANGUAGE – INTERNATIONAL LEVEL A1.1

GUTEN TAG! - LEARNING: To greet, learn numbers till 20, practice telephone numbers & email address, learn alphabet, speak about countries & languages; Vocabulary: related to the topic; Grammar: W – Questions, Verbs & Personal nouns I. (7.5)

FREUNDE, KOLLEGEN UND ICH - LEARNING: To speak about hobbies, jobs, learn numbers from 20; Vocabulary: related to the topic; Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural. (7.5)

IN DER STADT – LEARNING: To know places, buildings, question, know transport systems, understand international words; Vocabulary: related to the topic; Grammar: Definite & indefinite articles, Negotiation, Imperative with Sie. (7.5)

GUTEN APPETIT! – LEARNING: To speak about food, shop, converse; Vocabulary: related to the topic; Grammar: Sentence position, Accusative, Accusative with verbs. (7.5)

TAG FÜR TAG – LEARNING: To learn time related expressions, speak about family, ask excuse, fix appointments on phone; Vocabulary: related to the topic; Grammar: Preposition – am, im, um, von…bis, Possessive articles, Modal verbs. (7.5)

ZEIT MIT FREUNDEN – LEARNING: To speak about birthdays, understand & write invitations, converse in the restaurant; Vocabulary: related to the topic; Grammar: Accusative personal pronouns and prepositions. (7.5)

Total L: 45

TEXTBOOK:

REFERENCES:

15OH78 GERMAN LANGUAGE – INTERNATIONAL LEVEL A1.2

KONTAKTE - LEARNING: To arrange appointments, understand and give instructions, understand and reply letters, find information in the text, identify the situations and understand the conversation; Vocabulary: related to the topic; Grammar: Dative Preposition & Article, Accusative Possessive Article. (7.5)

MEINE WOHNUNG - LEARNING: To understand the advertisements related to flats/ho uses, describe a flat, write a text about a flat; Vocabulary: related to the topic; Grammar: Adjective with sein (sehr/zu), wechselpreposition with Dat. (7.5)

ALLES ARBEIT? – LEARNING: To describe daily routine, talk about the past, speak about jobs, position, advertisements, prepare telephone conversation; Vocabulary: related to the topic; Grammar: Conjunctions, Perfect tense (regular & irregular verbs). (7.5)

KLEIDUNG UND MODE – LEARNING: To speak about clothes, understand the conversation at shopping centers, about Berlin. Vocabulary: related to the topic; Grammar: Perfect tense (trennbare & nicht trennbare verbs), personal pronomen & verbs with Dat. (7.5)

GESUND UND MUNTER – LEARNING: To make personal statements, name body parts, understand sport activities, conversation with the doctor, get & give tips to healthy life, email writing; Vocabulary: related to the topic; Grammar: Imperative, Modal verbs. (7.5)

AB IN DEN URLAUB! – LEARNING: To suggest a city tour, describe the directions, write a postcard, describe the weather, make a complaint in the hotel, speak about the trips, letter writing; Vocabulary: related to the topic; Grammar: Adverbs (time). (7.5)

Total L: 45

TEXTBOOK:
REFERENCES:

APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES

15OH81 DATA STRUCTURES AND ALGORITHMS

INTRODUCTION: Data structures - Abstract Data Types - Basic data structures –Arrays, stacks, queues and linked lists-Operations and applications

ALGORITHMS: Introduction-Analysis of algorithms - Best, worst and average case time complexities - notations.


SORTING AND SEARCHING: Insertion sort, selection sort, heap sort, count sort and radix sort - searching, Linear Search.

BINARY SEARCH TREES: Searching – Insertion and deletion of elements-Balanced BST- AVL trees- Definition – searching – insertion and deletion of elements, AVL rotations


GRAPHS: Definition – representations (Adjacency matrix, packed adjacency list and linked adjacency list) – Graph search methods (Breadth first and depth first traversals).

DIVIDE AND CONQUER: Method – Merge sort, Quick sort, Binary Search.

GREEDY METHOD: Optimization problems – method – examples – Minimum cost spanning tree (Kruskal’s and prim’s algorithms), Knapsack problem

TUTORIAL PRACTICE:
Implementation of the following problems:
1. Sparse and dense Matrix operations using arrays.
2. Linked Lists: Singly linked, Doubly linked and Circular lists.
4. Problems using Queues.
5. Binary trees
6. Problems related to sorting and searching algorithms.
7. Binary search tree
8. Minimum cost spanning tree

Total L: 30+T:30 = 60

TEXT BOOKS:

REFERENCES:

15OH82 OPTIMIZATION TECHNIQUES

LINEAR PROGRAMMING: Graphical method for two dimensional problems – Central problems of Linear Programming – Definitions – Simplex Algorithm – Phase I and Phase II of Simplex Method.

CONVEX OPTIMIZATION: Convex sets and cones- Convex functions- Convex optimization problems- linear and quadratic programs; second-order cone and semi-definite programs; quasi-convex optimization problems; vector and multi-criterion optimization.

INTEGER PROGRAMMING: Gomory cutting plane methods for all integer and mixed integer programming problems - Branch and Bound method (Land – Dolg and Dakin algorithms) – Zero-One Implicit enumeration Algorithm.  


TUTORIAL PRACTICE:
1. Solving inequalities using Simplex, Two-phase, Dual simplex methods, Revised simplex method.
2. Finding initial basic feasible solution using (i) North-West corner rule(ii) Matrix minimum and (iii) Vogel’s approximation method and also perform optimalitytest using MODI method.
4. Gomory:s cutting plane methods for all IPP and mixed IPP.
6. Critical path for the given PERT and CPM networks.

TEXT BOOK:

REFERENCES:

15OH83 DATA SCIENCE

INTRODUCTION TO DATA SCIENCE: Data wrangling, cleaning, and sampling to get a suitable data set - Mathematics for understanding the data – Descriptive statistics : Visualizing Data - Central Tendency –Variability –Standardizing -Normal Distribution -Sampling Distributions.

DATA MANIPULATION AT SCALE: Parallel databases, parallel query processing, in-database analytics, MapReduce, Hadoop, Key-value stores and NoSQL; tradeoffs of SQL and NoSQL.


COMMUNICATING RESULTS: Visualization - descriptive statistics and visualization, privacy, ethics – multivariate visualization.

SPECIAL TOPICS: Graph Analytics: structure, traversals, analytics, PageRank, community detection, recursive queries, Semantic web.

CASE STUDY: Community Detection – Collaborative Network – Opinion mining – Co-citation network

TUTORIAL PRACTICE:
1. Introduction to R and problems using R.
2. Collect datasets from Kaggle and Data Analysis.
3. Implementation of various predictive models.
4. Generate the results using Confidence levels.
5. Implementation of SVD.

TEXT BOOK:

REFERENCES:
5. Matthew A. Russell,”Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites”, O'Reilly Media, 2013.
15OH84 DATA VISUALIZATION


STATIC DATA VISUALIZATION – tools – working with various data formats (3)


MAPS – Introduction to building choropleth maps (3)

TREES – Network visualizations – Displaying behavior through network graphs (6)

BIG DATA VISUALIZATION – Visualizations to present and explore big data – visualization of text data and Protein sequences (7)

TUTORIAL PRACTICE:
Note: Explore software like R, Python, Google Vision, Google Refine, and ManyEyes ; Data sets are available on Gap minder, Flowing data
1. Visualization of static data.
2. Visualization of web data.
3. Visualization of sensor data.
4. Visualization of protein data.

Total L: 30 + T: 30 = 60

TEXT BOOK:

REFERENCES:

15OH85 ARTIFICIAL INTELLIGENCE

INTRODUCTION: The foundations of AI - The History of AI- Intelligent agents- Agent based system. (2)


KNOWLEDGE REPRESENTATION AND REASONING: Knowledge representation - Logics – First order logic- Inference in first order logic – Higher order logic - Markov logic. (5)


DECISION-MAKING: basics of utility theory, sequential decision problems - decision network– policy -Decision process in infinite horizon: Optimal policy, Value iteration - policy iteration- Partially observable decision process – Decisions in Multi agent system: elementary game theory. (6)

LEARNING: Learning from observation - Knowledge in learning – Supervised Learning - Unsupervised and Reinforcement learning. (2)

ROBOTICS: Introduction. (2)

TUTORIAL PRACTICE:
Lab assignments will be provided for all the topics given below.
2. Hill climbing and genetic algorithm
3. Constraint satisfaction techniques,
4. Simple games – minimax and expectimax
5. Logic based exercises.
6. Implementing HMM models
7. Applications of sequential decision making and multi agent decision making
8. Implementing decision network and dynamic networks.

**REFERENCES:**


**TEXT BOOKS:**


**15OH86 PERVERSIVE COMPUTING**

**INTRODUCTION:** Past, present, future; the pervasive computing market, m-Business, challenges and future of pervasive computing - modelling key for pervasive computing - pervasive system environment interaction - architectural design for pervasive system, application examples of pervasive computing: Healthcare, Tracking, emergency information systems, home networking appliances and entertainment.

**DEVICE TECHNOLOGY FOR PERVERSIVE COMPUTING:** Hardware, computing devices and their characteristics - pervasive information access devices-smart identification, smart card, labels, tokens - embedded controls, smart sensors, actuators -Human-machine interfaces, Biometrics - Various operating systems for pervasive devices.


**APPROACHES FOR DEVELOPING PERVERSIVE APPLICATIONS:** Categorization - smart services for pervasive application development - developing mobile applications – presentation transcoding – device independent view component – heterogeneity of device platforms - Context Awareness and Mobility to build pervasive applications.

**CONTEXT AWARE SYSTEMS:** Modelling - mobility awareness - spatial awareness - temporal awareness - ICT system awareness - Intelligent Systems - basic concepts- autonomous systems - reflective and self-aware systems - self management and autonomic computing - complex systems.

**LOCATION AWARE SYSTEMS:** Basic concepts - location modelling - Introduction to location management – DNS Server, server process, client process – location update – location inquiry-location management cost - network topology – mobility pattern, memory less movement model, Markovian Model, Shortest distance model, Gauss-Markov model, Activity Based Model, Mobility Trace.

**TUTORIAL PRACTICE:**

1. Create application with onClick, onKeyDown, onFocusChanged Event Handlers.
2. Create application with Toast Notifications.
3. Create application with Android's Advanced User Interface Functions.
5. Create application to Create, Modify and Query an SQLite Database.
6. Create application that Works with an Android Content Provider.
7. Create application with Toast Notifications.
8. Create application that performs Data Storage and Retrieval from Android External Storage.
9. Create Location-Aware application that uses Proximity Alerts and Google Maps API.
10. Implementation of small packages to demonstrate all APIs.
**Note:** All implementations using android.

**TEXT BOOKS:**


**REFERENCES:**

15OH87 PARALLEL AND DISTRIBUTED COMPUTING


PARALLEL COMPUTER MEMORY ARCHITECTURES: Shared Memory - Distributed Memory - Hybrid Distributed-Shared Memory Multiprocessors: Communication and Memory issues - Message Passing Architectures - Vector Processing and SIMD Architectures.

PARALLEL PROGRAMMING MODELS: Overview - Shared Memory Model - Threads Model - Message Passing Model - Data Parallel Model - Other Models.


PRAM ALGORITHMS & BSP: PRAM model of computation - Work-Time formalism and Brent's Theorem; algorithm design techniques-parallel prefix, pointer jumping,

HIGH PERFORMANCE COMPUTING ARCHITECTURES - Latency Hiding Architectures - Multithreading Architectures - Dataflow Architectures.


TUTORIAL PRACTICE:
1. Basic Master – Worker program and send messages.
2. Write a program to find the summation of largest number in a very larger array of integers. (The contents of the array should be equally distributed to all processes).
3. Write a parallel program in SPMD to calculate the PI value using integral approximation method.
5. Select your own choice of very dense computational problem having divide and conquer method and implement it in parallel algorithm. And produce the performance chart with 2, 4, 6 and 8 nodes.

TEXT BOOKS:

REFERENCES:

15OH88 CYBER SECURITY


WEB SECURITY: Overview, various types of web application vulnerabilities, Reconnaissance, Authentication, Authorization (Fuzzing and Privilege Escalation), Session Management, Cross Site Scripting (XSS), Cross Site Request Forgery (CSRF), SQL Injection and Blind SQL Injection.


TUTORIAL PRACTICE:
1. Design of a Client server application for a basic cryptosystem.
2. Detection of a Buffer overflow attack.
3. Packet Sniffing using Wireshark Tool to perform the traffic analysis attack.
4. Key distribution using RSA (KDC) – Key hacking.
6. Password authentication.
7. Transaction security using SQL Injection attacks.
8. Port scanning tools.
9. Performing attacks and testing with attack tools.
10. Security testing for Web applications.

TEXT BOOKS:

REFERENCES:

15OH89 RANDOMIZED ALGORITHMS

INTRODUCTION: Randomized algorithms, randomized quick sort, Karger’s min-cut algorithm Las Vegas and Monte Carlo algorithms, computational models and complexity classes.


PROBABILISTIC METHODS: Overview of the method – maximum satisfiability - finding a large cut, Expander graphs.

MARKOV CHAINS AND RANDOMWALKS: Markov chains, Random walk on graphs - connectivity in undirected graphs – Expanders and rapidly mixing random walks.


ONLINE ALGORITHMS: Paging problem-adversary models- paging against an oblivious adversary-relating the adversaries-the adaptive online adversary, k-server problem.

PARALLEL AND DISTRIBUTED ALGORITHMS: Sorting on a PRAM – Maximal Independent sets.


TUTORIAL PRACTICE:
1. Implementation of randomized quick sort and solve real time problems using it.
2. Find solution for s-t min-cut problem adapting min cut algorithm.
3. Implementation of randomized selection and problems related to it.
4. Implementation of treap data structure.
5. Problems using randomized hash table.
6. Implement the shortest path and fast min-cut algorithms.
7. Implementation of randomized primality testing.

Total L: 30+TP:30 = 60
15OH90 APPROXIMATION ALGORITHMS

INTRODUCTION: Definition-performance ratios, vertex-cover problem. (3)

COMBINATORIAL ALGORITHMS: lower bounding techniques and Metric TSP, multiway cut problem, the minimum k-cut problem, FPTAS for knapsack, greedy algorithms for Makespan-PTAS for minimum Makespan, Euclidean TSP. (7)

LINEAR PROGRAMMING RELAXATIONS: LP-duality, min-max relations and LP-duality, rounding applied to vertex cover-simple rounding algorithm-randomized rounding, primal dual method and vertex cover. (5)

CUTS, METRICAL RELAXATIONS AND EMBEDDINGS: multiway cut, sum multi-commodity flow, some applications of multicut, rounding for Sparsest Cut via L1 Embeddings. (5)

SEMIDEFINITE PROGRAMMING: Strict quadratic programs and vector programs, properties of positive semidefinite matrices, the semidefinite programming problem, randomized rounding algorithm, improving the guarantee for MAX-2SAT. (5)

HARDNESS OF APPROXIMATION: reduction, graphs, and hardness factors, the PCP theorem, hardness of MAX-3SAT. (5)

TUTORIAL PRACTICE:
1. Implementation of vertex-cover algorithm.
2. Implementation of Greedy algorithm for makespan.
3. Problems related to Euclidean TSP.
4. Implementation of different algorithms with rounding.
5. Implementation of applications of multicut.

Total L:30+T:30 = 60

TEXT BOOKS:

REFERENCES:

15OH91 NETWORK SCIENCE

INTRODUCTION: Basics of networks and graphs, random network model - degree distribution, evolution, small world property, six degrees of separation, Watts-Strogatz model, local clustering coefficient, random networks and network science. (6)

BARABÁSI-ALBERT MODEL: Growth and preferential attachment, Barabási-Albert model, degree dynamics, degree distribution, diameter and the clustering coefficient, preferential attachment - absence of growth, measure, non-linearity, the origins. (6)

SCALE-FREE PROPERTY: Power laws and scale-free networks, Hubs, Universality, Ultra-small property, role of the degree exponent, Generating networks with a pre-defined degree distribution. (6)

EVOLVING NETWORKS: Bianconi-Barabási model, measuring fitness, Bose-Einstein condensation, evolving networks. (5)

DEGREE CORRELATIONS: Assortativity and disassortativity, Measuring degree correlations, Structural cutoffs, Degree correlations in real networks, Generating correlated networks, impact of degree correlations. (7)

TUTORIAL PRACTICE:
1. Implementation of Barabási-Albert model.
2. Implementation of Watts-Strogatz model.
3. Implementation of Bianconi-Barabási model.
4. Obtaining Degree correlations in real networks.
5. Case studies of the theory concepts on real networks.

Total L:30+T:30 = 60
15OH92 APPLIED STOCHASTIC PROCESSES 2 2 0 3

STOCHASTIC PROCESSES: Introduction – Classification of Stochastic Processes – Markov Chain (2)


RANDOM WALK MODELS: Symmetric random walk – Random walk on graphs – Gambler’s Ruin model (3)


GENERAL QUEUEING MODELS: Single and Multi server Poisson Queues - Single Server Queue with Poisson input and general service– General input and exponential service Queueing models. (5)

TUTORIALS PRACTICE:
1. Case Study for Markov Chain: Passport Credit Card Company, Manufacturing, Telecommunication
2. Case Study for generalized Markov Process: Healthy Heart Coronary Care Facility
3. Modeling Network Protocols using Queueing Models
4. Performance Evaluation of Communication Systems
5. Page Ranking Algorithms

Total L: 30+T: 30= 60

15OH93 MODELLING AND SIMULATION 2 2 0 3

PRINCIPLE OF COMPUTER MODELLING AND SIMULATION: Monte Carlo simulation. Nature of computer modeling and simulation. Limitations of simulation, areas of application. (3)

SYSTEM AND ENVIRONMENT: Components of a system - discrete and continuous systems. Models of a system - A variety of modelling approaches. (3)


DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS: Input - Output analysis - variance reduction techniques - Antithetic variables - verification and validation of simulation models. (4)
DISCRETE EVENT SIMULATION: Concepts in discrete-event simulation, manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem. (5)

SIMULATION LANGUAGES: GPSS - SIMSCRIPT - SIMULA - SIMPLE_1, Programming for Discrete event systems in GPSS, SIMPLE_1 and C. (4)

CASE STUDIES: Simulation of LAN - Manufacturing system - Hospital system. (4)

TUTORIAL PRACTICE:
1. Implement variance reduction.
2. Implement event scheduling.
4. Simulate a manufacturing system.

Total L: 30+T: 30=60

TEXT BOOKS:

REFERENCES:

15OH94 GRAPH ALGORITHMS


MATCHING: Maximum and perfect matchings, augmenting path, Berge’s, Konig’s and Tutte’s theorems, Hall’s theorem, Hungarian algorithm, Edmond-Blossom algorithm. Kuhn-Munkre’s algorithm for optimal assignment. (4)

NETWORK FLOW: Maximum flow in a network, minimum cut, Ford-Fulkerson algorithm, Max-flow min-cut theorem. Similarity between matching and flow theories. (3)


VERTEX COLORING: Vertex coloring and bounds. Sequential coloring, largest degree first algorithms. Maximum clique and vertex coloring. Mycielski’s construction for large chromatic number. (3)

GRAPH ISOMORPHISM: Isomorphism, subgraph isomorphism, László Babai’s quasi-polynomial time solution for graph isomorphism problem. (4)

PLANAR GRAPHS: Euler’s formula, dual graph, Kuratowski’s theorem, 4-color problem, Wagner’s theorem. Planarity testing – Hopcroft-Tarjan algorithm. (3)

TUTORIAL PRACTICE:
1. VLSI Physical design – maximum Independent set, maximum clique and minimum coloring for interval graphs, Steiner minimum tree in routing.
2. Isomorphism/subgraph isomorphism problem in Data mining - common subgraph pattern in networks, chemical compound within a chemical database.
3. Link verification using Eulerian trails.
4. Network flow – finding maximum flow in network
5. Register allocation, frequency assignment using vertex coloring
6. Traveling salesman problem using Hamiltonian concept
7. Planar graph embedding
8. Solving optimal assignment problem

Total L: 30+T: 30=60

TEXT BOOKS:
REFERENCES:

OPEN ELECTIVES OFFERED BY ENGINEERING DEPARTMENT

DEPARTMENT OF TEXTILE TECHNOLOGY

15TH02 SOUND AND THERMAL ISOLATION PRODUCTS AND CHARACTERIZATION

INTRODUCTION TO SOUND: Fundamentals of Sound- Sound Levels and the Decibel- Sound in the Free Field- The Perception of Sound.


SOUND ABSORPTION TEXTILES AND THE ENVIRONMENT: Environmental impact, manufacturing concerns, recycling of materials and components, sustainable product development. SOUND MEASUREMENTS AND STANDARDS: Impedance Tube Method- Reverberant Field Method- Steady State Method. Analysis of sound absorptive characteristics of fabrics tested by these methods.

THERMAL INSULATION PRODUCTS: Need for thermal insulation- Types of thermal insulation materials- Textile structures as thermal insulators- Factors influencing the thermal insulation characteristics. Requirement and design for thermal insulation textiles. End uses of thermal insulation textiles. Improving thermal Insulation in automotive interiors.


TEXT BOOKS:

REFERENCE:

15TH03 TECHNICAL TEXTILES IN ENGINEERING APPLICATIONS


PROTECTIVE TEXTILES: Design of protective clothing, Selection of protective clothing material. Thermal protection, Ballistic protection,chemical protection. Footwear textiles. Medical Textiles.

AUTOMOTIVE TEXTILES: Definition, products, market overview and growth projections of automotive textiles. Textile structures in automotives. Requirement and properties of textiles used in railway applications, marine applications, aircraft, application of composites in transportation.

INTERIOR AND EXTERIOR TRIMS FOR ROAD TRANSPORTATION: Requirement and design for Seat fabric, floor coverings, Headliners, door casings and parcel shelves, truck and car covers, Seat belt, Airbags, carpets, filters (air and oil), battery separators, tyre cords, hoses and belts. Methods of production and properties of textiles used in these applications
INDUSTRIAL TEXTILES: Tyres - Tire Cord Yarns and Fabrics - Quality requirements- Fibre properties - Manufacturing techniques. Belts - Conveyor and power transmission, Composition of belts, Carcass cords, fabrics. Hose fabrics - Definition and characteristics of hoses, reinforcement, Construction and types. (8)


TEXT BOOKS:

REFERENCES:

15TH04 ELECTRO ACTIVE TEXTILES

INTRODUCTION: Electrical conductivity-resistance, capacitance; metal conductors, ionic conductors, inherently conducting polymers-polyaniline, polypyrrole. (5)


TESTING & CHARACTERIZATION: Morphological characterisation, Electrical characterization- surface and volume resistance, Electromechanical characterization- change in resistance with elongation and compression, gauge factor, impedance value measurement, repeatability study, environmental effects. (12)

EMI SHIELDING - Theory of EMI shielding, evaluation of EMI shielding efficiency, factors influencing EMI shielding. (5)

TEXTILE SENSORS: Bio-medical sensors- strain sensor- design, characterization, goniometry application; pressure sensor-design, characterization, breathe rate measurement; communication textiles, display of ornamental applications. (7)

TEXTILE ELECTRODES: Textile electrodes for ECG and EEG measurement- design, characterization and method of conducting clinical trials (8)

TEXT BOOKS:

REFERENCES:

15TH05 FILTRATION PRODUCTS AND CHARACTERIZATION

INTRODUCTION: Definition of filter media, filtration mechanism and theory- types of filtration mechanism, mechanism of particle capture; woven fabric media- types of weave, finishing process, composite fabrics, properties of woven & non woven filter media, characteristics of melt blown webs, challenges of non woven filter media. (8)

RAW MATERIALS FOR NONWOVEN FILTER MEDIA: Polymers, fibers, fiber properties for filtration media, specialty fibers, resins & binders, additives and finishes. (5)

PROCESSES FOR FORMING NONWOVEN FILTER MEDIA: Dry formed- air laid, dry laid spun bonded webs, melt blown webs, electrospun webs, wet lay process, composite structures, pleating –types. (8)

TEST METHODS: Density & bulk, airpermeability, pore size and pore structure, porosity measurement techniques – liquid extrusion porosimetry, microscopy, internal bond strength, fold endurance characterization, water repellency and water resistance, filtration efficiency, arrestance, pressure drop, filter life testing , standards for non woven filter media. (8)

LIQUID FILTER APPLICATIONS: Non woven filter media for liquid filter applications, filters that use nonwoven filter media- cartridge filters, wound filter elements, candle filters and bag filters, testing of liquid filters. (8)
AIR FILTER APPLICATIONS: Industrial air filtration, heat ventilation and air conditioning systems, high efficiency air filtration, respirators, gas masks & face masks, vacuum cleaners, air purifiers and air demisters, Engine filtration. (8)

TEXT BOOKS:

REFERENCES:

15TH06 INDUSTRIAL TEXTILES 3003


TEXTILE STRUCTURES IN AUTOMOTIVES: Definition, products, market overview and growth projections of automotive textiles. Fibers, yarns, knitted, woven, and nonwoven – structural requirements and properties. Applications of 3D knitting, woven and nonwoven materials in automotive industry. (8)

INTERIOR AND EXTERIOR TRIMS FOR ROAD TRANSPORTATION: Requirement and design for Seat fabric, floor coverings, Headliners, door casings and parcel shelves, truck and car covers, Seat belt, Airbags, carpets, filters (air and oil), battery separators, tyre cords, hoses and belts. Methods of production and properties of textiles used in these applications. (8)

TEXTILES IN OTHER TRANSPORTATION: Requirement and properties of textiles used in railway applications, marine applications, aircraft, application of composites in transportation. (8)


TEXT BOOKS:

REFERENCES:

PROFESSIONAL ELECTIVES

DESIGN ENGINEERING

15A001 AERODYNAMICS OF ROAD VEHICLES 3003

INTRODUCTION: Scope, historical developments, fundamentals of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine. (8)

AERODYNAMIC DRAG OF CARS: Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles. (8)

SHAPE OPTIMIZATION OF CARS: Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners. (10)
VEHICLE HANDLING: Origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS: Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

TEXT BOOK:

REFERENCES:

15A002 AUTOMATIC TRANSMISSION

CONCEPT: Principles of automatic transmission, advantages, limitations, types - Mechanical, hydrodynamic, hydro mechanical, hydro static and electric.

MECHANICAL: Principle of centrifugal clutches, comparison between conventional and centrifugal clutches, centrifugal clutches used in two wheelers, over drives – Principle, operation, types, advantages and limitations.

HYDRODYNAMIC DRIVES: Principle of fluid coupling, construction, operation and characteristics, fluid coupling with conventional gear boxes. Introduction to torque converters, comparison between fluid coupling and torque converters, performance characteristics, slip, principles of torque multiplication, types of torque converters.


HYDROSTATIC DRIVES: Principles of hydrostatic drives, different systems of hydrostatic drives, fixed displacement pump and fixed displacement motor, variable displacement pump and variable displacement motor, variable displacement pump and variable displacement motor, applications, plunger type pump and plunger type motor, advantages and limitations, typical hydrostatic drives.


TEXT BOOKS:

REFERENCES:

15A003 AUTOMOTIVE ELECTRONICS


**SENSORS AND ACTUATORS:** Classification of sensors, sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, accelerometer, NOx sensor, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors and relay.

**INTRODUCTION TO RTOS:** Comparison of conventional OS with RTOS. Tasks & task states (Pre-emptive & Non-pre-emptive, scheduler, interrupt – Interrupt latency and context switch latency) – Task, multi-tasking, task synchronization, inter-task communication, shared data problem and its prevention - Features of a typical embedded RTOS (μC/OS-II).

**COMMUNICATION PROTOCOLS:** Introduction to control networking – Communication protocols in embedded systems – SPI, I2C, USB. Vehicle communication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, AUTO SAR.

**REFERENCES:**

**TEXT BOOKS:**

**REFERENCES:**

**15A004 AUTOMOTIVE CONTROL SYSTEMS**

**INTRODUCTION:** Open loop and closed loop systems – Examples, Control system components.

**SYSTEM REPRESENTATION:** Transfer function of physical systems: Mechanical systems - Translational and Rotational systems, Electrical network, Thermal and hydraulic systems. Transfer function of DC Generator, DC servomotor, AC servomotor, Transfer function of overall systems. Block diagram - reduction techniques. Signal flow graphs – Mason' gain formula.


**FREQUENCY RESPONSE ANALYSIS:** Frequency domain specifications – peak resonance, resonant frequency, bandwidth and cut-off rate, correlation between time and frequency responses for second order systems. Polar plot, Bode plot – Gain Margin and Phase Margin.


**STATE VARIABLE ANALYSIS:** Introduction to state-space analysis – Physical variable, Phase variable and Canonical variable forms. Transfer function from state-space representation.

**TEXT BOOKS:**

**REFERENCES:**

**15A005 AUTOMOTIVE PRODUCT DEVELOPMENT STRATEGIES**

**INTRODUCTION TO PRODUCT DESIGN:** Introduction, principles of new product development, success and failure in new products, risk management, funnel and its stages, quality control of product development and meeting targets. The principles of product styling-virtual perception of product style, attractiveness and product styling process.

**PRODUCT PLANNING:** Product planning process, aim and opportunities in product planning, competing product analysis, style planning, factors of contextual styling and Intrinsic styling, styling specifications.
GLOBAL PRODUCTS AND ITS PROBLEMS: Importance, challenges and opportunities of global products, changes and complexity in global products, global product problems – addressing potential problems, multiple causes and its effects, root cause and network of causes and measures, everyday product problems and action. (9)

PLM ENABLING GLOBAL PRODUCTS: Product lifecycle management (PLM), key characteristics and functions, importance, benefits of PLM, metrics and targets of PLM, PLM applications – data/document management, part/product management, process/workflow management, program/project management etc. (9)

CHANGES FOR GLOBAL PRODUCTS: Changing roles of product organizations, increased regulation of product, better managed product, multiple of new products, breakthrough computer aided product development. (9)


15A006 HYDRAULICS AND PNEUMATICS SYSTEMS

ELEMENTS OF HYDRAULIC SYSTEMS: Introduction to fluid power, properties - Hydraulic fluids, air. Selection of hydraulic fluids, comparison between hydraulics and pneumatics. Pumps, motors and cylinders - Types, characteristics, construction details. Valves for control of direction, flow and pressure, types, construction details. (9)


PNEUMATIC SYSTEMS DESIGN AND INDUSTRIAL APPLICATIONS: General approach, travel step diagram. Types - sequence control, cascade, step counter method. K.V. Mapping for minimization of logic equation. Metal working, handling, clamping, application with counters. Design of pneumatic circuits. (9)

ADVANCED TOPICS IN HYDRAULICS AND PNEUMATICS: Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming. (9)


15A007 MECHATRONICS

INTRODUCTION: Definition of mechatronics, introduction to mechatronics systems – need and applications, role of Mechatronics in automation, manufacturing, products and design, elements of Mechatronics. (6)

INTRODUCTION TO CONTROL SYSTEMS: Open loop and closed loop control, elements of closed loop control, introduction to sampled data, digital control and multivariable control systems. Mathematical model for mechanical and electrical systems, transfer function. (6)

TRANSUDCERS AND SENSORS: Importance of sensors in mechatronics, static and dynamic characteristics of sensors. Classification – transducers for measurement of displacement, strain, position, velocity, flow, pressure, temperature, humidity, vibration, liquid level and light sensors. (6)
CONTROL ELEMENTS AND ACTUATORS: Control elements - ON/OFF push buttons, control relays, contactors, selector switches, micro switches and solid state switches. Actuators - solenoids, AC and DC motors, servo, stepper and linear motors. Hydraulic and Pneumatic controls - control valves, cylinders and hydro motors.

MICROPROCESSORS: Microprocessors - introduction, 8085 architecture, types of memory, machine cycles and timing diagram, addressing modes, instruction set, development of simple programs.

INTERFACING 8255: Basic concepts of I/O, I/O mapping and memory mapping, 8255 block diagram, port structure, Interrupts, multiple interrupt processing. Applications-seven segment display interface, keyboard interface

MICROCONTROLLER:8051 Microcontroller architecture, registers, addressing modes, interrupts, port structure, timer blocks and applications- temperature control and stepper motor speed control

MEMS: Introduction, MEMS and micro system products, application of micro systems in the automotive industry, working principles of micro systems – micro sensors, micro actuation, MEMS with micro actuators and micro accelerometers

REFERENCES:

TEXT BOOKS:

REFERENCES:

15A008 AUTOMOTIVE EMBEDDED SYSTEMS

INTRODUCTION TO EMBEDDED SYSTEMS: Embedded Systems Definition - Components of embedded systems - Hardware Module - Microprocessor, microcontrollers, on-chip peripherals - Program memory(PM), Data memory(DM), parallel port structures, timer, input capture & output compare units, ADC, PWM. Embedded system programming - Up-loaders, ISP, ROM emulators, in-circuit emulators. Debug Interfaces - BDM and JTAG.

HARDWARE MODULES: 16-bit microcontrollers-architectural overview of C166 family-memory organization, fundamental CPU concepts and optimization measures, on-chip system resources, peripheral event controller (PEC) ad interrupt control, external bus interface, parallel ports, general purpose timers(GPT), watchdog timer, serial channels, capture/compare units, pulse width modulation unit, analog to digital converter, real time clock, on-chip FC bus module, universal serial bus (USB) interface.

SOFTWARE DEVELOPMENT TOOLS: Introduction to Integrated development environment (IDE), creating new project, creating new file, adding files to project, options for target, compile and building project, simulation and debugging, set breakpoints, monitor on-chip peripherals using simulators, study of example programs.

INTEGRATION OF HARDWARE AND SOFTWARE: Introduction to microcontroller development kit (easy kit), developing project using IDE software, downloading embedded software into target system, introduction to on-chip debugging resources (JTAG), debugging target system using on-chip debugging support (OCDS).

DRIVE-BY-WIRE: Challenges and opportunities of X-by-wire system and design requirements, steer-by-wire, brake-by-wire, electronic throttle including adaptive cruise control, shift-by-wire.

TEXT BOOKS:

REFERENCES:

15A009 VEHICLE CONCEPT STYLING AND DESIGN

INTRODUCTION: Drawing in product design, drawing by hand, drawing by computer, mass production, geometric versus naturalistic drawing, modernist design. Basic drawing skills - Perspectives, metric projections, spherical projections, orthographic projections, sections and scrap views. Tools and materials
**COMPUTER SYSTEMS:** The computer processor, system software, the central processing unit, memory, frame buffers, display, input devices, hardcopy output, 3D output devices, networking, healthy and safety. Concept design - Satisfying the client, sketch, schematic, evaluating the design, 3D modeling concepts, hybrid approach, commercial computer solutions, drawing in space, creating organic forms. (9)

**PRESENTATION DRAWING AND VISUALS:** From watercolor washes to markers, painting by numbers, the art of design, visual tricks, making marker drawing, 2D computer programs: paint and vector, 3D computer aided styling (CAS), creating virtual reality, shading a computer model, ray tracing and radiosity, adding texture, fractals and commercial modelers. (9)

**FROM GENERAL ARRANGEMENTS DRAWING TO PRODUCTION:** Technical production documentation, the general arrangement drawing, drafting standards, computer aided drafting, geometric constructions, controlling curves, parametric design, CAD data - Exchange standards and all change in the CAD market. (9)

**TECHNICAL ILLUSTRATION:** Art of technical illustration, techniques of technical illustration, thick and thin lines, sections, cutaways and ghosting, photo-tracing, annotation and labeling, computer aided illustration, interactive technical illustration and commercial solutions. (9)

**TEXT BOOKS:**

**REFERENCES:**

**15A010 SIGNALS AND SYSTEMS**

**SIGNALS AND SYSTEMS:** Introduction – Continuous Time (CT) & Discrete Time (DT) signals – Signal operations - Basic CT & DT signals - Representation of signals using impulse function – Classification of CT & DT signals – CT & DT Systems – Basic System Properties. (9)

**LINEAR TIME INVARIANT SYSTEMS:** Discrete time LTI systems: Convolution Sum – Continuous time LTI systems: Convolution Integral – Properties of LTI systems – Unit step response of an LTI system – LTI systems described by linear constant-coefficient differential and difference equations. (9)

**FOURIER ANALYSIS OF CT SIGNALS AND SYSTEMS:** Response of LTI systems to complex exponentials - Representation of CT periodic signals by Continuous Time Fourier Series (CTFS) – Convergence of CTFS – Properties of CTFS - Representation of CT aperiodic signals by Continuous Time Fourier Transform (CTFT) – Convergence of CTFT – Fourier transform for CT periodic signals - Properties of CTFT - Frequency response of systems characterized by linear constant-coefficient differential equations. (9)

**SAMPLING:** Representation of CT signal by samples – Impulse train sampling – Zero order hold sampling – Reconstruction of CT signal from samples - Effect of under sampling – Aliasing. (5)

**FOURIER ANALYSIS OF DT SIGNALS AND SYSTEMS:** Representation of DT periodic signals by Discrete Time Fourier Series (DTFS) - Properties of DTFS - Representation of DT aperiodic signals by Discrete Time Fourier Transform (DTFT) – Convergence of DTFT – Fourier transform for DT periodic signals - Properties of DTFT - Frequency response of systems characterized by linear constant-coefficient difference equations. (8)

**Z-TRANSFORM ANALYSIS OF SIGNALS AND SYSTEMS:** z-transform – Properties of z-transform – Inverse z- transform – Long division, Partial fraction and Cauchy’s residue Methods – Stability and Causality in z domain – Analysis of systems characterized by linear constant-coefficient difference equations – Solution of difference equations with initial conditions. (5)

**TEXT BOOKS:**

**REFERENCES:**
15A011 AUTOMOTIVE INSTRUMENTATION


AMPLIFIERS AND SIGNAL CONDITIONING CIRCUITS: Analogue signal acquisition with operational amplifier circuits basics - analysis of operational amplifiers circuits - selected examples of basic circuits (Amplifier, Integrator, Adder, Sign Switch, Comparator and Schmitt Trigger) - digital signal acquisition - theory of digital to analog and analog to digital conversion - DAC principles - ADC circuits - recorders - signal conditioning and filtering.


NOISE AND VIBRATION: Sound level meters - acoustic measurement - FFT analyzer - anechoic chamber - varechoic chamber - sound level measurements - NVH standard - Torque measuring instruments, dynamometers.

Total L: 45

TEXT BOOKS:

REFERENCES:

15A012 AUTOMOTIVE TESTING

WIND TUNNEL TEST: Test requirements – ground boundary simulation - wind tunnel selection and Reynolds number capability, model requirements, model details, model mounting, test procedure. Crash test – types


FUEL CONSUMPTION TEST: Type I & II, test route selection, vehicle test speeds, cargo weights, driver selection, test data form, calculations. Test on rough terrain, pot holes with laden and unladen conditions.

SUSPENSION AND STABILITY FOR DIRECTIONAL CONTROL: Measurement of dimensional and geometric characteristics, measurement of centre of gravity position, measurement of moments and products of inertia, measurement of suspension kinematic characteristics, measurement of suspension elastic and coulomb friction characteristics, measurement of shock absorber characteristics.

STEERING CONTROL SYSTEM DIRECTIONAL CONTROL TEST: Analysis of constant radius test, constant steer angle test, constant speed variable radius test, constant speed variable steer angle test, response gain test.


ENERGY CONSUMPTION TEST: Engine cooling fan, air conditioning and brake compressors, hydraulic pumps power consumption. Antilock brake systems energy consumption.

Total L: 45

TEXT BOOKS:
REFERENCES:

15A013 AUTOMOTIVE PRODUCT LIFE CYCLE MANAGEMENT

3 0 0 3

MOTIVATION AND INTRODUCTION: e-commerce, B to B, B to C forms of business, extended enterprise, concepts in PDM - product life cycle, business objects, work flows, versions, views, product structure, change processes, work list, information flow model in product development, engineering bill of materials and manufacturing bill of materials. (10)

COMPONENTS OF PLM SOLUTIONS: Object oriented approach in product development solutions, phase gate process in product design - disparate databases and connectivity, use of EAI technology (middleware) - cases for preparation of combined BOM and other reports. Component supplier management and sourcing. (10)

PRODUCT VISUALISATION: CAD neutral environment and visualisation of products, standard software, use of visualization in several stages of lifecycle, reviews, mark up - case studies. (10)

ROLE OF PLM IN INDUSTRIES: (like auto, aero, electronic) - other possible sectors, ten step approach to PLM, benefits of PLM. (7)

DETAILS OF MODULES IN A PDM/PLM SOFTWARE: Example (4)

BASES ON CUSTOMISATION OF AUTOMOTIVE PDM/PLM SOFTWARE (6)

TEXT BOOKS:

REFERENCES:

15A014 VIBRATION AND NOISE ENGINEERING

3 0 0 3

BASES OF VIBRATION:Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies. (9)

VIBRATION CONTROL TECHNIQUES: Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, engine mounts and transmissibility, semi-active and active mounts - crank shaft damping, modal analysis. (9)

BASES OF NOISE AND SOURCES: Introduction, noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise. (9)

NOISE CONTROL: Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, soundtransmission through barriers, Helmholtz resonators. (9)

SILENCERS AND ACTIVE NOISE CONTROL: Introduction- Requirements -reactive and absorptive type -simple expansion chamber and its TL calculation – double chamber mufflers Extended-Tube Expansion Chamber(ETEC)- back pressure considerations- active noise control strategies. (9)

TEXTBOOKS:

REFERENCES:
15A015 VEHICLE DEVELOPMENT PROCESS

VEHICLE DEVELOPMENT PROJECTS: An Overview, Categories of vehicle development projects, Platforms and model lines, The product evolution process (PEP), Vehicle project management, Aspects of international development projects. Cars that topped and cars that flopped, Factors of success in the automotive industry. Phases of the product evolution process: Initial phase, Concept phase, Series development phase, Series support and further development. (9)

VIRTUAL CAR PROCESS: Building virtual cars. Geometric integration, further functional geometry evaluation, Virtual build groups. E/E system development: From machinery to E/E systems, Systems engineering processes. (9)

MANAGEMENT PROCESSES FOR COMPLETE VEHICLE DEVELOPMENT: Target management, Design problem management, Release and change management, Quality management. (9)

CUSTOMER RELEVANT COMPLETE VEHICLE CHARACTERISTICS: Registrability, Total vehicle costs, Design appeal, Cabin comfort, Infotainment, Agility, Passive safety, Theft deterrence, Reliability, Sustainability. (10)

SECONDARY COMPLETE VEHICLE CHARACTERISTICS: Production Integration, Service Integration. (8)

TEXT BOOKS:

REFERENCES:

15A016 AUTOMOTIVE TRIBOLOGY

INTRODUCTION TO TRIBOLOGY: Friction, wear and lubrication principles of tribology, thick film lubrication, boundary layer lubrication. (6)

FRICTION AND WEAR: Laws of friction, causes of friction, types of wear and mechanisms of wear, wear properties of friction and anti-friction metallic and non-metallic materials (9)

LUBRICANTS: Solid lubricants, liquid lubricants, properties of lubricants, selection for general applications and special applications such as low temperature, high temperature, extreme pressure, corrosion resistance etc. (12)

HYDRODYNAMIC LUBRICATION: Basic concepts, Reynolds equation, lane bearings. Design of journal bearings- short and finite bearings, design of bearings with steady load, varying load and varying speed. (9)

LUBRICATION OF AUTOMOBILE SYSTEMS: Engine lubricating systems, lubrication of piston, piston rings and cylinderliners, lubrication of cam and followers, lubrication of in volutes gears, hypoid gears and worm gears, friction aspects of clutch, brake sand belt drive. (9)

TEXT BOOKS
1. Desmond F. Moore, “Principles and applications of Tribology”, Springer 2007

REFERENCE:
1. Majumdar B C, “Introduction to Tribology of Bearings”–, Springer 2004

15A017 MODELLING OF DYNAMIC SYSTEMS

SYSTEM MODEL REPRESENTATION: Configuration form, State-space representation, input-output equation, Transfer function, State-space representation from the input-output equation. Linearization, Determination of operating point, Numerical solution of Nonlinear model. (9)
MECHANICAL SYSTEM MODELING: Translational systems, Rotational systems, Mixed rotational and translational systems and Gear train systems. Modeling of Electro mechanical systems, Thermal systems, Pneumatic systems and Hydraulic systems. Transient response of First-order systems and Second-order systems. Open loop and close loop control systems. (9)

CONTROLLER COMPONENTS: Sensors, Differentiating and amplification, Actuators, Electrical components, Hydraulic components and Pneumatics components. Time resonance of Second-order systems, Time response specifications. Steady state error for Unit step input, Unit ramp input and Unit parabolic input. Types of feedback control systems.Type-0 system, Type-1systemandType-2system. (9)

DESIGN SPECIFICATIONS: Specifications of second order system, Derivative error compensation, Derivative output compensation, Integral error compensation, Proportional plus Integral plus Derivative compensation. (9)

SYSTEM STABILITY: Algebraic criterion, Hurwitz stability criterion, Routh stability criterion. Automobile vehicle Drive line model. ABS Control systems. Complete vehicle model. (9)

Total L: 45

TEXTBOOKS:

REFERENCES:

15A018 AUTOMOTIVE BIOMECHANICS

INTRODUCTION TO BIO MECHANICS : Basics of Bio-mechanics; Relevance in automotive industries; Dummies – crash testing – rating Testing and Procedure (9)

MODELLING OF HUMAN RESPONSE AND INJURY IN SIDE IMPACTS: Human body modelling; Dummies and mathematical model development- impact rating and criterion- classification of injuries- restraints and design- Estimating Effects of Vehicle Mass and Active Safety Technologies on Injury/Fatality Risk (9)


HEAD/Brain BIO MECHANICS: Introduction- basic of head injuries and criterion- restraint design- vehicle body design and optimization- Skull protection- multiple injury mitigation – Male –female injury mechanics - Human and ATD Response to High-Speed Vertical Loading- neck injury bio-mechanics. (9)

RERAINT AND PROTECTIVE SYSTEM INJURY ASSESSMENT AND EVALUATION: Introduction- Overlap/angled frontal crash testing and real-world performance- Computational injury biomechanics -Biomechanical injury data analysis -Development of future vehicle safety features. (9)

Total L: 45

TEXT BOOKS:

REFERENCES:

15A019 INTELLIGENT PROPERTY RIGHTS


INTERNATIONAL SCENARIO: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. (9)

PATENT RIGHTS: Scope of Patent Rights. Licensing and transfer of technology. Patent information and data bases, Geographical Indications (9)

NEW DEVELOPMENTS IN IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR –patent corporation treaty (PCT)- patent laboratory treaty (9)
15A021 AUTOMOTIVE HVAC

INTRODUCTION: Air conditioning system - Schematic layout, compressor, condenser, expansion valve, evaporator, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

PSYCHROMETRY: Moist air behaviour, psychrometric chart, psychrometric processes - Summer and winter air-conditioning, cooling load calculations.

REFRIGERANT: Properties of refrigerants, common refrigerants, containers, handling refrigerants, tapping into the refrigerant container, ambient conditions affecting air conditioning system, refrigeration system diagnostics.

VENTILATION: Air flow through recirculation unit and automatic temperature control. Duct system - Controlling flow, vacuum reserve, testing the air control and handling systems.

AIR CONDITIONING: Automotive heaters - Heater system, manually and automatically controlled air conditioner, air conditioning in cars, busses, trucks, location, working and maintenance.

REFERENCES:

15A022 MODELLING AND SIMULATION OF INTERNAL COMBUSTION ENGINES

MODELING OF IC ENGINES: Heat of reaction - \(H_p\) and \(U_p\) calculations, adiabatic, constant volume combustion, constant pressure combustion, temperature drop due to fuel vaporization, adiabatic flame temperature, mean effective pressure, torque and thermal efficiency at full throttle, part throttle and supercharged conditions. Spray models, flow models and combustion models.

COMBUSTION IN SI ENGINES: Combustion in premixed flames - Stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion – Theories and effect of engine operating variables on combustion.

COMBUSTION IN CI ENGINES: Combustion in diffusion flames - Droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature and diesel knock.

SIMULATION OF IC ENGINES: SI and CI engine simulation – Air standard cycle, fuel-air cycle, progressive combustion cycle and actual cycle simulation – Part throttle, full throttle and supercharged conditions.

SIMULATION OF NEW ENGINE CONCEPT: Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine and controlled auto ignition engine.

REFERENCES:
REFERENCES:

15A023 ADVANCED THEORY OF INTERNAL COMBUSTION ENGINES

3 0 0 3

COMBUSTION PROCESSES: Combustion in premixed and diffusion flames, combustion process in IC engines, adiabatic flame temperature, effect of super charging and scavenging on combustion. (9)

ABNORMAL COMBUSTION IN SI ENGINES: Stages of combustion, flame propagation, rate of pressure rise, cycle-to-cycle variation, abnormal combustion, theories of detonation, heat release. (9)

COMBUSTION AND KNOCK IN CI ENGINES: Droplet and spray combustion theory, stages of combustion, delay period, peak pressure, heat release, gas temperature, diesel knock. (9)

COMBUSTION OF FUELS: Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels, chemical energy and heating values, chemical equilibrium and maximum temperature, flame velocity and area of flame front, fuel spray characteristics, penetration and atomization. (10)

ADVANCED IC ENGINES: Adiabatic and low heat rejection engines, homogeneously charged compression ignition engines - multi-fuel engines, stratified charged and lean burn engines. (8)

TEXT BOOKS:

REFERENCES:

15A024 COMPUTATIONAL FLUID DYNAMICS

3 0 0 3

INTRODUCTION: Application areas of CFD, Basic concepts of fluid flow - governing equations, conservation of mass, momentum and energy – Navier-stokes and energy equation for Newtonian fluid, Mathematical classification of flow - hyperbolic, parabolic, elliptic and mixed flow types. (8)


CFD TECHNIQUES: Lax - Wendroff technique - MacCormack’s technique, Relaxation technique. ADI technique, Pressure correction technique, SIMPLE algorithm. Fluid flow and convection problems: Upwind scheme, Stability criteria. (9)

TURBULENCE MODELING: Turbulence energy equation- one-equation model, the k-ω model, the k- ε model. (9)

CASE STUDIES: Modeling and analysis of heat transfer, fluid flow and automobile components using CFD packages. (6)

Total L: 45

TEXT BOOKS:

REFERENCES:
15A025 FUELS AND COMBUSTION

FUELS: Gaseous Fuels, Liquid Fuels, Solid Fuels, Stoichiometry and Heat Calculations, Analysis of Combustion and Products, Heat of Reaction, Adiabatic Flame Temperature


PREMIXED FLAME: Bunsen Burner Flame, Laminar Flame Speed, Quenching of Laminar Flames, Flammability Limits, Minimum Ignition Energy for Spark Ignition, Flame Stabilization, Flame Speed Measurements, Basics of Turbulent Premixed Flames


TEXT BOOKS:

REFERENCES:

INDUSTRIAL AND MANUFACTURING ENGINEERING

15A031 VALUE ENGINEERING


VE JOB PLAN: Introduction, orientation, information phase, speculation phase, analysis phase, development phase, implementation phase, and follow up phase. Study of a product for functions.


FAST DIAGRAMMING AND VE LEVEL OF EFFORT: Value decision, decision process, queuing theory and Monte Carlo Method, cost models, life cycle costs. VE team, co-ordinator, designer, different services, definitions, construction management contracts, value engineering case studied. To draw FAST for a process.

CASE STUDY: Case studies related to human resource, manufacturing and marketing field.

TEXT BOOKS:

REFERENCES:

15A032 COMMERCIAL FLEET OPERATION

INTRODUCTION: Modes of transport, road transport - Types of roads, advantages, motor transport in India.
15A033 QUALITY ASSURANCE AND RELIABILITY

INTRODUCTION AND PROCESS CONTROL FOR VARIABLES: Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process-factors – process capability–process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart. (9)

PROCESS CONTROL FOR ATTRIBUTES: Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts. (9)

ACCEPTANCE SAMPLING: Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C curves – producer’s Risk and consumer’s Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD-uses of standard sampling plans. (9)

LIFE TESTING - RELIABILITY: Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves. (9)


TEXT BOOKS:

REFERENCES:

15A034 TOTAL QUALITY MANAGEMENT

INTRODUCTION: Definitions of the terms - quality, quality planning, quality control, quality assurance, quality management, Total Quality Management (TQM) as per ISO 8402 - overview on TQM - The TQM axioms - Commitment - Scientific knowledge - Involvement - Consequences of total quality. ISO 9000 Series Quality System Standards: The structure of ISO 9000 series quality system standards - certification process - action plan development for cases. Study of quality audit. (10)
THE DEMING AND JURAN APPROACH TO TQM: Deming's fourteen points on quality management - five DDs - implementing the Deming philosophy - action plan - the Deming cycle - questions and opinions of Deming. : Developing a habit of quality - Juran quality trilogy - the universal break through sequence - comparison Juran and Deming approaches. (10)

CROSBY AND THE QUALITY TREATMENT AND KAIZEN: Crosby's diagnosis of a troubled company - Crosby's quality vaccine - Crosby's absolutes for quality management - Crosby's fourteen steps for quality improvement. Kaizen and innovation - the Kaizen management practices - total quality control (TQC) - approaches of Faigenbaum, Ishikawa - Kaizen and TQC - Kanban systems - small group activities - quality control circles - suggestion systems - comparison of Kaizen and Deming's approach. (10)

SUPPORTING TOOLS, ACTIVITIES AND TECHNIQUES IN TQM PROJECTS: Affinity diagram - bar chart - block diagram - brainstorming - cause and effect analysis - customer-supplier relationship checklist - decision analysis - flow charts - force field analysis - line graph/run charts - Pareto analysis - quality costing - Quality Function Deployment (QFD) - quality project approach and the problem solving process. Quality in auto service station. (8)

STRATEGIC QUALITY MANAGEMENT: Integrating quality into strategic management - Quality and the management cycle - Resources for Quality activities - Training for Quality - Self Managing Teams - Role of the Quality Director - Obstacles to achieving successful Strategic Quality Management. Five S study. (7)

TOTAL L: 45

TEXT BOOKS:

REFERENCES:

15A035 MATERIALS FOR AUTOMOBILE INDUSTRY 3 0 0 3

INTRODUCTION: Classification and characteristics of metals, ceramics, polymers and composites. (5)

IRON AND STEELS: Cast iron – Austempered ductile iron, compacted graphite iron, steels -Plain carbon steels, low alloy steels, HSLA steels, IF steels, bake hardening steels, TRIP steels, ultra high strength steels, stainless steels - production, properties and applications. (12)

NON-FERROUS ALLOYS: Aluminium alloys – Cast alloys, wrought alloys, age hardenable alloys, working and heat treatment, applications in automobiles, Magnesium alloys – Cast and wrought alloys, working and heat treatment, applications. Titanium alloys. (12)

POLYMERS AND CERAMICS: Processing of polymers, brief description of equipment and process details of extrusion, injection moulding, thermofoming, blow moulding, concept of polymer design, and selection criteria. Preparation and forming of ceramics, applications. (11)

COMPOSITE MATERIALS: Production of composite materials and products, moulding and forming of composites, machining and joining of composites, application of composites in automobiles, metal matrix composites, polymer matrix composites and ceramic matrix composites, applications. (5)

TOTAL L: 45

TEXT BOOKS:

REFERENCES:

15A036 PROCESS PLANNING AND COST ESTIMATION 3 0 0 3


PROCESS PLANNING: Definition–Objective–Scope–approaches to process planning-Process planning activities – Finished part requirements- operating sequences- machine selection-material selection parameters-Setof documents for process planning- Developingmanufactory logic and knowledge- production time calculation – selection of costoptimal processes. (10)
INTRODUCTION TO COST ESTIMATION: Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost. (8)

COST ESTIMATION: Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation. (7)

PRODUCTIONCOSTESTIMATION: Estimation of material cost, labour cost and over heads, allocation of overheads –Estimation for different types of jobs. (10)

TEXT BOOK:

REFERENCES:

15A037 LEAN METHODS FOR AUTOMOBILE ENGINEERS

INTRODUCTION: History - TPS - Objectives - Key principles - Implications of lean. Traditional vs. mass production vs. lean manufacturing vs. smart manufacturing. single variant vs. mixed model support. Pros and Cons of Lean - Benefits of Lean - Automobile applications


LEAN IMPLEMENTATION: Road map to implement lean project - Hoshin planning - Best practices.


TEXT BOOKS:

REFERENCES:

MISCELLANEOUS AUTOMOTIVE TECHNOLOGIES

15A040 TWO AND THREE WHEELER TECHNOLOGY

TWO WHEELERS: Types- standard class, touring class, sports bike, cruisers class, off road class. Main frame, types- tubular steel frame, diamond, cradle, backbone, underbone, trellis frame.THREE WHEELERS: Type- passenger carrier, goods carrier and its features. Main components of three wheeler.
POWER UNIT FOR TWO & THREE WHEELERS: Two stroke SI engine - components, principle of operation, Types of two stroke engine: based on scavenging method- crank case, separately scavenged engine, based on scavenging process - cross flow, loop flow (MAN, Schnuerle, Curtis type), uni -flow (opposed piston, poppet valve, sleeve valve), based on overall port timing - symmetrical and unsymmetrical diagrams. Scavenging -efficiency, pumps. Reed valve, Rotary disc valve engine, fuel system, lubrication system, air and water cooling system, magneto coil and battery coil spark ignition system, electronic ignition system, variable timing ignition system (VTI), starting systems-kick starter, electric starting.

TRANSMISSION & SUSPENSION SYSTEMS FOR TWO & THREE WHEELER: Multiple and centrifugal clutches, gear box, gear shift mechanism, Final drive- shaft drive and chain drive. Front suspension-Head stock mounted forks, leading link, Trailing link,Telescopic forks, rear suspension- conventional dual spring /damper type, prolink progressive type, Pro arm type, torsion bar, leaf spring.

SUB SYTEMFOR TWO & THREE WHEELERS: Panel meters and controls on handle bar, Controls on foot. Electrical systems - lights- replaceable bulb, sealed beam, tail light and stop light, turn signal lights, horn, fuses. Drum brakes- Brake lever, wheel brake mechanism-single leading shoe, double leading shoe brakes, disc brakes- master cylinder caliper assemble, disc, brake fluid, front and rear brake links layouts. Wheels & Tyres - spoked wheel, cast wheel, disc wheel, tyre construction, tubed and tubless tyre, composite wheel construction, split rim wheel.

SERVICE AND MAINTENANCE: Servicing and maintenance of carburetor, spark plug cleaning, ignition timing adjustment, gear box, steering head, shaft and chain drive, suspension, brake servicing and adjustment. Periodic maintenance schedules.

TEXT BOOKS:

REFERENCES:

15A041 INTELLIGENT VEHICLE TECHNOLOGY

DRIVER ASSISTANCE SYSTEM: Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance, vehicle monitoring.

TELEMATICS: Global positioning system, geographical information systems, navigation system, architecture, automotive vision system, road recognition.

SAFETY SYSTEMS: Active and passive safety, airbags, seat belt tightening system, forward collision warning systems, child lock, anti lock braking systems, Autonomous Vehicle System, Lane departure warning system, Adaptive headlight system, Day time running lights (DRL), Automatic wiper system, Traffic Sign Identification.

COMFORT SYSTEMS: Adaptive cruise control system, Active suspension system, power steering, collapsible and tiltable steering column, power windows, and climate control system.

SECURITY SYSTEMS: Anti theft technologies – mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding, Bio metric systems.

TEXT BOOKS:

REFERENCES:

15A042 SPECIAL PURPOSE VEHICLES

CRANES AND EXCAVATORS: General description, specifications and functions, of cranes, mobile cranes with strut and cantilever type jibs, tractor towed and tractor mounted cranes. General description, specification and functions of excavators classification based on attachments, face shovel, drag shovel, hoe, drag-line and grab or clam shell, advantages and limitations.

GRADERS: Description, specification of tractor towed graders and motor graders, classification and functions of graders, functional details of spreading, mixing, ditching, bank sloping, snow removal, stripping, scarifying, and finishing, elementary details of transmission system (coupling, clutches, gear box, driving axles, propeller shafts), running gear and operating equipment air braking system; hydraulic system and its components, merits and limitations of graders.


ROOTERS, SCARIFIERS AND SCRAPERS: General description, specification and functions, tractor towed rooters and scarifiers - Heavy duty, light duty. General description, specification and functions, tractor towed and motorized scrapers, scraper work in cutting, cambering, side hill cutting, spreading on embankments, compaction of fill merits and demerits.

COMPACTION VEHICLES AND OTHER SPECIAL PURPOSE VEHICLES: General description, specification and functions, smooth wheeled rollers, pneumatic tired rollers, agricultural Rollers, sheep's foot rollers, vibrating compactors. General description, specification and functions, Ambulance, oil tankers, surveillance vehicle, television recording mobile unit, reefer vehicle, double decker bus, vestibule bus, fire fighting vehicle.


15A043 ELECTRIC, HYBRID AND FUEL CELL VEHICLES

ELECTRIC VEHICLES: Architecture of an electric vehicle, essentials and performance of electric vehicles – Traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations.

HYBRID VEHICLES: Hybrid electric drivetrains - Concepts, architecture, design, control strategies, merits and demerits.

ELECTRIC PROPULSION SYSTEMS: DC motor drives, induction motor drives, permanent magnet motor drives and switched reluctance motor drives.

ENERGY STORAGE DEVICES: Electrochemical batteries – Reactions, thermodynamic voltage, lead-acid batteries, nickel based batteries, lithium based batteries, flywheel and ultra-capacitors, Battery management systems.


15A044 ALTERNATE FUELS

GASEOUS FUELS: Properties, composition, production, storage, engine modifications, combustion, performance and emission characteristics in SI and CI engines, advantages and disadvantages of compressed natural gas (CNG), liquefied petroleum gas (LPG), hydrogen and ammonia.

**ONE CREDIT COURSES**

**15AF01 GASOLINE ENGINE MANAGEMENT SYSTEM**

**Introduction:** Evolution of Fuel Injection & Ignition System. Driving factors for Gasoline Engine Management System. Overview of gasoline fuel injection system. Torque, Air, Fuel, Combustion and Exhaust System functioning. **System components and functions of MPFI and GDI System.** Fuel System: Hydraulic Circuit – High Pressure & Low Pressure, Filter, Pre-supply pumps, high pressure pump, pressure control valve, metering unit. **Electronics:** electronic control unit, **Sensors and Actuators:** crank & cam sensor, engine air temperature, air quantity, air pressure sensors, air mass meter, gasoline high pressure sensor, solenoid/piezo injector, EGR valve, **Air System:** Electronic Throttle, Variable Valve Timing Control, **Ignition System and Knock Control** – Ignition coil, spark plug, knock sensor, **Exhaust System:** Lambda Control, Turbo charge control, Three way catalytic control.

**Diagnostic and Safety of Engine Management System:** Onboard Diagnostics OBD, ISO26262 safety, Testing. **Vehicle and Engine Calibration:** Calibration Infrastructure & Techniques, Function, System Calibration, summer, winter, altitude & release test.

**REFERENCES:**

**15AF02 DIESEL ENGINE MANAGEMENT SYSTEM**

**EVOLUTION OF DIESEL FUEL INJECTION SYSTEM:** Driving factors for Diesel Engine Management System. Overview of diesel fuel injection system. Torque, Air, Fuel, Combustion and Exhaust System functioning. **System components and functions of common rail diesel injection system:** Hydraulic Circuit – High Pressure & Low Pressure, Filter, Pre-supply pumps, high pressure pump, pressure control valve, metering unit.

**Electronics:** electronic control unit, **Sensors & Actuators:** crank & cam sensor, engine air temperature, air quantity, air pressure sensors, diesel high pressure sensor, solenoid/piezo injector, EGR valve, Electronic Throttle, VVT, **and Exhaust System:** Turbo charge control, diesel particulate filter, and selective catalytic reduction system. **Diagnostic and Safety of Engine Management System:** Onboard Diagnostics OBD, ISO26262 safety. **Vehicle and Engine Calibration:** Calibration Infrastructure & Techniques, Function & System Calibration, summer, winter, altitude & release test.

**REFERENCES:**

15AF03 VEHICLE SYSTEM ENGINEERING

INTEGRATION OF MAJOR ASSEMBLY: Selection of engine, matching of gear box and integration. Suspension system, axle and steering system and integration with chassis member.

Integration of controls: Clutch, gear box, brakes and steering linkages.

Layout design of a vehicle.

REFERENCES:

15AF04 COMPUTER AIDED INDUSTRIAL DESIGN FOR AUTOMOBILES

INTRODUCTION: Computer aided industrial design tools, Alias design products, Alias design interface.

AN OVERVIEW ON COMPUTER AIDED INDUSTRIAL DESIGN: Features of curve, Creating curves, Transform tools, Creating a surface, Projecting curves on surface, Mirroring objects, Stretching a curve, Breaking a curve at inflections, Rebuilding and planarizing a curve and Advanced surface creation. Data transfer from CAID to CAD.

REFERENCES:

15AF05 SKETCHING FOR DESIGNERS

INTRODUCTION: Study of geometry of elements in products and its application in object drawing.

SKETCHING: Product presentation in various media like pencil, ink and colour. Presenting thoughts and ideas in design through sketches, perspective and exploded views. Presentation of product design concepts through simplified graphics presentation. Typefaces, Typography and printing, Exposure to digital photography.

REFERENCES:

15AF06 INDUSTRIAL DESIGN

INTRODUCTION TO BASIC ELEMENTS: Line, texture, color, form, symmetry, balance, scale, mass, unity and variety. Concept of visual language and visual design.


REFERENCES:
15AF07 COMPUTER AIDED AUTOMOBILE STYLING

INTRODUCTION: Surface Continuities, Construction Settings and its Importance, Curves and Construction techniques, Surface and Surface Modeling techniques, Building Basic volumes. (5)

AN OVERVIEW ON COMPUTER AIDED STYLING: Sketch Modeling Exercise, Full Exterior Modeling Exercise, Full Interior Modeling Exercise, Working with Industry level Class A Quality, Working with Scan, Patch planning and Modeling. (10)

REFERENCES:

15AF08 VEHICLE DESIGN PROCESS


REFERENCES:

15AF09 ACTIVE SAFETY SYSETMS


Driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact. (6)

REFERENCES:

15AF10 PASSIVE SAFETY SYSETMS

INTRODUCTION: Legislative Safety Requirements, ISO26262 Safety Requirements, ASIL standards. Passive Safety System and Components: Sensors, controllers, actuators, Multiplexing and DE multiplexing, diagnosing and troubleshooting methods. Seat belt, regulations, automatic seat belt lightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety. (9)


REFERENCES:
15AF11 INTEGRATED PRODUCT DEVELOPMENT

INTRODUCTION TO NPD: Product - Importance of Global Product - New Product Development (NPD) process in 21st Century - involvement of mechanical, electronics and information systems in NPD - Methods to execute NPD - Phases of NPD process. (4)

REQUIREMENT ANALYSIS: Importance of Business Analyst - PESTEL analysis - SWOT - 9 Types of Requirements. (3)

PRODUCT DEVELOPMENT: User requirements - Conceptual Design: Screening - Prototype: Types of prototype and selection process - Develop the product and simulate - Manufacture the product: Conventional vs. Modern Technology - Test the product: Alpha, Beta and Gamma - Launch the product - After Sales - EoL. (5)

INTELLECTUAL RIGHTS: Importance of Intellectual rights - Patent, Copyright, Trademark. (1)

CASE STUDY: Team Project: Demonstrate the NPD process for a given case study. (2)

Total = 15

REFERENCES:

15AF12 CAR DESIGN AND PACKAGING FUNDAMENTALS

History of vehicle architecture in design, Design process overview, Anatomy of the package, Functions & segment, Packaging ideation, Size & proportion, Occupant packaging, Interiors & Cargo, Powertrain, Wheels & Tires, Body, Mobility.

Total L: 15

REFERENCE:

15AF13 AUTOMOTIVE COMMUNICATION PROTOCOLS

Introduction - Local interconnect network - advantages and disadvantages - Controller area network - fundamentals and applications - architecture – CANape- simulator- Flexray – By teflight – Advantages and limitations - Domestic Digital bus

Applications: Body electronics – Infotainment systems – Navigation systems

REFERENCES:
2. Distributed Automotive embedded systems , SAE international ,2007

15AF14 CHALLENGES AND ISSUES IN FUEL CELL TECHNOLOGIES

Overview of Fuel Cells : Fuel cell types - Classification by operating temperature/electrolyte type, Fuel Cell Performance, Activation, Ohmic and Concentration over potential Fuel cell design and components- Cell components, stack components, system components Overview of intermediate/high temperature fuel cells - Solid oxide fuel cells (SOFC), Molten carbonate fuel cells (MCFC), Phosphoric acid fuel cells (PAFC),Polymer Electrolyte fuel cells (PEFC).

Challenges and Issues in Fuel Cells: Heat and mass transfer in polymer electrolyte fuel cells, water management in PEFCs, Current issues in PEFCs Direct methanol fuel cells (DMFC) - Electrochemical kinetics methanol oxidation, Current issues in DMFCs, Fuel crossover in DMFCs, Water management in DMFCs, high methanol concentration operation, limiting current density.

REFERENCES:

15AF15 PRODUCT DEVELOPMENT PRACTICES


REFERENCES:
3. Plastic product development: Plastic materials, Plastic processing, plastic tooling, introduction to Rheology analysis

OFFERED BY THE DEPARTMENT OF HUMANITIES

15OF01 EXPORT - IMPORT MANAGEMENT

INTRODUCTION: Export – Import Business – Preliminaries for starting Export – Import Business Registration. (3)
EXPORT PROCEDURES: Obtaining an Export License – Export Credit Insurance – Procedures and Documentation. (4)
FOREIGN EXCHANGE: Finance for Exports – Pricing - Understanding Foreign Exchange Rates. (3)
IMPORT PROCEDURES: Import Policy – License - Procedure and Documentation. (3)
EXPORT INCENTIVES: Incentives – Institutional Support. (2)

REFERENCES:

15OF02 INSURANCE & RISK MANAGEMENT

INTRODUCTION TO RISK MANAGEMENT: Risk in Our Society. (2)
INSURANCE AND RISK: Client Side – Components of the Costs of Risk. (2)
MASS CONTROL: Insurance Intermediaries – Insurance Companies and their Role in Deducting Business / Role Risks. (4)
FINANCIAL RISKS: Shift of Risks – Risk Derivatives. (3)

REFERENCES:

15OF03 VALUES AND ETHICS AT WORK PLACE

HUMAN VALUES AND ETHOS: Meaning and Significance of Values – Sources of Individual Values - Value crisis in the Contemporary Indian Society – Moral and Ethical Values. (4)
APPLICATION OF VALUES: Relevance of Values in Management – Personal Values and Values at Work place – Values for Managers. (2)
WORK ETHICS: Professional Values & Ethics – Need – Issues – Challenges – Ethical Leadership – Ethical dilemma - Case Study. (4)

SHARED VALUES IN THE ORGANIZATION AND ITS IMPACT: Need to identify and share values – the Value Construct and How to Promote Shared Values. (2)

UNIVERSAL VALUES: Cross Cultural Values - Impact of Culture on Organizations and Managing Workforce Diversity. (3)

REFERENCES:

15OF04 DEVELOPMENT OF INDUSTRIALISATION

EVOLUTION OF MODERN ECONOMY- Colonialism, Capitalism and economic development. (2)
AMERICAN HISTORY- Before and After European arrival. (4)
ROLE SLAVERY and trade in America. (4)
INDIAN ECONOMY – Pre and Post Independence, (3)
INDUSTRIALIZATION IN ASIA AND AFRICA – Colonialism – anti-colonialism and Socialism. (2)

REFERENCES:

15OF05 CREATIVITY AND SOCIAL ENTERPRISE

CREATIVITY- Understanding the creative skills (2)
WAYS TO IMPROVE creativity and exercises. (4)
INNOVATION – Process of Innovating new ideas - Importance of Innovation. (4)
ENTREPRENEURIAL skills and development – Intrapreneurship. (3)
SOCIAL ENTREPRENEUR and social enterprise – success stories of entrepreneurs – Leadership styles adopted by successful entrepreneurs. (2)

REFERENCES:

15OF06 SOCIAL AND PSYCHOLOGICAL WELL BEING

DEFINING SOCIAL PSYCHOLOGY and social influences on behavior. (2)
ANALYSIS OF SOCIAL and psychological problems and the solutions to address social problems. (4)
ROLE OF SPORTS AND GAMES, yoga practices, tracking and outdoor activities in addressing social and psychological problems. (4)
ORIGINS OF PSYCHOLOGICAL DISORDER – roots of social anxiety - prevention of psychological disorders. (3)
NATURE OF INTERVENTIONS – Evaluation of Interventions and implementing the interventions. (2)

REFERENCES:

15OF13 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

INVESTMENTS ENVIRONMENT: Classification - Financial Instruments – Security Trading. (2)

TYPES OF SECURITY: Trading – Orders, Margin Trading – Clearing and Settlement Procedures. (5)

SECURITY ANALYSIS: Industry Analysis – Company Analysis. (4)

PORTFOLIO: Measuring Risk and Returns and Treatment in Portfolio Management. (4)

REFERENCES:

15OF14 IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM

INTRODUCTION – Need for Quality – Definitions of Quality – Dimensions of Product and Service Quality – Basic Concept of TQM – Contributions of Deming, Juran and Crosby – Barriers to TQM. (2)


REFERENCES:

15OF15 FINANCIAL MANAGEMENT

INTRODUCTION: Meaning of finance - Definition of financial management - Scope of Financial Management - Functions of Financial Manager. (2)

OBJECTIVE OF FINANCIAL MANAGEMENT: Profit Maximization and Wealth Maximization. (4)

CAPITAL STRUCTURE: Designing of Capital Structure - Profitability and Liquidity Aspects. (4)

DIVIDEND POLICY: Determinants of Dividends- Bonus share – Tax aspects. (3)
CORPORATE RESTRUCTURING: Merger and Acquisition (M&A) - Case Studies.  

REFERENCES:

15OF16 PERSONALITY DEVELOPMENT THROUGH TRANSACTIONAL ANALYSIS  

EXPLORING THE PERSONALITY - Structural Ego states - Functional Ego states. 

REFERENCES:

OFFERED BY THE DEPARTMENT OF ENGLISH  

15OF10 CORPORATE COMMUNICATION  


ORAL COMMUNICATION: Communicating in Organizational Settings - Recognizing effective Communication - Mastering Listening and Nonverbal Communication Skills - Overcoming Barriers to Communication - Communicating in Teams and adapting to Cross Cultural Communication contexts.

WRITTEN COMMUNICATION: Planning, Writing, and completing business messages - Writing messages for Electronic Media - Creating effective E-mail messages - Writing routine and positive and negative messages - Writing persuasive messages – Training on writing Reports and proposals – Mastering the Format and layout of Business Documents.

REFERENCES:
15OF11 - INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

UNDERSTANDING ORGANIZATIONAL COMMUNICATION: Communication Networks in an Organization; Intra-organizational communication; Inter-organizational communication; Flow Nomenclature; Workplace diversity and intercultural aspects of communication (4)

COMMUNICATION FUNCTIONS IN ORGANIZATIONS: Teamwork and team dynamics; Conflict resolution strategies and styles; Leading and influencing others-facilitation skills (3)

WRITTEN COMMUNICATION: Email Writing, Professional Reports, and Memos (4)

INTERPERSONAL SKILLS: Nature and Dimensions of Interpersonal Communication; Personality and Communication styles; Active listening and intentional responding; Working with emotional intelligence (4)

REFERENCES:

Total L:15

15OF12 – HUMAN VALUES THROUGH LITERATURE


DRAMA: Karnad, Girish, Tughlaq – Statesmanship and friendship (3)

ONE-ACT PLAY: Chekhov, Anton. The Bear – Love (1)

SHORT STORY: Maugham, Somerset. “Mr. Know-All” – Empathy, Desai, Anita. “Devoted Son” – Family Bond. (2)

NOVEL: Murthy, Sudha. Gently Falls the Bakula – Gender equality (2)

REFERENCES:
3. Additional readings on individual texts

Total L: 15 hrs

OFFERED BY THE DEPARTMENT OF MATHEMATICS

15OF21 PRINCIPLES OF BUSINESS ANALYTICS

PREDICTIVE ANALYTICS: CLASSIFICATION AND DISCRETE CHOICE PROBLEMS: Simple linear regression - multiple linear regression model development and diagnostics - analysis of transactional data using binary logistic and multinomial logistic regression models - discrete choice models, non-linear regression. Classification Trees, Classification and Regression Tree (CART) - forecasting. (5)

PREDICTIVE ANALYTICS: MARKETING, RETAIL AND OPERATIONS ANALYTICS: Markov chain models in marketing: Modelling customer relationship as a Markov chain - brand switching - market share estimation - Markov model for customer retention - Customer Lifetime Value (CLV) estimation. (5)

PRESCRIPTIVE ANALYTICS: Multi-criteria decision making - analytic hierarchy process - data envelopment analysis and their applications in operations - marketing and finance. Six sigma methodologies for problem solving: DMAIC methodology for problem solving and process improvement - DMADV methodology for design and development of new process. (5)

REFERENCES:

Total L: 15