SEMESTER I

15P101 CALCULUS AND ITS APPLICATIONS

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


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


Total L: 45

TEXT BOOKS:

REFERENCES:

15P104 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. (4+4)

FILES: Need for files – Operations on files - Sequential and Random access file functions - File Handling Functions - Error handling functions. (2+2)

Preprocessor Directives - Command Line Arguments. (2+2)

Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:

15P105 ENGINEERING METALLURGY

CRYSTAL STRUCTURE: Amorphous and Crystalline materials, unit cell, lattice, crystal systems, SC, BCC, FCC and HCP structures, Packing Factor, miller indices, crystallographic planes and directions, crystal imperfections – classification, single crystals, polycrystalline materials, isotropy. (7)

CONSTITUTION OF ALLOYS: Definition of alloy & alloy system, classification of alloys, characteristics of pure metals, compounds and solid solutions. (2)

PHASE DIAGRAMS: Need for phase diagrams, Binary phase diagrams - Isomorphous, eutectic and eutectoid systems, Interpretation of phase diagrams, Iron - Iron carbide equilibrium diagram. (8)


PLASTIC DEFORMATION AND FRACTURE: Importance of plastic deformation, mechanism of plastic deformation – slip, condition for slip, Schmid factor, twinning. Fracture – definition, types and their characteristics. (5)

MECHANICAL PROPERTIES AND TESTING: Introduction to mechanical properties - examples, tensile, hardness, impact, fatigue and creep testing – description of testing and physical interpretation of properties. (5)

FERROUS MATERIALS: Classification of ferrous alloys, low, medium and high - carbon steels - properties and applications, stainless steels, tool steels, effect of alloying additions in steel. Gray, white, malleable and ductile irons – properties and applications. (5)

NON-FERROUS MATERIALS: Copper, Aluminium, Nickel, Magnesium, Titanium, Lead and Tin alloys – composition, properties and applications. (4)

Total L: 45

TEXT BOOKS:

REFERENCES:

15C104 ENGLISH LANGUAGE PROFICIENCY

LEARNING LANGUAGE THROUGH STANDARD LITERARY AND GENERAL TEXTS: Integrated Tasks focusing on Language Skills – Training based on Text based Vocabulary, tone, register and Syntax features. (12)
**GRAMMAR IN CONTEXT:** Word Order – Subject Verb Concord – Style features – Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals and Transformation of Sentences.

**GUIDELINES FOR WRITTEN COMMUNICATION:** Principles of Clear Writing - Paragraph Writing – Essay Writing – Emphasis Techniques – Summarizing and Paraphrasing – Analytical Writing – Letter Writing

**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:**

**15P110 ENGINEERING GRAPHICS - I**

**INTRODUCTION:** Introduction to Engineering Drawing - Bureau of Indian Standards (BIS), Drawing Instruments, Types of Lines and Lettering - Methods of dimensioning - Geometrical constructions - Free hand sketching.

**CONIC SECTIONS AND SPECIAL CURVES:** Construction of ellipse, parabola, cycloid and involutes.

**ORTHOGRAPHIC PROJECTION:** Principles of orthographic projection, Projection of Points, Lines, Planes and Solids. Orthographic projection of simple engineering components-missing view exercises

**TEXT BOOKS:**

**REFERENCES:**

**15P111 PHYSICS LABORATORY I**

**LIST OF EXPERIMENTS:**
1. Determination of Young’s modulus of a wooden bar – Cantilever 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.

15P113 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

REFERENCES:
1. Laboratory manual prepared by Mechanical Department, 2010.

SEMESTER II

15P201 COMPLEX VARIABLES AND TRANSFORMS

COMPLEX VARIABLES: Complex differentiation-Analytic function, Cauchy Riemann equations, harmonic functions. (6+4)

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. (8+5)

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. (12+9)

FOURIER ANALYSIS: Fourier series - functions of any period 2L, half range expansions. Fourier transforms, Fourier cosine and sine transforms. (9+6)

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. (10+6)

TEXT BOOKS:

Total L: 45 + T: 30 = 75
REFERENCES:

15P202 MATERIALS SCIENCE


Total L: 45

TEXT BOOKS:

REFERENCES:

15P203 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.

TEXT BOOKS:

REFERENCES:

15P204 ENGINEERING MECHANICS

STATICS OF PARTICLES: Forces – Systems of forces - Concurrent forces in plane and space-Resultant - Problems involving the equilibrium of a particle-free body diagram-equilibrium of particle in space. (6+4)

STATICS OF RIGID BODIES IN TWO DIMENSIONS: Rigid bodies - Two dimensional structure-moment of force about an axis - moment of a couple - equivalent systems of coplanar forces - Rigid body in equilibrium - Problems involving equilibrium of rigid body - types of supports - reactions of beams and frames. (6+4)


ANALYSIS OF TRUSSES: Roof trusses - Method of joints - Method of sections. (6+4)

CENTROID AND MOMENT OF INERTIA: Centroids of areas, composite areas, determination of moment of inertia of plane figures, polar moment of inertia-radius of gyration – centre of gravity and mass moment of inertia of simple solids. (6+4)

KINEMATICS OF PARTICLES: Introduction-plane, rectilinear motion-time dependent motion-rectangular coordinates - projectile motion. (6+4)


Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

15P205 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING


ELECTRONIC DEVICES: Operation of PN junction diodes, VI characteristics, zener diode, BJT-types - CB, CE, CC configurations, input and output characteristics, difference between FET and BJT, MOSFET- types, principle of operation and characteristics. Opto-Electronic Devices-Introduction, types, photo- conductive, photo diode, phototransistor, Light emitting diode - Principles and Applications. (7)
ELECTRONIC CIRCUITS: (Qualitative analysis only) Half wave and full wave rectifier, capacitive filters, inductor filter, zener voltage regulator, RC-coupled amplifier, RC phase shift oscillator.

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.

DIGITAL ELECTRONICS: Number systems- representation of signed numbers: 1’s complement and 2’s complement, logic gates, Boolean Algebra, Half & full - Adder, Subtractor, JK Flip flops, Multiplexer, Asynchronous Modulo-16 counter and Shift register.

TEXT BOOKS:

REFERENCES:

Total L: 45

15P210 ENGINEERING GRAPHICS II

PICTORIAL PROJECTION: Principles of isometric Projection, conversion of isometric view to orthographic view and orthographic view to isometric view.

SECTION OF SOLIDS: Type of sections, section of regular solids and engineering components.

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

PERSPECTIVE PROJECTION: Principles of perspective projection - visual ray method.

INTRODUCTION TO COMPUTER GRAPHICS: 2D and 3D part modeling, extraction of 2D views.

TEXT BOOKS:

REFERENCES:

Total P: 60

15P211 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. Department of Physics, “Physics Practicals”, PSG College of Technology 2015.

Total P: 30
15P212 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.

SUMMER TERM

15P215 PROFESSIONAL SKILLS

UNIT I A: HISTORICAL PERSPECTIVE OF MANUFACTURING ENGINEERING: Industrial revolution, purpose and evolution of production engineering, conscious design & manufacturing, economics - time and cost analysis. (L: 4)

UNIT IB: TRAINING IN CAD PACKAGE: Solid modeling and assembly practice, Extraction of 2D view from 3D modeling, Coloring and shading of 3D models. (L: 8 P: 20)

UNIT II: SEMINAR PRESENTATION AND TECHNICAL REPORT WRITING

WRITING COHERENT PROJECT REPORT: Overview structure of reports, gathering information - synopsis / abstract - title - headings – table of contents – list of figures – list of tables – list of appendices – chapters – structured paragraphs – inferences, conclusions – figures – tables – flow charts – complete design (headers and footers).-plagiarism -Intellectual Property Rights. Each student will be required to submit a technical report based on the guidelines provided by the department. (L: 8 P: 8)

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. (P: 12)

REFERENCES:
3. Manuals prepared by CAD/CAM centre, PSG College of Technology.

15P216 INPLANT TRAINING & TECHNICAL SEMINAR

1. Factory layout, Organization structure, various departments.
2. Study of Broaching machine – Construction, mechanism of working.
5. Study of Pressure die casting process.
7. Study of Motor Assembly.
8. Study of Lathe Assembly.
9. Study of Electro Discharge Machining and die making.
10. Visit to Foundry Division.
11. Visit to TIFAC – CORE.
12. Visit to Nano Technology Laboratory.

Note: Students will make presentations on the details of activities carried out during InPlant Training in the presence of a committee of faculty members every week. At the end of InPlant Training, a comprehensive report will be submitted by the students for assessment.

REFERENCE:
1. Manuals prepared by Training Department, PSGII.
SEMESTER III
15A301/15C301/15M301/15Y301/15P301 NUMERICAL METHODS

ERRORS: Approximations and round-off errors - truncation errors. (2+1)


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 – Liebmann 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:

15P302 STRENGTH OF MATERIALS

STRESSES AND STRAINS: Normal Stress and strain, stress-strain diagram of Ductile and Brittle materials, Hooke’s Law, Poisson’s Ratio, shear stress-strain and proof resilience, factor of safety, thermal stress, volumetric strain, relationship between elastic constants. (6+4)

AXIALLY LOADED MEMBERS: Change in dimensions of axially loaded members, stress in stepped bars, uniformly varying sections and composite bar. Strain Energy due to axial force, stresses due to gradual load, sudden load and impact load. Hoop and Longitudinal stresses in thin cylindrical and spherical shells under internal pressure. (8+4)

SHEAR FORCE AND BENDING MOMENT: Relationship between load, shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads - maximum bending moment and point of contra flexure. (7+6)

FLEXURE IN BEAMS: Theory of simple bending and assumptions - flexure equation, section modulus, normal stresses due to flexure. (6+4)

TORSION: Theory of torsion and assumptions - torsion equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft. (5+4)

PRINCIPAL STRESSES AND PLANES: (Two dimensional only) State of stress at a point - normal and tangential stresses on a given plane, principal stresses and their planes, plane of maximum shear stress, analytical method - Mohr’s circle method, application to simple problems. (7+4)

DEFLECTION OF DETERMINATE BEAMS: Governing differential equation - Macaulay’s method - moment area method, application to simple problems (cantilever beams and simply supported beams only). (6+4)

Total L: 45 + T: 30 = 75

TEXT BOOKS:
REFERENCES:

15P303 FLUID MECHANICS AND MACHINERY

INTRODUCTION: Properties of fluids. Concept of gauge and absolute pressures. Measurement of pressure using manometers of different types. Types of flow - laminar, turbulent, unsteady, steady, non-uniform and uniform flows. Stream line, streak line and path line. (5+3)

IDEAL FLOW: Irrotational and rotational, stream function, potential function, continuity equation, derivation of three dimensional equations. (6+4)

FLUID DYNAMICS: Control volume concept - statement of Navier Stokes equation, derivation of Bernoulli’s equation, Navier stokes equation and Euler’s equation, derivation of energy equation and examples illustrating the use of energy equations. (10+7)

BOUNDARY LAYER THEORY: Development of boundary layer, boundary layer equations, Blasius solution, integral momentum equation, drag on a flat plate, boundary layer separation and its control, streamlined and bluff bodies - flow around circular bodies and aero foils. (10+6)

DIMENSIONAL ANALYSIS AND MODEL TESTING: Buckingham’s \( \pi \) theorem, Reynolds, Froude and Mach number and their application in model testing. (4+3)

FLOW THROUGH PIPES: Friction loss calculation, Darcy-Weisbach equation, use of Moody diagram, minor losses, design and layout of piping. (6+4)

HYDRAULIC TURBINES: Impact of jets, force on blades - plane and curved - Pelton wheel, Francis turbine, Kaplan turbine, cavitation in turbines, performance characteristics of various turbines. (4+3)

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

15P304 WELDING TECHNOLOGY

INTRODUCTION: Comparison between casting and welding processes, definition of welding as per AWS, Classifications of welding, advantages and disadvantages. Basic welding positions, types of weld and joints. (5)

GAS AND ARC WELDING: Gas welding, principle and equipment, applications and selection, arc welding, principle, electrodes, energy source characteristics. (4)

SPECIAL WELDING PROCESSES (FUSION): TIG and MIG welding processes, Carbon arc welding and Atomic Hydrogen welding, stud welding, thermit welding, discussion on ESW, PAW, LBW, EBW, applications and selection. (8)

SPECIAL WELDING PROCESSES (NON-FUSION): Resistance welding, friction and ultrasonic welding, diffusion welding, explosion welding, forge welding, FSW – applications and selection. (7)

WELDING METALLURGY: Definition, heat affected zone (HAZ), temperature distribution in welding, pre and post heat treatment, weld decay, weldability of steel, Cast Iron, Aluminum alloys. (5)

INSPECTION AND TESTING OF WELDMENTS: Welding defects, remedies, destructive test methods, NDT of weldments. (4)

DESIGN OF WELDED JOINTS: Basic principles, weld symbols, welding procedure specifications (WPS), residual stresses and distortion, design of weldments, Cost estimation in welding. (6)
AUTOMATION AND CAE IN WELDING: Automation in welding – seam tracking and arc sensing – welding robots. Applications of CAE in modeling welding processes and temperature distributions.

Total L: 45

TEXT BOOKS:

REFERENCES:

15P305 MACHINING TECHNOLOGY

INTRODUCTION: Overview of manufacturing, materials in manufacturing, manufacturing processes and production systems.

THEORY OF METAL MACHINING: Theory of chip formation in metal machining – concept of orthogonal and oblique cutting, force relationship and the merchant equation, power and energy relationship in machining, cutting temperature.

MACHINING OPERATIONS AND MACHINE TOOLS: Turning and related operations, drilling and related operations, milling, machining centres and turning centres, other machining operations - shaping, planing, broaching, high speed machining.

CUTTING TOOL TECHNOLOGY: Tool wear, tool life and Taylor tool life equation, tool materials – HSS, cemented carbides, coated carbides, cermets, ceramics, diamond, cubic boron nitride, manufacturing of cutting tools, tool geometry, cutting fluids.

SELECTION OF CUTTING CONDITIONS: Machinability, tolerance and surface finish, selecting feed and depth of cut, optimizing cutting speed, product design considerations in machining.

GRINDING AND OTHER ABRASIVE PROCESSES: Grinding – cylindrical, surface, profile, grinding wheel, analysis of grinding process, related abrasive processes – honing, lapping, superfinishing, polishing and buffing.

Total L: 45

TEXT BOOKS:

REFERENCES:

15C070 ECONOMICS FOR ENGINEERS

INTRODUCTION: Definition – Nature and Scope - Significance of Economics for Engineers.


TEXT BOOKS:

REFERENCES:

15P310 MACHINE DRAWING

INTRODUCTION: Introduction to machine drawing. Types and importance of sectional views, solid modeling and sectioning of mechanical elements. (12)

CONVENTIONS: Code of practice for engineering drawing, conventional representation of details – drilled, tapped, countersunk and counter bored holes, internal and external threads. Conventions to represent standard components - bolt, nuts, washers, screws, cotters, pins, keys, circlips, bearings, gears, springs and flanges. (12)

LIMITS, FITS AND TOLERANCES: Limits, fits and tolerances - types, representation of tolerances on drawing, calculation of minimum and maximum clearances and allowances. Geometric tolerance - uses, types of form and position tolerances, symbols, method of indicating geometric tolerances on part drawings. Surface finish symbols - methods of indicating the surface roughness. (12)

ASSEMBLY USING SOLID MODELING: Introduction - methods and concepts of assemblies, assembly requirements, importance of bill of materials. Solid modeling - Commands used for modeling and assembly of components using Pro/E, creation of bill of materials and balloons, extraction of 2D views and sections. (12)

PRACTICE SESSION: Various views of the assemblies of following components – Flange coupling, cotter joints, knuckle joint, screw jack, universal coupling, pipe vice and plummer block in drawing sheet and using CAD software. (12)

TEXT BOOKS:

REFERENCES:

15P311 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

1. Verification of Ohm’s law and Kirchoff’s laws.
3. Mechanical Characteristics of DC Shunt 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. Application of Transistor as an amplifier and a switch
8. Applications of Operational Amplifier: Adder, Integrator
9. Study of logic gates and implementation of binary adder
10. Implementation of Modulo-16 Counter

TOTAL P: 30

REFERENCE:
1. Laboratory Manual Prepared by the Electrical and Electronics Engineering Department.
METALLURGY AND STRENGTH OF MATERIALS LABORATORY

METALLURGY LABORATORY
1. a) Study of Metallurgical Microscope.
   b) Specimen preparation for metallographic studies.
2. Microstructural Study of etched Grey cast iron, SG iron and malleable cast iron.
3. Microstructural Study of low, medium and high carbon steels.

STRENGTH OF MATERIALS LABORATORY
5. Torsion Test on Beams: Torque and angle of twist characteristics, shear stress, modulus of rigidity – strain energy.
6. Deflection Test on Beams: Load deformation characteristics, Young’s Modulus, Maxwell’s Reciprocal law verification.
7. Shear Test on Metals: Direct Shear Strength - Single Shear and Double Shear.

REFERENCES:
1. Laboratory Manual prepared by the Department of Civil Engineering and Department of Metallurgical Engineering,

SEMESTER IV

15A401/15C401/15M401/15Y401/15P401 PROBABILITY AND STATISTICS

PROBABILITY: Sample spaces and events, interpretations of probability, addition rule, conditional probability, multiplication and total probability rules, independence, Baye’s theorem. (4+4)

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. (6+6)

JOINT PROBABILITY DISTRIBUTIONS: Two dimensional discrete and continuous random variables, marginal and conditional probability distributions, independence, covariance, correlation and linear regression. (8+6)

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. (4+4)

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. (5+6)

ANALYSIS OF VARIANCE: Introduction, assumptions of analysis of variance, completely randomized design, randomized block design, Latin square design. (3+4)

Total L: 30 + T: 30 = 60

TEXT BOOKS:

REFERENCES:
15P402 MEASUREMENT SYSTEMS

INTRODUCTION: Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Static and Dynamic performance characteristics, sources of error, Classification and elimination of error. (6)

DISPLACEMENT AND MOTION MEASUREMENT: Transducers, resistive potentiometers, resistance strain gauge, linear variable differential transformer, variable inductance and variable reluctance pickups, capacitive pickups, eddy current non contacting transducers, piezoelectric transducers, ultrasonic transducers, linear and rotary encoders, linear and angular velocity measurements, seismic motion transducers, seismic instrument for vibrational displacement and velocity, seismic accelerometer, piezoelectric accelerometers. (10)

FORCE AND TORQUE MEASUREMENT: Measuring methods, elastic transducers, strain gauge load cells, piezoelectric load cells, hydraulic and pneumatic systems, torque measurement by mechanical, hydraulic and electric dynamometers, transmission dynamometers. (7)

TEMPERATURE MEASUREMENT: Liquid-in-glass thermometers, bi-metal temperature sensing elements, thermistors, thermocouples, RTD and thermopiles, Pyrometry – Optical and total radiation pyrometer, Infrared thermography, calibration of temperature measuring devices. (7)

FLOW MEASUREMENT: Variable area meter, turbine type meter, magnetic flow meter, pulse producing methods, pressure probes, Anemometry. (7)

PRESSURE MEASUREMENT: Static and dynamic pressures, elastic transducers, secondary transducers used with elastic transducers, strain gauge pressure cells, high pressure measurement gauges, low pressure measurement. (8)

TEXT BOOKS:

REFERENCES:

Total L: 45

15P403 THERMAL SYSTEMS AND HEAT TRANSFER

THERMODYNAMICS: Introduction to thermal systems - Zeroth law, first and second laws of thermodynamics, applications, steady flow energy equation, ideal gas processes - calculation for work done, heat transfer and entropy changes, Carnot cycle. (13+10)

POWER PLANTS: Otto, diesel cycles, Rankine cycle, Steam power plant, Brayton cycle, gas turbine power plant, cogeneration and combined cycle power plants – energy conservation and energy audit. (12+8)

IC ENGINES: Principles of operation, valve and port timing diagrams, indicator diagrams, carburetors, diesel fuel pump and injector, need for cooling and lubrication of IC engines, conventional and electronic ignition systems, calculation of fuel consumption, mechanical, brake, thermal and indicated thermal efficiencies, heat balance performances characteristics. (12+8)

HEAT TRANSFER: Heat conduction through planes, cylinder and spherical geometry, transient conduction, critical thickness of insulation, natural and forced convection, empirical relations for heat transfer coefficients - heat transfer analysis in manufacturing processes. (8+4)

TEXT BOOKS:

REFERENCES:

Total L: 45 + T: 30 = 75
15P404 MECHANICS OF MACHINES

BASICS OF MECHANISMS: Terminology and definitions, degrees of freedom, Grashof’s Law. Kinematic inversions – 4 - bar chain, single slider crank chain, double slider crank chain, Mechanical advantage, Transmission angle. Description of common mechanisms, applications of mechanisms. (5+3)

KINEMATICS: Displacement, velocity and acceleration analysis of simple mechanisms using graphical method. (6+3)

KINEMATICS OF CAM: Classifications, displacement diagrams – parabolic, uniform velocity, simple harmonic paths. Layout of plate cam profiles for different types of followers - knife edged and roller. (6+4)

GEARS: Spur gear terminology and definitions – fundamental law of toothed gearing and tooth forms. Interchangeable gears, gear tooth action – interference, pressure angle and undercutting - Types of gears. (5+4)

STATIC AND DYNAMIC FORCE ANALYSIS OF SIMPLE MECHANISMS: Free body diagram – conditions of equilibrium, two, three and four force members, Inertia force and D Alembert’s principle- Dynamic force analysis of simple mechanisms. (6+4)

FLYWHEEL: Turning moment diagram – fluctuation of energy and speed, weight of flywheel required. (5+3)

BALANCING: Balancing of revolving in single plane and several planes – balancing of reciprocating masses - primary and secondary forces and couples, balancing of multi-cylinder inline engine. (5+4)

VIBRATION: Basic features of vibratory systems, degrees of freedom, single degree of freedom system – equation of motion for undamped and damped free vibration, and forced vibration, amplitude of forced vibration. (7+5)

Total L: 45 + T: 30 = 75

TEXT BOOKS:

REFERENCES:

15P405 FOUNDRY TECHNOLOGY

INTRODUCTION: Introduction to metal casting, advantages and limitations of casting process. (1)

 PATTERNS: Pattern and Core box - types and materials, requirements of good pattern equipment. Importance of pattern and core on quality and economy of the castings. (6)

 MOULDING AND COREMAKING: Foundry moulding sand-constituents and characteristics, preparation and properties of moulding sand. Moulding methods and Techniques. Coresand – Preparation, coremaking techniques, core inspection and finishing operations, core setting. (7)

 MELTING: Selection of furnace for a melting application, Types of furnaces – description, advantages and limitations, melting practices. (4)

 GATING: Elements of a gating system, types of gates – applications, advantages and limitations, classification of gating systems, hydraulic and design of gating systems, influence of gating design on casting quality. (7)

 SOLIDIFICATION AND RISERING OF CASTINGS: Solidification of pure metal and alloys, need and functions of a riser, approaches to risering – Caine, NRL, modulus and VEM approaches, risering aids. (5)

 FINISHING AND INSPECTION OF CASTINGS: Various finishing operations on castings, NDT of castings. (3)

 SOME POPULAR CASTING PROCESSES: Shell Moulding, Investment casting, Die-casting, Centrifugal casting - Characteristics, capabilities, advantages and limitations. (3)

 ALLOYS HANDLED BY FOUNDRIES: Discussion on foundry practices for cast iron, steel, SG iron and aluminum alloys. (6)
INTRODUCTION TO CASTING SIMULATION: Need for casting simulation, inputs required for simulation and simulation output – simple case studies.

TEXT BOOKS:

REFERENCES:

15P410 THERMAL ENGINEERING AND FLUID MACHINERY LABORATORY

1. Experimental study on valve timing diagram in 4-stroke engine cut model and experimental study on port timing diagram in 2-stroke engine cut model.
2. Heat balance test on 4-stroke diesel engine.
3. Performance test and determination of air fuel mixture on a variable speed diesel engine.
4. Determination of drag and lift co-efficient using wind tunnel.
5. Performance test on reciprocating compressor.
6. Performance study on axial flow fan.
10. Performance test on centrifugal pump.

REFERENCES:
1. Laboratory Manual prepared by the Department of Mechanical Engineering, 2012.

15P411 MACHINING TECHNOLOGY LABORATORY

1. Study of construction features of Lathe – Head stock, tail stock, carriage, apron gear box.
2. Exercise in lathe - Facing, chamfering and step turning
3. Exercise in lathe - Taper turning
4. Exercise in lathe - knurling and drilling
5. Exercise in lathe - Grooving, Thread cutting
6. Drilling, counter boring, counter sinking and tapping exercise
7. Exercise in milling machine
8. Gear cutting exercise using Gear Hobbing Machine
9. Keyway slotting exercise
10. Exercise in shaping machine

REFERENCES:
1. Laboratory Manual prepared by Department of Mechanical Engineering, 2012.

SEMESTER V

15P501 STATISTICAL QUALITY CONTROL

BASIC STATISTICS FOR QUALITY CONTROL: Introduction to quality, definition of quality, measures of location and dispersion, statistics and parameters, causes of variation and their characteristics, constant and variable system of chance causes, patterns of variation.

CONTROL CHART FUNDAMENTALS AND APPLICATIONS: Variables and attributes, defects and defectives, statistical basis of the control chart, purpose of control charting, anatomy of a control chart, two types of errors, rational subgrouping, sensitizing rules, guidelines for implementing control charts, control chart for mass production - X Bar and R, X Bar and s, X-MR chart, control chart for short production runs, control chart for tool wear monitoring, control chart for attributes, effect of variable sample size, use of software.
REGRESSION: Definition, need for regression, Simple linear probabilistic model for regression, assumptions, method of least squares, estimation of constants, ANOVA for linear regression, testing the usefulness of the model, coefficient of determination, checking the assumptions, multiple regression – general linear model and assumptions, ANOVA for multiple regression, interpretation of results, polynomial regression, limitations of regression, use of software. (10)

ACCEPTANCE SAMPLING: Single Sampling, Double Sampling, Multiple Sampling, Sequential Sampling, use of Dodge-Romig Tables in sampling inspection. (10)

DESIGN AND ANALYSIS OF EXPERIMENTS: Classical design of experiments – Single Factor Experiment, Multiple Factor Experiment, Randomized Block design, Latin Square Design, analysis of experimental results. Taguchi Design of Experiments – planning, analysis and conducting phases, analysis and interpretation of experimental results – case studies, use of software. (10)

TEXT BOOKS:

REFERENCES:
LINEAR AND ANGULAR MEASUREMENTS: Length standard, Line and end standard, slip gauges, assembling slip gauge stacks, micrometers, verniers, dial gauges. Comparators, types, principle and applications. Angular measuring instruments - Sine bar, angle gauges, autocollimator, angle dekker, tool maker’s microscope.

SURFACE METROLOGY: Sources of surface irregularity in manufacturing, functional significance of surfaces, elements of surface texture and surface integrity, surface roughness parameters and their measurements. Measurement of geometric forms, straightness, flatness and roundness.

DESIGN OF LIMIT GAUGES: Limit gauge types, principles of limit system, Taylor’s principle of gauge design, design of limit gauges.

LASER METROLOGY: Interference of light rays, applications of laser interferometer, flatness interferometer, calibration of gauges by interference methods, testing of machine tools using laser interferometer.

THREAD AND GEAR MEASUREMENT: Standard thread profiles, measurement of major, minor and effective diameter, 3 wire method and best wire size, gear tooth profile measurement, run out and composite error measurement, gear pitch measurements.

ADVANCES IN METROLOGY: Co-ordinate measuring machine, constructional features, types, applications of CMM. Machine Vision system, applications in metrology. Introduction to Nanometrology.

TEXT BOOKS:

REFERENCES:

15P504 METAL FORMING PROCESSES


FORGING: Classification of forging process – Hand forging equipments and operations – Types of presses and hammers - Analysis of plane strain and axisymmetric forging problems – Forging defects, causes and remedies.


EXTRUSION: Classifications of extrusion process and equipments - Analysis of extrusion process - Production of seamless pipes - Extrusion defects, causes and remedies.

DRAWING: Methods of drawing, preparation of metals for drawing process - Analysis of rod and tube drawing processes.


SPECIAL FORMING METHODS: Explosive forming, electromagnetic forming, electro hydraulic forming, High velocity forming – petro forge hammer and dynapak process - Super plastic forming.

POWDER METALLURGY: Production of metal powders, powder characteristics, Process fundamentals - powder blending, compacting, sintering and secondary operations. P/M product design, recent trends and special P/M processes.

TEXT BOOKS:

REFERENCES:

STATIC FAILURE THEORIES: Failure of ductile materials under static loading – distortion energy theory, maximum shear stress theory maximum normal stress theory; failure of brittle materials under static loading – Coulomb-Mohr theory, modified – Mohr theory. 


DESIGN OF SHAFTS AND COUPLINGS: Forces on shafts due to gears, belts and chains, estimation of shaft size based on strength stiffness. couplings, types and applications, rigid couplings and flexible flange couplings. 

SPRINGS: Spring configurations spring rate, spring materials, helical compression springs, end details, active coils, spring index, stresses in helical compression spring, buckling, design for static and fatigue loading. 

WELDED JOINTS: Types of welded joints, weld symbols, strength of welds, centrally loaded, unsymmetrical sections, axially loaded and eccentrically loaded joints. 

BEARING SELECTION: 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). Hydrodynamic bearings - (theory, applications, advantages and limitations), Sommerfield number, dimensionless parameters, optimum bearings, newer bearing materials, design of hydrodynamic bearings. hydrostatic bearings (qualitative treatment only). 


15P510 MANUFACTURING TECHNOLOGY LABORATORY 

1. Linear, circular interpolation - Face and End milling exercise using CNC Machine 
2. Exercise on Surface Grinding 
3. Exercise in Lapping – Hand and Machine Lapping 
4. Exercise in Honing 
5. Measurement of cutting forces using dynamometers 
6. Plastic Injection Molding Exercise 
7. Rapid Prototyping 
8. Exercise on metal forming - Hydraulic Press 
9. Wear analysis using Pin-On-Disc method 
10. Exercise using Tool and Cutter Grinder 
11. Demonstration of Ultrasonic Welding – Plastic and Metal welding 
12. Demonstration of TIG Welding 

Total P: 60 


15P511 METROLOGY AND COMPUTER AIDED INSPECTION LABORATORY 

1. Calibration of Vernier caliper, Micrometer and Dial gauge. 

Total P: 60
5. Gear metrology: Base tangent measurement and gear composite error measurement.
7. a) Surface finish measurement using electronic surface roughness tester.
   b) Form measurements: Measurement of straightness, flatness, circularity and cylindricity.
8. Straightness measurement using autocollimator.
10. Measurement of part dimensions using machine vision system.

REFERENCES:
1. Laboratory Manual prepared by Department of Production Engineering.

SEMESTER VI
15P601 OPERATIONS RESEARCH


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. (8)

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. (9)

REPLACEMENT THEORY: Replacement of items that deteriorate, replacement of items that fail, group replacement. (7)

TEXT BOOKS:

REFERENCES:

15P602 JIGS, FIXTURES AND DIE DESIGN

PRINCIPLES OF LOCATING AND CLAMPING ELEMENTS: Principles of location, Planes of movement, Locating from a flat surface, Locating from a internal diameter, Locating from a external diameter, Locating from external profile, Ejectors, Spring stop buttons, Types of clamps. (5+3)

DESIGN OF JIGS: Drill bush – Types of bushings, Types of jigs- plate, latch, channel, box, angle plate, angular post, turnover, pot, trunnion, pump, rack and pinion operated jig and air operated jig, Design and development of jig for given component. (6+7)

DESIGN OF FIXTURES: Types of fixtures - Milling, Lathe, Boring, Broaching, Grinding fixtures, Welding fixtures and Modular fixtures, Design and development of fixture for given component. (5+4)


DESIGN OF PLASTIC INJECTION MOULDS: Mould elements and mould construction. Types of mould - two plate mould, three plate mold Feed system, Ejection system, Cooling system, Mould materials and Mould manufacturing. (6+8)

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

REFERENCES:

15P603 DESIGN FOR MANUFACTURE AND ASSEMBLY

DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS: DFM approach, DFM guidelines, standardisation, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka - Yoke principle; 6n concept.

TOLERANCE ANALYSIS: Cumulative effect of tolerances, sure fit law, normal law and truncated normal law, obtainable tolerances in axial dimensions for various machining operations, Process capability, process capability metrics, $C_p$, $C_{pk}$, cost aspects, feature tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process.


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, model-III, control of axial play-introducing secondary machining operations, laminated shims, examples.

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.

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, design of weldments.

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

DESIGN FOR MACHINING: Design features to facilitate machining, datum features - functional and manufacturing, component design-machining considerations, redesign for manufacture, examples.

TEXT BOOKS:

REFERENCES:

15P604 COMPUTER NUMERICAL CONTROL MACHINES

INTRODUCTION: Types of CNC machines - general purpose - special purpose, multitask machines, construction / operation, machine specification.


CUTTING TOOLS: Cutting tools for turning, milling, drilling, types, insert, coated tools, tool holders, ISO designation.
CONTROL SYSTEM: Electrical switchgear items - MCB, limit switch, encoder, feedback devices, servo motor, feed drives, spindle drives, control system, block processing, interpolation.

PART PROGRAMMING: Turning centre programming, machining centre programming, ISO and EIA standards, G and M codes, absolute, incremental positioning, canned cycles, work datum, tool offset, cutter radius compensation, tool length offset, programming simple components, shaft, pin, industrial components housing, brake drum, pocket milling, automobile components, engine block, dry run.

PROGRAMMING USING CAM: Component modeling, machine selection, tool selection, coordinate reference, step by step procedure, cutter location data, simulation, post processor.

TESTING OF MACHINE TOOLS: Geometrical alignment test, cutting tests, test charts, testing of CNC machine tools, standard test specimen, dynamics-self excited and forced vibration, test for thermal stability, accuracy, repeatability, isolation of machine tools.

TEXT BOOKS:

REFERENCES:
15P610 FLUID POWER AND CNC LABORATORY

1. Study of Fluid power symbols and hydraulic elements
2. Design and simulation of systems using single acting actuator and Pneumatic elements.
3. Design and simulation of systems using double acting actuator, Pneumatic elements
4. Design and simulation of systems using double acting actuator and Pneumatic elements with emergency modules
5. Design and simulation of systems using Electro Pneumatic elements
6. Design and simulation of systems using double acting actuator and PLC.
7. Design and simulation of hydraulic systems using software
8. Design and simulation of systems using software
9. Profile milling exercises incorporating sub programs in CNC VMC
10. Canned cycle exercises for CNC VMC

Total P: 60

REFERENCES:
1. Laboratory Manual prepared by Department of Production Engineering.

15P611 CAD/CAE/CAM LABORATORY

1. Constraint based modeling and assembly.
2. Top down modeling.
4. Static analysis of a tool/die using software.
5. Modal analysis of a machine tool component using software.
6. Analysis of casting problem (assuming it as a Thermal/Fluid problem) using software.
7. Analysis of a simple welding problem (based on thermal gradient) using software.
8. Analysis of a simple metal forming problem (contact analysis and plastic deformation) using software.
9. NC code generation for prismatic components
10. NC code generation for cylindrical components

Total P: 60

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

15P620 INNOVATION PRACTICES

Innovation Practices involves the following:

❖ Idea generation and Concept Selection
  • Markey survey and concept generation
  • Patent search for foolproof concept selection
  • Time line of activities
❖ Design Optimization
  • CAD model development
  • Simulation in CAE environment
  • Design optimization
  • Approximate cost estimation
❖ Development and Testing
  • Model/prototype development
  • Validation and testing
  • Report submission and presentation
REFERENCES:

SEMESTER VII

15P701 AUTOMATION AND ROBOTICS

INTRODUCTION: Fundamental concepts in manufacturing and automation, Types and Levels of automation, automation strategies, automation migration. Introduction to CIM, components of CIM, process design for CIM.

AUTOMATED FLOW LINES AND ASSEMBLY: Automated flow lines, methods of work transport, automated flow lines with and without storage buffers, parts feeding devices, single and multi-station assembly machines. Performance and Economics of Assembly Systems, Feasibility Study for Assembly Automation

AUTOMATED MATERIAL HANDLING AND INSPECTION: Automated guided vehicle system, components of AGVS, control system, routing, design features, AS/RS components, design of an AS/RS. Automated inspection, online and offline inspection, sensor technology for manufacturing process monitoring and inspection.


TRANSFORMATION AND KINEMATICS: homogeneous transformations, forward solution, inverse solution, motion generation, Jacobian control. Trajectory and path planning.

TEXT BOOKS:

REFERENCES:

15P702 ENVIRONMENT CONSCIOUS MANUFACTURING

OUR ENVIRONMENT: The human population and the environment, the human population’s effects on the earth, the ecosystem, chemical cycling and succession, the biogeochemical cycles, major global biogeochemical cycles - carbon, carbon-silicate, nitrogen and phosphorus cycles, global warming, greenhouse effect, major greenhouse gases.

MANUFACTURING SYSTEMS: Levels of manufacturing systems, environmentally conscious manufacturing- components, system effects and assessment.

WATER POLLUTION IN MANUFACTURING SYSTEMS: Metalworking fluids- environmental and health impact, Heavy metals in water, MWF pollution prevention through process planning, process modification and in process recycling, water footprint analysis.

AIR AND SOLID POLLUTION IN MANUFACTURING SYSTEMS: origin of airborne particles in manufacturing, traditional and modern particulates mitigation/elimination techniques. Industrial solid and hazardous waste management, Carbon footprint analysis.


TEXT BOOKS:
REFERENCES:

15P710 INDUSTRIAL ENGINEERING AND LEAN PRACTICES LABORATORY

INDUSTRIAL ENGINEERING
1. Solving linear programming problem, transportation problem, assignment problem
3. Project management using PERT/CPM
4. Line balancing

LEAN PRACTICES
1. Exercise on Value Stream Mapping using Lean Simulation Kit
2. Exercise on Jidoka using Lean Simulation Kit
3. Exercise on Kanban using Lean Simulation Kit
4. Exercise on Single Minute Exchange of Dies using Lean Simulation Kit
5. Exercise on Cell layout using Lean Simulation Kit
6. Exercise on Theory of Constraints

REFERENCES:

15P711 PRODUCT DESIGN AND DEVELOPMENT LABORATORY

1. Study of reverse engineering concepts
2. Demonstration of 3D scanning
3. Study of rapid prototyping machines
4. Demonstration of Fusion Deposition Modeling
5. Demonstration of Selective Laser Sintering
6. Demonstration of Vacuum casting
7. Demonstration of Virtual Reality
8. Exercise on Failure Mode and Effect Analysis
9. Identify a consumer product as needed by the market, develop concept, develop CAD model, simulate in CAE environment, optimize, develop tooling and make a physical prototype. Prepare a detailed report.

REFERENCES:

15P720 PROJECT WORK I

- Review of Patents / Design Registration /Trademarks
- Identification of a problem domain
- Need for the current study
- Literature survey and patent search
- Problem formulation based on literature survey
- Objectives and feasibility study
- Time Line of activities for project work I
- Progress of the work based on the methodology
- Conclusions from the project work
- Report preparation

REFERENCE:
SEMESTER VIII

15P820 PROJECT WORK II

- Review of Patents / Design Registration / Trademarks
- Identification of a problem domain
- Need for the current study
- Literature survey and patent search
- Problem formulation and proposing different solutions for the problem based on literature survey
- Objectives and feasibility study
- Time Line of activities for project work II
- Progress of the work based on the methodology
- Detailed analysis and interpretation of results
- Validation of results
- Conclusions

REFERENCE:

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.

PRACTICALS: Listening, Speaking, Reading and Writing.

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

REFERENCES:

15C082 BASIC FRENCH

INTRODUCTION:


TEXT BOOK:

REFERENCES:
1. Dondo Modern French Course --- Mathurin Dondo

15C083 BASIC JAPANESE

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

Basic script, Method of writing hiragana and katakana, and Combination sounds and simple words


Place markers “Koko”, “Soko”, “Asoko”, Direction markers “Kochira”, “Sochira”, “Achira” and Japanese department stores: Asking for and buying something

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 (2)

Particle “de (by means of)”, Particle "ni (to)", Aaemasu (give) and Moraimasu (receive) and Visiting a Japanese house. (2)

Adjectives ("I" and "na" type), Adjectives (Positive and negative usage), Particle "ga (however, but), "Dore which?") and Leaving a room, thanking someone for hospitality (2)

Likes and dislikes, Potential verbs (wakarimasu and dekimasu), "Kara (~ because)", Adverbs and Asking some one out over the phone (2)

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 (2)

Counters and Counting suffixes (2)

Introduction to Adjectives (na and ii type), Different usages of adjectives, Comparison, Likes and dislikes and Going to a trip (2)

Need and desire (ga hoshii), Wanting to … (Tabeti desu), Going for a certain purpose (mi – ni ikimasu) and Choosing from a menu (2)

Verb groups, I, II and III and Exercises to group verbs (2)

Please do (te kudasai), Present continuous tenses (te imasu), Shall I? (~ mashou ka) and Describing a natural phenomenon (It is raining) (2)

To grant permission (~te mo ii desu), Asking for permission (~ te mo ii desu ka) and Should not do (~ te wa ikemasen) (2)

Describing a continuing state and Describing a habitual action (2)

Roleplays in Japanese (2)

A demonstration on usage of chopsticks and Japanese tea party (2)

Total L: 45

TEXT BOOK:
1. Minna no nohongo – Romaji ban (first 10 lessons of this book)

REFERENCE:

OPEN ELECTIVES

MATHEMATICS

15OH01 ADVANCED LINEAR ALGEBRA 3 0 0 3

VECTOR SPACES: General vector spaces, real vector spaces, Euclidean n-space, subspaces, linear independence, basis and dimension, row space, column space and null space. (8)

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. (12)

LINEAR TRANSFORMATIONS: General linear transformation - kernel and range, matrices of linear transformations, change of basis, rank and nullity. (12)

EIGENVALUES AND EIGENVECTORS: Eigenvalues and eigenvectors, diagonalization, orthogonal diagonalization, quadratic forms, application of conic sections, quadratic surfaces - discrete dynamical systems. (13)

Total L: 45

TEXT BOOKS:
REFERENCES:

15OH02 ALGEBRAIC STRUCTURES
3 0 0 3

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
3 0 0 3

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.

TEXT BOOKS:

REFERENCES:

15OH04 GRAPH THEORY AND ITS APPLICATIONS
3 0 0 3


EULERIAN AND HAMILTONIAN GRAPHS: Eulerian graphs – Königsberg 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)


TEXTBOOKS:

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

15OH05 MATHEMATICAL FINANCE

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)

TEXT BOOKS:

REFERENCES:

15OH06 MATHEMATICAL MODELING AND SIMULATION

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 \( \pi \), 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.

**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 data.

**TEXT BOOKS:**

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

**15OH07 NUMBER THEORY FOR COMPUTING**

**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

**ARITHMETICAL FUNCTIONS AND DISTRIBUTION OF PRIME NUMBERS:** Multiplicative functions – functions \( \tau(n) \), \( \sigma(n) \) and \( s(n) \) - functions \( \phi(n) \), and \( \mu(n) \). Prime distribution function \( \pi(x) \), prime number theorem, the \( n \)th prime.

**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.

**COMPUTATIONAL NUMBER THEORY:** Primality testing: Fermat’s pseudoprimality test, strong pseudoprimality test, integer factorization: trial division and Fermat method, quadratic and number field sieves.

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

**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, p 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 structure function, minimal cuts, minimal paths, common mode failures, three state devices. (8)

TEXT BOOKS:

REFERENCES:

15OH10 SOFT COMPUTING 3 0 0 3

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. (15)

NEURAL NETWORKS: Basic concepts, neural network architectures - single layer, multilayer, recurrent networks, learning methods, back propagation network. (15)

GENETIC ALGORITHMS: Basic concepts, encoding, fitness function, reproduction, inheritance operators, cross over, inversion and deletion, mutation operator, bit-wise operators, generational cycle. (10)

HYBRID SYSTEMS: Genetic algorithm based backpropagation networks, fuzzy backpropagation networks. (5)

Total L: 45

TEXT BOOKS:

REFERENCES:

15OH11 STOCHASTIC MODELS 3 0 0 3

STOCHASTIC PROCESSES: Definition, Markov chains: Classifications of states, absorption probability, period, Chapman-Kolmogorov equations, steady state probabilities. (12)

CONTINUOUS TIME MARKOV CHAINS: Definition, Chapman-Kolmogorov equations, Kolmogorov forward and backward equations, steady-state probabilities, birth-death processes. (9)

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. (10)

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. (14)

Total L: 45

TEXT BOOKS:

REFERENCES:
PHYSICS

15OH20 ANALYTICAL TECHNIQUES FOR MATERIALS CHARACTERIZATION

3 0 0 3


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). (10)

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). (9)


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 (8)

TEXT BOOKS:

REFERENCES:

15OH21 LASER TECHNOLOGY

3 0 0 3

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)


DYE 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)


TEXTBOOKS:

REFERENCES:

Total L: 45

56

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)


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. (11)

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. (11)

SEMICONDUCTOR NANOSTRUCTURES: Quantum confinement in semiconductor nanostructures - Quantum wells, quantum wires, quantum dots, superlattices, band offsets and electronic density of states – Fabrication techniques – Requirements, epitaxial 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. (11)


TEXTBOOKS:

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


(9)

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.

(8)

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

(10)


(9)


(9)

TEXT BOOKS:

REFERENCES:

15OH25 SENSORS FOR ENGINEERING APPLICATIONS

STRAIN AND PRESSURE MEASUREMENT: Resistance strain guage, 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


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).


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


TEXTBOOKS:

REFERENCES:

15OH27 NONLINEAR SCIENCE AND ENGINEERING APPLICATIONS

INTRODUCTION: Dynamical systems: Linear and Nonlinear Forces, Mathematical Implications of Nonlinearity- Linear waves-ordinary differential equations (ODEs)- Partial differential equations (PDEs)- Methods to solve ODEs and PDEs- Numerical methods – Linear and Nonlinear oscillations- Nonlinear waves- Quantitative features


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:

15OH29 CHAOTRONICS


Total L: 45

60
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 embrittlement. (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:

Total L: 45

15OH37 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)


Total L: 45
15OH41 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.


TEXT BOOKS:

REFERENCES:

Total L: 45

COMPUTER APPLICATIONS

15OH46 COMPUTER GRAPHICS AND VIRTUAL REALITY


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


Total L: 45
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.

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


TEXT BOOKS:

REFERENCES:

15OH48 DATABASE MANAGEMENT SYSTEM
3 0 0 3


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. (7)

DATABASE TRANSACTION & SECURITY: - Transaction processing – properties - Concurrency control mechanism - security and integrity threats - Defense Mechanism. (5)

TEXT BOOKS:

REFERENCES:

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. (11)


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. (7)

SORTING AND GRAPH ALGORITHMS: Dense matrix Algorithm: Matrix-vector multiplication - Matrix-matrix multiplication- Issues in sorting on parallel computing - Sorting networks - Bubble sorts and its variants - Quick sort - Graph algorithms - Definition and representation - Prims algorithm - Dijkstra’s algorithm - All pairs shortest path - Transitive closure – Connected components. (9)

TEXT BOOKS:

REFERENCES:

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)


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 ole.(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)

Total L: 45
15OH53 OBJECT ORIENTED PROGRAMMING


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

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.

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


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

TEXT BOOKS:

15OH54 PROGRAMMING IN PYTHON

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.


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.


TEXT BOOKS:
REFERENCES:

15OH55 RESPONSIVE WEB DESIGN


CASCADEING STYLE SHEETS: Introduction - Levels of Style Sheets - Style Specification Formats – Style Classes - Properties and Property Values - Color - The span and div Tags.

HTML5: Media Queries supporting different viewpoints – 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.

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.


TEXT BOOKS:

REFERENCE:

15OH56 SOCIAL WEB MINING


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


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.

TEXT BOOKS:

REFERENCES:

15OH57 SOFTWARE ENGINEERING


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

Total L: 30+T:30 = 60

TEXT BOOKS:

REFERENCES:

15OH59 GEOGRAPHIC INFORMATION SYSTEM


Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration- Geodatabases


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.


REFERENCES:

REFERENCES:

15OH60 PROGRAMMING FOR ROBOTICS

2 2 0 3

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:

REFERENCES:

HUMANITIES

15OH61 AN INTRODUCTION TO INDIAN CONSTITUTION

3 0 0 3

CENTRE-STATE RELATIONS: Directive Principles of State Policy, Fundamental Rights and Duties, Centre-State Relations.
UNION GOVERNMENT: Powers, Functions and Position of President, Vice-President and Council of Ministers .


JUDICIARY: The Union Judiciary - Supreme Court and High Court.  

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

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

Total L: 45  

TEXT BOOKS:  

REFERENCES:  

15OH62 ENTREPRENEURSHIP 3 0 0 3  
INTRODUCTION TO ENTREPRENEURSHIP: Definition – Characteristics and Functions of an Entrepreneur – Common myths about entrepreneurs – Importance or Entrepreneurship. Seminar in R5 & R6.  


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


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

Total L: 45  

TEXT BOOKS:  

REFERENCES:  

15OH63 HUMAN RESOURCE MANAGEMENT 3 0 0 3  

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

Total L: 45
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)

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. (5)

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

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

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. (6)

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-Meet/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

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:

15OH68 FINANCIAL AND MANAGERIAL ACCOUNTING

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. (6)

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:

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)


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.

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 ammunitions; Field Craft and Battle Craft; Fighting - Role of Fighting Arms and map reading.

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.

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.

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.

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

15OH75 ENGLISH AND SOFT SKILLS FOR EMPLOYABILITY

SELF MANAGEMENT AND ATTITUDES: Self Concept, Stress management, Positive attitude, Influential Skills, Initiative, Empathy, Social Etiquette.
COMMUNICATION STYLES: Presentation Skills, Interpersonal Communication Skills, Interviewing Skills, Verbal and Nonverbal (body language) skills, Active Listening, Professional Writing, Effective email writing

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

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

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

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.

REFERENCES:

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

15OH76 ENGLISH FOR COMPETITIVE EXAMINATIONS

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

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

SPEAKING: Sub skills of speaking- Genre-specific oral communication

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

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

REFERENCES:

15OH77 GERMAN LANGUAGE – INTERNATIONAL LEVEL A1.1

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

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.

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.
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, Modalverbs. (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)

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/houses, describe a flat, write a text about a flat; Vocabulary: related to the topic; Grammar: Adjective with sein (sehr/zu), wechsel/preposition 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, e-mail writing; Vocabulary: related to the topic; Grammar: Imperative, Modalverbs. (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)

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 (5)

ALGORITHMS: Introduction-Analysis of algorithms - Best, worst and average case time complexities - notations. (2)

TREES: Terminologies – Binary tree - Sequential and linked representation - operations - Traversals - Expression trees - Infix, Postfix and Prefix expressions – Heaps- Max heap-Min heap. (4)

76
SORTING AND SEARCHING: Insertion sort, selection sort, heap sort, count sort and radix sort - searching, Linear Search. (4)

BINARY SEARCH TREES: Searching – Insertion and deletion of elements-Balanced BST- AVL trees-Definition – searching – insertion and deletion of elements, AVL rotations (4)

MULTIWAY SEARCH TREES: Indexed Sequential Access – m-way search trees – B-Tree – searching, insertion and deletion. (3)

GRAPHS: Definition – representations (Adjacency matrix, packed adjacency list and linked adjacency list) – Graph search methods (Breadth first and depth first traversals) . (2)

DIVIDE AND CONQUER: Method – Merge sort, Quick sort, Binary Search. (3)

GREEDY METHOD: Optimization problems – method – examples – Minimum cost spanning tree (Kruskal’s and prim’s algorithms), Knapsack problem (3)

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:
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.

Total L: 30+T:30 = 60

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

DYNAMIC DATA DISPLAYS: Introduction to web based visual displays – deep visualization – collecting sensor data – visualization – D3 framework - Introduction to Many eyes and bubble charts

MAPS – Introduction to building choropleth maps

TREES – Network visualizations – Displaying behavior through network graphs

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 Gapminder, 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.


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


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.

LEARNING: Learning from observation - Knowledge in learning - Supervised Learning - Unsupervised and Reinforcement learning.

ROBOTICS: Introduction.

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.

Total L: 30+T:30 = 60

TEXT BOOKS:

REFERENCES:
15OH86 PERVERSIVE COMPUTING


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.


TUTORIAL PRACTICE:
1. Create application with onClick, onKey Down, onFocus Changed 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 Android's Advanced User Interface Functions.
8. Create Location-Aware application that uses Proximity Alerts and Google Maps API.
9. Implementation of small packages to demonstrate all APIs.

Note: All implementations using android.

Total L:30+T:30=60

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.

Total L:30+TP:30 = 60

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. (4)


PROBABILISTIC METHODS: Overview of the method – maximum satisfiability - finding a large cut, Expander graphs. (4)

MARKOV CHAINS AND RANDOMWALKS: Markov chains, Random walk on graphs - connectivity in undirected graphs – Expanders and rapidly mixing random walks. (4)

DATA STRUCTURES AND GRAPH ALGORITHMS: Random Treaps, hashing – hash tables – perfect hashing, skip lists - Fast min-cut. (4)

ONLINE ALGORITHMS: Paging problem-adversary models- paging against an oblivious adversary-relating the adversaries-the adaptive online adversary, k-server problem. (4)

PARALLEL AND DISTRIBUTED ALGORITHMS: Sorting on a PRAM – Maximal Independent sets. (3)

DERANDOMIZATION: The method of Conditional Probabilities – Derandomizing max-cut algorithm – Constructing pairwise independent values modulo a prime - Pairwise independent – large cut. (3)

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

TEXT BOOKS:

REFERENCES:

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. (5)

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)

Total L:30+T:30 = 60

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.

TEXT BOOK:

REFERENCES:

15OH92 APPLIED STOCHASTIC PROCESSES

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

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


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.

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

TEXT BOOKS:

REFERENCES:

15OH93 MODELLING AND SIMULATION

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

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


DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS: Input - Output analysis - variance reduction techniques - Antithetic variables - verification and validation of simulation models.


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

CASE STUDIES: Simulation of LAN - Manufacturing system - Hospital system.

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

Total L: 30+T: 30=60
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-Munkner’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 – Hopcraft-Tarjan algorithm. (3)

Total L: 30+T: 30=60

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

TEXT BOOKS:

REFERENCES:
PROFESSIONAL ELECTIVES

15P001 MECHATRONICS

INTRODUCTION: Introduction to Mechatronics, need and applications, elements of mechatronic systems, role of mechatronics in automation, manufacturing and product development.


MECHATRONICS SYSTEM DESIGN: Design process-stages of design process. Case studies of Mechatronics systems – oil lubricating system – Engine Management system – Adaptive control in CNC machines

TEXT BOOKS:

REFERENCES:

15P002 MODELING AND CONTROL OF DYNAMIC SYSTEMS

INTRODUCTION TO CONTROL SYSTEMS: Introduction, need for control systems. Open-loop and closed-loop systems, Components of feedback control systems, effect of feedback control, types of feedback control systems. Transfer function: Block diagram reduction, Signal flow graphs.

MATHEMATICAL MODELS OF PHYSICAL SYSTEMS: Mechanical translational and rotational systems, Fluid and Thermal systems, D.C. generator and motor; Transportation Lag Systems.

TRANSIENT RESPONSE: Typical inputs, Time domain specifications, First and second order systems, steady state errors.

STABILITY: Concept of stability, necessary and sufficient conditions of stability, Routh Hurwitz Criterion. Lead, Lag, Lag-Lead Compensation using time domain analysis


TEXT BOOKS:
1. Ogata K, “Modern Control Engineering”, Pearson Education, New Delhi, 2004

REFERENCES:
15P003 MAINTENANCE AND SAFETY ENGINEERING

MAINTENANCE: Types – breakdown, preventive, predictive, TPM; elements of preventive maintenance – checklist, schedule, procedure. (6)

TOTAL PRODUCTIVE MAINTENANCE: Principles; preparatory stages of implementation – TPM organisation structure, creation; basic TPM policies and aids, master plan. (7)

TPM IMPLEMENTATION: Small group activities, autonomous maintenance, establishing planned maintenance, training, developing equipment management program. (7)

SAFETY SYSTEMS ANALYSIS: Definitions, safety systems; safety information system: basic concept, safety cost / benefit analysis; industrial safety engineering, OSHA regulations. (7)

FIRE PROTECTION SYSTEM: Chemistry of fire, water sprinkler, fire hydrant, alarm and detection system. Suppression system: CO₂ system, foam system, Dry Chemical Powder (DCP) system, halon system, portable extinguisher. (6)

SAFETY IN MACHINE OPERATION: Design for safety, lock out system, work permit system, safety in use of power press, cranes. Safety in foundry, forging, welding, hot working and cold working, electroplating and boiler operation. (6)


TEXT BOOKS:

REFERENCES:

15P004 FINITE ELEMENT APPLICATIONS IN MANUFACTURING

INTRODUCTION: Need for and use of finite element method in solving problems in engineering and manufacturing, Mathematical representation of manufacturing processes - metal casting, metal cutting, metal forming, welding, heat treatment and injection molding, use of partial differential equations, interpretation of boundary conditions and initial conditions. (7)

FINITE ELEMENT ANALYSIS: Introduction, concept of elements, 1D, 2D and 3D models and elements, plane stress and plane strain models, Shape functions, stiffness matrix and its use, stress-strain relation ships, global and natural coordinate systems and Jacobian for transformations, element assembly, difference between CAD models and FEA models of physical components, elements for heat transfer problems and fluid flow problems. (10)

FEA OF METAL FORMING PROCESSES: Review of theory of plasticity applied to metal forming processes, flow curve, models for friction and heat transfer, Modelling of simple forging operations, plane strain upsetting, computer implementation. Modeling of rolling and extrusion. (9)

FEA OF METAL CASTING PROCESSES: Mathematical modelling of solidification processing, boundary conditions, initial conditions solutions by FEA - simple case studies on sand mold and die casting, Case study using CAE packages and softwares used in Foundries. (9)

INTRODUCTION TO FEA OF WELDING PROCESSES: Model for manual metal Arc welding, boundary conditions, solutions by FEA using CAE softwares. (5)

Introduction to Computer aided design and analysis of Injection molded components using CAE softwares. (5)

TEXT BOOKS:

REFERENCES:

Total L: 45

Total L: 45

15P005 DESIGN AND MANUFACTURE OF GEARS

INTRODUCTION TO GEARS: Types of gears, classification, application of gears, gear boxes, gear drawing. (3)

GEAR DESIGN: Review of gear fundamentals - Law of gearing, nomenclature, interference, minimum number of teeth, gear correction-Ss and S; Gear tooth forces. Design of spur gears, design of helical gears, design of worm & worm wheel, design of bevel gears. (18)

GEAR MATERIAL SELECTION AND HARDENING METHODS: Properties of gear materials, non-metallic, non ferrous and plastic gears, selection of material for power transmission, high speed application, hardening by through hardening, case hardening, induction hardening, flame hardening, nitriding and tuftriding, hardening defects. (5)

PRODUCTION OF CYLINDRICAL GEARS: Procedure of cutting gears and obtainable quality in hobbing and gear shaping- cutter selection and work holding methods, setting calculations. Rack type gear shaping machine description and application. Internal gear cutting methods, CNC gear hobbing and gear shaping machines. (6)

PRODUCTION OF CONICAL GEARS: Production of straight bevel gears by bevel gear generator, duplex rotary cutter method – Gleason Reva cycle method - spiral and hybrid bevel gear generation, Gleason Tri-AC, description of machine. (5)

GEAR FINISHING METHODS: Gear finishing advantages, finishing of gears by grinding, shaving, lapping and honing methods, cold rolling of gears - description of process, machine, cutters and process parameters setting. (4)

OTHER PRODUCTION METHODS: Gear production by stamping, die casting, powder metallurgical process, injection and compression moulding of plastic gears, cold and hot rolling. Mass production methods, shear speed shaping, gear broaching. (4)

Total L: 45

TEXT BOOKS:

REFERENCES:

15P006 PRODUCT LIFECYCLE MANAGEMENT

INTRODUCTION: Product development process and functions-present market constraints-need for collaboration use of internet class technologies and data transfer, various developments on internet and its impact on business, architecture of PLM solutions.(6)

PRODUCT LIFECYCLE: Concept of product lifecycle, its use, important phases, examples. (3)

INTRODUCTION TO PRODUCT DATA MANAGEMENT: Document management, representation of lifecycle of business objects, concepts on roles, users and project management, system administration, access control and its use in lifecycle. (9)

AUTOMATING BUSINESS PROCESSES: Work flows, lifecycle - work flow integration, product configuration, product structure, configuration management and change management. (9)

PRODUCT VISUALISATION: Use of CAD neutral approach and visualisation techniques in product development, Examples, approaches for integration of CAD systems with PDM/PLM systems, introduction to Virtual Reality (7)

INTEGRATION OF ERP SYSTEMS: Integration with PDM – use of middleware in integrating business applications in product development. (7)

INTRODUCTION TO PLM/PDM SOFTWARE: PDM/CPC/PLM softwares and their comparison. (4)

Total L: 45

TEXT BOOKS:
REFERENCES:

15P007 SURFACE ENGINEERING AND TRIBOLOGY

SURFACE ENGINEERING: Significance of surfaces, nature of surfaces contact, surface energy, surface topography, surface texture evaluation techniques, surface integrity, Instruments and techniques for surface analysis, scanning electron microscopy and atomic forces microscopy, surface zone layers, structure of superficial layers, characteristics of superficial layer obtained by manufacturing processes, strength properties, tribological properties.

SURFACE COATINGS: Structure of coatings, classification of coatings, need for technical and technological coatings, techniques for producing surface layers, thermal spraying, electron beam technology, laser based technology, ion implantation techniques, CVD methods and PVD techniques.

SURFACE HARDENING: Surface hardening by flame and induction, laser and electron beam hardening, selection and applications, surface diffusion process, carbonitriding, aluminizing, siliconizing, chromizing, sursulf, selection of diffusion process.

TRIBOLOGY: Scope of Tribology, Tribology in metal working, surface effects on tribology, liquid lubricants and lubrication, lubrication by solids, mechanism and effects of lubrication, film parameter, selection criteria for lubricants, basics of hydrodynamic, elasto-hydrodynamic, boundary and extreme pressure lubrication, tribological components, bearings, gears and piston rings.

FRICTION AND WEAR: Laws of dry friction, mechanism of friction, sliding friction of metals and polymers, stick slips in machine tool slides, frictional heating and contact temperature, wear mechanisms, abrasive, erosive and cavitation wear, effects of adhesion between wearing surfaces, seizure and scuffing, corrosive wear and fatigue wear, wear analysis and measurement.

INTRODUCTION TO NANO TRIBOLOGY: Micro / Nanotribology of MEMS - Materials and Devices, Friction and wear on atomic scale.

TEXT BOOKS:

REFERENCES:

Total L: 45

15P008 MANUFACTURE OF AUTOMOTIVE COMPONENTS

ENGINE AND ENGINE COMPONENTS: Casting of engine block - conventional and expendable pattern, machining of engine blocks. Casting of cylinder heads, forging of crank shaft, connecting rod and gudgeon pins, machining and heat treatment, casting of piston by gravity casting, squeeze casting, forging of valves, heat treatment and surface improvement, cylinder liners and piston ring manufacturing.


PROPELLER SHAFT: Casting of propeller shaft, extrusion of propeller shaft, extrusion dies and its materials, requirements, heat treatment and surface hardening of propeller shaft.

AXLES AND SPRINGS: Forging of front and rear axles, casting of rear axle casing, leaf spring materials and its requirements, manufacturing of leaf springs.

BODY PANELS: Forming of body panels, principles of hydro forming, press forming, welding of body panels, resistance welding and other welding processes.

AUTOMOTIVE PLASTIC COMPONENTS: Principle of injection moulding, injection moulding of instrument panel, moulding of bumpers, tooling and tooling requirements and manufacture of metal panels.

AUTOMOTIVE COMPONENTS USING COMPOSITES: Composites and different types, ceramic matrix piston rings, chemical vapour deposition, physical vapour deposition, composite molding of friction lining, composite propeller shaft manufacturing, composite leaf springs and process for making composite panels.
MISCELLANEOUS, ASSEMBLY, SAFETY AND TESTING: Tyre and tube manufacturing, materials and its requirements, painting, painting booth, coach work. Sub assembly, group assembly and line assembly of automobile components, safety aspects in component manufacturing and utilization, performance testing of vehicles.

**TEXT BOOKS:**

**REFERENCES:**

**15P009 LEAN MANUFACTURING**

**ORIGIN OF LEAN PRODUCTION:** Craft Production – Mass Production – Ford System – Growing Dysfunction – Origin and History of Lean Production.

**LEAN PRODUCTION SYSTEM:** Necessity of Lean Production – Systems and Systems thinking – Construction of Lean Production: Lean image and Lean Activities – Muda and its types – Mura – Muri.

**STABILITY:** Standards in Lean System – Visual Management – 5S – Total Productive Maintenance: Key measures; Six Big Losses; Hidden Losses; Machine Loss Pyramid; Small group activity.

**STANDARDIZED WORK:** Comparison of Methods Engineering and Lean thinking – Elements to be managed - Necessity and prerequisites of Standardized work – Elements of Standardized work - Charts: Production capacity chart; Standardized combination table; Standardized work analysis chart – Man power reduction – Comparison of overall efficiency with individual efficiency – Kaizen – Common Layouts

**JUST IN TIME (JIT):** Definition - Principles of JIT: Continuous Flow; Pull – JIT system – Kanban – Six Kanban rules - Expanded role of conveyance – Production leveling – Three types of Pull Systems – Value Stream Mapping: Symbols; Current state VSM and Future state VSM.


**TEXT BOOKS:**

**REFERENCES:**

**15P010 MATERIAL HANDLING SYSTEMS**

**INTRODUCTION:** Definition and scope of material handling – importance of material handling – basic classification of materials – definition of Unit Loads – Advantages and Disadvantages – Load utilization processes and handling methods – Pallets, skids and containers – Alternative method of handling – Packaging for materials handling.

**INDUSTRIAL VEHICLES / TRUCKS:** Classification – Hand Trucks – Power Trucks – Fork Lift Trucks – Tractors.
BELT CONVEYORS: Definition – general characteristics – types of Belt conveyors – Parts of Belt Conveyors – Aspects of Belt Conveyor Design. (6)


REFERENCES:

Total L: 45

TEXTBOOKS:

15P011 NON-TRADITIONAL MACHINING TECHNIQUES 3 0 0 3

INTRODUCTION: Need for advanced machining processes, types of advanced machining processes, hybrid processes, applications and limitations. (3)

ULTRASONIC MACHINING (USM): Introduction, process description of ultrasonic machining, equipments, mechanics of cutting-hammering and throwing model proposed by Shaw, typical problems and comparison, factors affecting material removal rate, dimensional accuracy and surface quality, applications and limitations. (4)

ABRASIVE MACHINING PROCESSES: Description of the equipment, nozzles, modeling of material removal, problems, parametric analysis, process capabilities and applications of abrasive jet machining, water jet machining, abrasive water jet machining and abrasive flow machining. (4)

ELECTRON BEAM AND LASER BEAM MACHINING: Introduction, working principle, electron beam machining system, vacuum system, process parameters, characteristics, advantages and applications. Introduction, different types of lasers, characteristics and their production, material removal mechanism, process characteristics, applications, three dimensional machining, advantages and limitations. (10)

PLASMA ARC MACHINING: Generation of plasma, plasma arc cutting system, elements, different types of torch design and its characteristics-air plasma, oxygen injected plasma, dual gas, water injected plasma, effect of process parameters, applications and limitations. (4)

ELECTRICAL DISCHARGE MACHINING (EDM): Introduction, mechanism of material removal, description of the equipment, electrodes, dielectric fluids, different types of flushing, material removal rate, process characteristics and applications. Wire- Electrical Discharge Machining (Wire-EDM): Equipments, process variables, process capabilities and applications in die making. (6)

ELECTRO CHEMICAL MACHINING (ECM): Principle of electrolysis, theory of ECM, description of the equipment, electrolytes, modeling of material removal rate, accuracy and surface finish, advantages and limitations, various applications - electro chemical grinding, electro chemical deburring and honing, chemical etching process and its applications. (8)

MICROMACHINING: Need and applications, types, mechanics of micromachining, minimum chip thickness, micro turning, micro drilling and micro end milling. (4)

Total L: 45

TEXT BOOKS:

REFERENCES:

15P012 SUPPLY CHAIN MANAGEMENT

INTRODUCTION TO SUPPLY CHAIN MANAGEMENT: Meaning and Definition, development chain, key issues in supply chain management (SCM).

INVENTORY MANAGEMENT: Introduction, single stage inventory control, single period models, initial inventory, multiple order opportunities. Risk pooling, centralized and decentralized systems, managing inventory in the supply chain, forecasting.

VALUE OF INFORMATION: Introduction, Bullwhip effect, information sharing and incentives, information for coordination of systems, information and supply chain trade-offs. Supply chain integration - push, pull and push-pull system. Demand driven strategies, impact of internet on supply chain strategies, benefits and risks of outsourcing.

STRATEGIC ALLIANCES: Logistics related business function, Framework for strategic alliance, third party logistics, retailer-supplier partnerships, distributor-integration, procurement and out sourcing strategies, e-procurement.

GLOBAL LOGISTICS: Introduction, global market forces, managing global risks, requirements for global strategy implementation, issues in international supply chain management.

COORDINATED PRODUCT AND SUPPLY CHAIN DESIGN: general framework - design for logistics, supplier integration into to new product development, mass customization, the dimensions of customer value.

INFORMATION TECHNOLOGY FOR SCM: Goals of supply chain information technology, information technology standards, information technology infrastructure, RFID and Point-of-sale data, benefits, supply chain efficiency.

TEXT BOOKS:

REFERENCE:

15P013 PLC PROGRAMMING AND APPLICATIONS

PROGRAMMABLE LOGIC: Introduction, programmable Logic structures Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs) and Programmable Gate Arrays (PGAs), Field Programmable Gate Arrays (FPGAs) Sequential network design with Programmable Logic Devices (PLDs).

PROGRAMMABLE LOGIC CONTROLLERS (PLCs): Introduction Parts of PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming devices Diagnostics of PLCs with Computers.

PLC PROGRAMMING: Simple instructions Programming EXAMINE ON and EXAMINE OFF instructions Electromagnetic control relays Motor starters Manually operated switches Mechanically operated and Proximity switches Output control devices Latching relays PLC ladder diagram Converting simple relay ladder diagram in to PLC relay ladder diagram.

TIMER INSTRUCTIONS: ON DELAY timer and OFF DELAY timer counter instructions Up/Down counters Timer and Counter applications program control instructions Data manipulating instructions math instructions.


TEXT BOOKS:
REFERENCES:

15P014 MECHANICAL VIBRATIONS

INTRODUCTION: Relevance of and need for vibrational analysis. Mathematical modelling of vibrating systems – discrete and continuous systems – single degree of freedom systems – free and forced vibrations, various damping models. (8)

TWO DEGREES OF FREEDOM SYSTEMS: Generalized co-ordinated, principal co-ordinates, derivation of equations of motion, co-ordinate coupling, Lagrange’s equation, Dynamic vibration absorbers. (6)

MULTI DEGREES OF FREEDOM SYSTEMS: Derivation of equations of motion, influence coefficients, orthogonality principle, calculation of natural frequencies by Matrix, Rayleigh, Stodala, Dunkerley and Holzer methods . (9)

TRANSIENT VIBRATION: Impulse and arbitrary excitation, base excitation, Laplace transform formulation, response spectrum. (4)

VIBRATION MEASUREMENT AND CONTROL: Tests and Measurements of vibration, FFT analyzer, accelerometer, Methods of vibration control – excitation reduction at source, balancing of rigid, flexible and variable mass rotors - viscoelastic polymers - Condition monitoring of machines – Modal Analysis. (12)


Total L: 45

TEXT BOOKS:

REFERENCES:

15P015 PRECISION MANUFACTURING

INTRODUCTION: Accuracy and precision, application of precision machining, general concept of accuracy of machine tool, spindle rotation accuracy, significance of radial spindle rotation error and test methods, displacement accuracy, influence of geometric accuracy of machine tools on workpiece accuracy. (5)

INFLUENCE OF VARIOUS ERRORS ON MACHINING ACCURACY: Sources of error, Static stiffness, error due to - variation of the cutting force, total compliance in different machining methods, thermal effects, forced vibration, clamping and setting errors, location. Typical locators, principle of constant location surfaces. (8)


ULTRA PRECISION MACHINE ELEMENTS: Introduction – Guide ways, Drive systems, Spindle drive, preferred numbers, Rolling elements, hydrostatic and hydrodynamic bearings, pneumatic bearings. (8)

MICRO AND NANO MANUFACTURING: Bulk micro machining, surface micro machining, LIGA process, advances in lithography, etching-wet and dry, plasma, RIE, Doping-diffusion, ion implantation, thin film technology-sputtering, CVD, PVD, epitaxy, packaging. Machining of soft metals, mirror finish diamond turning, mirror finish grinding of ceramics, balls for bearings. (8)

PRECISION MEASUREMENT TECHNIQUES: Atomic force microscope, scanning tunneling microscope, on line measurement of dimensional features and form, laser measurement systems, nano positioning system. (7)

Total L: 45

TEXTBOOK:

REFERENCES:
15P016 PRODUCT DEVELOPMENT STRATEGIES

PRODUCT ANALYSIS: Product design in pre and post economic liberalization, Product Classification, product life cycle, cost, quality and servicing, concurrent engineering.

DIGITAL AND PHYSICAL PROTOTYPES: Prototype development, digital prototyping, physical prototyping, rapid prototyping, dimensional analysis and similitude, assembly and testing.

IT ENABLED PRODUCT LIFE CYCLE MANAGEMENT: Internet, concept of CPC, PDM/PLM, Need for PLM, Importance of PLM.

PRODUCT CONCEPT: Concept Generation, Concept Selection, Product Architecture, architecture types, product modularity, types of modularity.

INDUSTRIAL DESIGN: Definition, ergonomics, anthropometric data, visual effects of line and form, color, aesthetic concepts, style, styling and design studios, CAD.

ENGINEERING APPROACHES: Taguchi methods, QFD, FMEA, Fault tree analysis, Design for six sigma, DFMA, design for safety, reliability and environment, axiomatic design.


REVERSE ENGINEERING: Scanning methods, cloud points, NURBS surfaces, reengineering, tear down approach, bench marking.

MANAGING DESIGN PROJECTS: Tasks, selecting team members, Collaborators and consultants, Design for environment issues.

Total L: 45

TEXT BOOKS:

REFERENCES:

15P017 APPLIED HYDRAULICS AND PNEUMATICS

INTRODUCTION: Introduction to fluid power, properties - hydraulic fluids, air. Selection of hydraulic fluids, comparison between hydraulics and pneumatics.


TYPICAL INDUSTRIAL APPLICATION OF HYDRAULIC SYSTEMS: Circuits for deceleration, regenerative circuits, differential circuits, feed circuits, sequencing circuits, synchronizing circuits, fail-safe circuits.


TYPICAL INDUSTRIAL APPLICATIONS OF PNEUMATIC SYSTEMS: Metal working, handling, clamping, application with counters.

SERVO AND PROPORTIONAL VALVES: Types, operation, application. Hydro-Mechanical servo systems.

Total L: 45

TEXT BOOKS:
REFERENCES:

15P018 COMPOSITE MATERIALS PROCESSING 3 0 0 3

INTRODUCTION: Need for composite development, classification of composite materials, advantages. Types, role of reinforcement, manufacture of reinforcements.

POLYMER MATRIX COMPOSITE: Characteristics of PMC, matrix materials, rule of mixtures, Manual lay-up, automated lay-up using tape laying machines and fiber placement machines, vacuum bag molding, spray-up, filament winding, pultrusion and resin transfer molding. Introduction to Polymer - matrix nanocomposites.


METAL MATRIX COMPOSITE: Characteristics of MMC, matrix materials, processing methods – solid state, liquid state, vapour deposition, applications.

CERAMIC MATRIX COMPOSITE: Characteristics of CMC, matrix materials, processing methods – solid, liquid and vapour deposition methods, applications. Introduction to Ceramic - matrix nanocomposites.

COMPOSITE FABRICATION AND JOINING: Cutting, machining and drilling to fabricate composite parts, adhesive bonding and mechanical fastening methods. Introduction to nano composite.

TEXT BOOKS:

REFERENCES:

15P019 SIMULATION OF MANUFACTURING SYSTEMS 3 0 0 3

INTRODUCTION TO SIMULATION: Areas of application, systems and system environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event system simulation, steps in a simulation study.

RANDOM NUMBER GENERATION: Properties of random numbers, generation of pseudo-random numbers, techniques for generating random numbers, tests for random numbers.

RANDOM VARIATE GENERATION: Inverse transform technique, exponential, uniform, weibull, triangular, empirical, continuous, discrete distribution, direct transformation for the normal distribution, acceptance, rejection technique, poisson, gamma.

INPUT MODELLING: Data collection, identifying the distribution with data, parameter estimation, goodness-of-fit tests, selecting input models without data.

DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS: Length of simulation runs, variance reduction techniques, experimental layout, validation.

MANUFACTURING SYSTEMS EXAMPLES: Simulation of single machine job shop, two machine job shop, simulation of inventory system and simulation of projects networks.

INTRODUCTION TO SIMULATION SOFTWARE: Programming for discrete event systems, Case studies.

TEXT BOOKS:

REFERENCES:
15P020 COMPUTATIONAL FLUID DYNAMICS

INTRODUCTION: Basic concepts of fluid flow - derivation of the governing equations, conservation of mass, momentum and energy - Mathematical classification of flow - hyperbolic, parabolic, elliptic and mixed flow types. (10)

DISCRETISATION: Finite difference method - forward, backward and central difference schemes, explicit and implicit methods. Properties of numerical solution methods - stability analysis, error estimation, difference between the FDM and FVM methods. (9)

PRINCIPLES OF FLUID FLOW MODELING: The importance of flow properties such as conservation, transport etc., upwind schemes, artificial viscosity, the relationship between cell Reynolds Number and Courant Number (5)

INTRODUCTION TO GRID GENERATION: Choice of grid, grid oriented velocity components, cartesian velocity components, staggered and collocated arrangements, adaptive grids. (4)

CFD TECHNIQUES: Lax - Wendroff technique – MacCormack’s technique, relaxation technique. ADI technique, Pressure correction technique - SIMPLE algorithm. (10)

TURBULENCE MODELING: Turbulence energy equation - one-equation model, the k-ω model, the k-ε model. (4)

CASE STUDIES: Solving industrial problems using CFD packages. (3)

Total L: 45

TEXT BOOKS:

REFERENCES:

15P021 SIX SIGMA

INTRODUCTION: Six sigma definition – DMAIC and DMADV deployment models – project reporting, project budgets, project records, six sigma teams – team membership, stages in group development, member roles and responsibilities, facilitation technique. (8)

DEFINE PHASE: Project charter, Project decomposition – work breakdown structure, Pareto analysis; Deliverables – Critical to Quality Metrics, Critical to Schedule Metrics, Critical to Cost Metrics; Project scheduling – Gantt charts, PERT – CPM. (6)

MEASURE PHASE: Process definition – Flowcharts, SIPOC; Metric definition; capability analysis; SPC techniques – control chart selection, control chart interpretation, distributions; Measurement System Evaluation – Gage R &R. (8)

ANALYSE PHASE: Analyzing the source of variation – cause and effect diagram, box plots, statistical interference, regression, correlation; Design of Experiments. (8)

IMPROVE PHASE: Improvement decisions – category importance weights; optimization using simulation; Risk assessment tools – design review, fault-tree analysis, safety analysis, FMEA. (5)

CONTROL PHASE: Business Process control planning – maintaining gains, tools and techniques useful for control planning, preparing the process control plan, process control planning for short and small runs, process audits, selecting process control elements. (4)

DESIGN FOR SIX SIGMA (DFSS): Design for six sigma quality, Quality Function Deployment, TRIZ (6)

Total L: 45

TEXT BOOKS:

Total L: 45
REFERENCES:

15P022 RAPID PROTOTYPING

INTRODUCTION: Need for compression in product development, digital manufacturing-digital and physical prototyping, history of RP systems, survey of applications, growth of RP industry, classification of RP systems.

IT ENABLED PRODUCT DEVELOPMENT: Role of internet, collaborative product design, PDM/PLM.

TYPES OF RAPID PROTOTYPING: Stereo Lithography apparatus (SLA), Fused deposition modeling (FDM), Selective laser sintering (SLS), Direct metal laser sintering (DMLS), Laminated object manufacturing (LOM), laser engineered net shaping (LENS), Concept modelers, 3D printing-jetting out binder, jetting out polymer.

RAPID TOOLING: Direct and Indirect tooling, soft and hard tooling, bridge tooling, aluminum filled epoxy tooling, spray metal tooling, 3D kiltool, cast kirsute, direct AIM, sand casting tooling, laminate tooling, vacuum casting and room temperature vulcanizing, rapid injection molding.

RAPID MANUFACTURING PROCESS OPTIMIZATION: Accuracy, surface finish, strength, part built orientation, economic analysis.

REVERSE ENGINEERING: Scanning methods, surface generation from point cloud, re engineering, standards for data exchange, STL, IGES, STEP, file transfer protocol.

RPT IN MEDICAL APPLICATIONS: Digital Imaging and communications in medicine (DICOM), MRI, CT scan, Surgery, RP in Bio medical. Dental.

SUBTRACTIVE RAPID PROTOTYPING: High speed machining, 3, 4 and 5 axis machining, CAM software.

REFERENCES:

15P023 OPTIMIZATION TECHNIQUES FOR MANUFACTURING

BASIC CONCEPTS: Statement of the Optimization problem, classification, basic definitions, functions, region of search, Weierstrass theorem, hessian matrix, Taylor series expansion, quadratic forms, optimality criteria for constrained and unconstrained optimization, Karush-Kuhn-Tucker (KKT) conditions, Lagrangian multipliers, convexity.


UNCONVENTIONAL OPTIMIZATION TECHNIQUES: Genetic algorithms, Simulated annealing – simple problems.

RESPONSE SURFACE METHODOLOGY: Response surfaces, two-level factorial designs, addition of centre points, central composite design, sequential nature of RSM, limitations of RSM, Taguchi orthogonal arrays. Case studies in manufacturing.

REFERENCES:
INTRODUCTION: Need for eco-friendly propulsion systems - Contemporary vehicle fleet in India and around the world - Contribution of vehicles in emission of pollutants - Types of alternate propulsion systems - Examples of hybrid vehicles

DESIGN OF HYBRID PROPULSION SYSTEMS: Forces acting on a vehicle: Acceleration force, Aerodynamic drag, slope resistance, rolling resistance - Front wheel drive (FWD) - Rear wheel drive (RWD) - All wheel drive (AWD) - Power and efficiency of IC engines

PARALLEL HYBRID ELECTRIC VEHICLE: Vehicle architecture - Examples - Regenerative Braking and fuel restored

SERIES HYBRID ELECTRIC VEHICLE: Vehicle architecture - Examples - Power management strategies - Efficiency map

BATTERY ELECTRIC VEHICLE: Challenges and components involved in design - Types of storage devices - Vehicle architecture - Electric motor efficiency

COMBINED HYBRID ELECTRIC VEHICLE: Vehicle architecture - Mechanical transmission – Starting of IC engines - Electric mode - Nomogram

TESTING OF HYBRID ELECTRIC VEHICLES: Emission testing - Battery testing - motor testing - IC engine efficiency testing

WELL TO WHEEL: Electricity production - Charging ports - Vehicle efficiency and emission - Emission norms and eco score of vehicles

ALTERNATE RESOURCES: Solar panels - Hydrogen gas - Bio gas and Natural gas

TEXTBOOKS:

REFERENCES:
**DETERMINANTS:** Link between GDP and transport - Competition between Traffic modes – Growth rate of sustainable logistics

**INDICATORS:** Transported weight - Transport performance - Vehicle Kilometer

**ENVIRONMENTAL ASSESSMENT:** Environmental impacts - Contribution of vehicles to environmental stresses - External costs - Importance of vehicle emission norms - Alternate vehicle technologies - Life Cycle assessment of vehicles

**TEXTBOOKS:**

**REFERENCES:**

**15P026 AUTOMOTIVE STANDARDIZATION**

**INTRODUCTION:** Importance of standardization - Definition of standard as per standard - Trend towards standardization of standards - Globalization as driving force - De facto and formal standards - Standard setters and institutionalization - Certification systems - Production systems - Research methods and approach

**INSTITUTIONALIZATION:** Historical roots - International Organizations - Indian Organizations - Types of standards - Differences - Standardization Languages - IEC process - BIS process- Anatomy of a standard - Life cycle of a standard

**ECONOMIC IMPACTS OF STANDARDS:** Fund for standardization - Costs involved - Economics of scale - No pain No gain issue - Information asymmetry

**AUTOMOTIVE INDUSTRY:** End of craft production - Taylorism and standardization - Mass production - Production systems - Reflective production system - Current trend: Standardized production systems

**CASE STUDY OF PRODUCTION SYSTEM IN AUTOMOBILE INDUSTRY:** Background - Operating model - Reputed automobile manufacturer’s production system - Implementation - Audit: Theory versus practice - Comparison of production systems among various leading automobile manufactures - Analysis and interpretation

**RENEWABLE ENERGY VEHICLE STANDARDIZATION:** Current issues in Electric vehicle standardization - Research to innovation - From modeling to engineering through real world data analysis - Limitations of electromagnetic standards for Electric vehicles - Advanced electronic architecture design for the next electric vehicle generation

**TECHNOLOGY MATURITY & STANDARDIZATION TIMING:** Technology life cycle - Time versus Performance curve - Difference between standardization and regulation

**TEXTBOOKS:**

**REFERENCES:**
4. Official website of Bureau of Indian Standards http://www.bis.org.in/

**15P027 INDUSTRIAL ERGONOMICS**

**INTRODUCTION:** Definition, history of ergonomics, ergonomics for productivity, safety, health and comfort, human technological system, multidisciplinary engineering approach, human – machine system, manual, mechanical, automated system.
ANTHROPOMETRY IN WORKSTATION DESIGN: Introduction, measuring human dimensions, Definition of anthropometric measures, using anthropometric measures for industrial design, procedure for anthropometric design exercises. (6)

HAND TOOL DESIGN: Introduction, fitting the task, designing for the user, prevention of injuries, segmental vibration, design guidelines for hand tools (6)

DESIGN OF CONTROLS: Introduction, appropriateness of Manual control for task, computer input devices, control movement stereotypes, controls for overhead cranes in manufacturing, control-response compatibility, coding of controls, hand tools, part bins, parts, coding by location, colour, size, shape, labeling, mode of operation, parts and things touched by hand, emergency controls, organization of items at workstation, principles for the design of workstation. (7)

DESIGN OF SYMBOLS, LABELS AND VISUAL DISPLAYS: Introduction, symbols, labels, and written signs, warning signs, information processing, information overload, attention and active processing, comprehension and agreement, selecting and performing a response. (7)

ILLUMINATION AT WORK: Introduction, measurement of illuminance and Luminance, Measurement of contrast, requirements in manufacturing, use of photometer, recommended illumination levels, the ageing eye, use of reflected lighting, cost efficiency of illumination, special purpose lighting for inspection and quality control. (6)

NOISE AND VIBRATION: Introduction, measurement of sound, noise exposure and hearing loss, hearing protectors, analysis and reduction of noise, reduction of noise in manufacturing plant, effect of noise on performance, Broadbent and Poulton’s Theories, annoyance of noise and interference with communication, interference of noise and with spoken communication, preferred noise criteria curves, preferred speech interference levels, whole body vibration, sources of vibration discomfort. (7)

TEXT BOOKS:

REFERENCES:

ONE CREDIT COURSES
OFFERED BY THE DEPARTMENT

15PF01 PROCESS IMPROVEMENT AND PRODUCT DESIGN THROUGH LEAN SIX SIGMA

LEAN SIX SIGMA FUNDAMENTALS
- Definition of term Sigma, Z Score, CTQ, Opportunity, Defect, DPMO
- Types of data…importance of measurement, repeatability and reproducibility
- Six Sigma Quality Level, Relationship between DPMO and Process Capability, Short/Long term Six Sigma, Z Shift
- Six Sigma’s focus on inputs (X’s) over outputs (Y’s) using the formula Y=f (X)
- Structure of execution team, Rhythm to sustain the improvement
- Intro to DMAIC, DMADOV, Lean….how it is different from Traditional Quality ISO

METHODOLOGIES OF LEAN SIX SIGMA
- DMAIC
- DMADOV (DFSS)
- Lean

TOOLS AND TECHNIQUES
DMAIC
- QFD
- FMEA
- Fishbone Diagram
- Hypothesis Test
- DoE
- SPC

DFSS
- Kano Model
• Decision Making Tools
• Pugh Matrix
• Robust Design Tools

LEAN

• Value Stream Mapping
• 5 S

REFERENCES:

15PF02 DESIGN AND OPTIMIZATION TECHNOLOGY

OPTIMIZATION TECHNOLOGY

• Fundamentals and requirements of design optimization (what, when and why of optimization)
• Optimization semantics, terminologies
• Optimization techniques in practice
• Discussion on Gradient based vs. Stochastic based optimization techniques
• Fundamentals, requirements and challenges in multiple objectives design optimization
• Demonstration of optimization using EXCEL solver

TRANSFER FUNCTIONS

• Fundamental concepts of transfer function generation
• Introduction to design of experiments
• Importance of meta models in design optimization
  – What is a meta model
  – Why meta models
  – How to generate a meta model
  – When to use a meta model

ROBUST DESIGN

• Fundamental concepts of robust design methods
• Uncertainty quantification - how variation impacts performance
• Discussion on the importance of maintaining design margins on customer CTQ’s
• Linking probabilistics with optimization – driving robust designs

CASE STUDIES

Two case studies to be worked out in the class
Tool – Excel Solver

REFERENCES:

15PF03 INTRODUCTION TO PRECISION MACHINING

CNC Turning - Principles, types, machines, tools.
CNC Milling - Basic principles of milling, concepts of 3/4/5 axes, High Speed Milling, machine and controller types.
EDM - Wire and Sinking, principles, application.
Work and Tool Holding - types, applications.
CAM - Principles, softwares, examples. (1)

Metrology - Principles, measurements, examples. (1)

GD & T

Quality Management – 8 principles, purpose, ISO, process orientation, non-quality dispositions etc. (1)

Conventional precision manufacturing methods of Jig Boring, Jig Milling, Jig Grinding, Surface and Cylindrical Grinding. (1)

Productivity Improvement - types, measurement, Overall equipment effectiveness /total effective equipment performance OEE/TEE measurements, Machine utilisation etc. (2)

Shop visit and assessment. (4)

REFERENCES:
1. Material Provided by M/s. L&T, Coimbatore.

15PF04 NON-DESTRUCTIVE TESTING OF AIRCRAFT STRUCTURES 1 0 0 1


REFERENCES:

15PF05 APPLICATION OF STRENGTH CRITERIA 1 0 0 1


REFERENCES:
OFFERED BY HUMANITIES

15OF01 EXPORT - IMPORT MANAGEMENT

1 0 0 1


EXPORT PROCEDURES: Obtaining an Export License – Export Credit Insurance – Procedures and Documentation.  

FOREIGN EXCHANGE: Finance for Exports – Pricing - Understanding Foreign Exchange Rates.  

IMPORT PROCEDURES: Import Policy – License - Procedure and Documentation.  


REFERENCES:  

Total: 15

15OF02 INSURANCE & RISK MANAGEMENT

1 0 0 1

INTRODUCTION TO RISK MANAGEMENT: Risk in Our Society.  

INSURANCE AND RISK: Client Side – Components of the Costs of Risk.  


REFERENCES:  

Total L: 15

15OF03 VALUES AND ETHICS AT WORK PLACE

1 0 0 1

HUMAN VALUES AND ETHOS: Meaning and Significance of Values – Sources of Individual Values - Value crisis in the Contemporary Indian Society –Moral and Ethical Values.  

APPLICATION OF VALUES: Relevance of Values in Management – Personal Values and Values at Work place – Values for Managers.  


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

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

REFERENCES:  

Total L : 15

15OF04 DEVELOPMENT OF INDUSTRIALISATION

1 0 0 1

EVOLUTION OF MODERN ECONOMY: Colonialism, Capitalism and economic development.  

REFERENCES:  

Total (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:

Total L: 15

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)
ENTREPRENEURAL skills and development – Intrapreneurship. (4)
SOCIAL ENTREPRENEUR and social enterprise – success stories of entrepreneurs – Leadership styles adopted by successful entrepreneurs. (3)

REFERENCES:
4. Robert B Tucker, " Innovation Everybody’s Business”, 2010

Total L: 15

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:

Total L: 15

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)

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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.


REFERENCES:

15OF15 FINANCIAL MANAGEMENT


OBJECTIVE OF FINANCIAL MANAGEMENT: Profit Maximization and Wealth Maximization.

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

DIVIDEND POLICY: Determinants of Dividends- Bonus share – Tax aspects.

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.

MOTIVATION – Strokes Maslow’s Hierarchy of Needs.

INTERPERSONAL RELATIONSHIP - Time Management – Transactions - Time Structuring.

STRESS MANAGEMENT - Working Styles – Contamination.
106

**ASSERTIVENESS AND LEADERSHIP SKILLS** - Life positions – Competency. (2) Total L: 15

**REFERENCES:**

**OFFERED BY THE DEPARTMENT OF ENGLISH**

**15OF10 CORPORATE COMMUNICATION**

**1001**

**INTRODUCTION:** Basics of Corporate Culture, Etiquette, Code governing manners and conduct, Personal Grooming, People relationship, Worthy goals/ideals. (3)

**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. (4)

**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. (5)

Presentation and Negotiation Skills. (3)

Total: 15

**REFERENCES:**

**15OF11 - INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION**

**1001**

**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)

Total L:15

**REFERENCES:**

**15OF12 – HUMAN VALUES THROUGH LITERATURE**

**1001**

**PROSE:** Kalam, Abdul. “College Education” from Wings of Fire, Emerson, R W. “Self-Reliance” Independence, Russell, Bertrand. “Education” Harmony (5)


**DRAMA:** Karnad, Girish, Tughlaq – Statesmanship and friendship (3)
ONE-ACT PLAY: Chekhov, Anton. *The Bear* – Love

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

**NOVEL:** Murthy, Sudha. *Gently Falls the Bakula* – Gender equality

**REFERENCES:**
3. Additional readings on individual texts

**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.

**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.

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

**REFERENCES:**