SEMESTER - 1

19P101 CALCULUS AND ITS APPLICATIONS

3 1 0 4

DIFFERENTIAL CALCULUS: Function of two variables, limits and continuity, partial derivatives, chain rule, extreme values and saddle points, Lagrange multipliers, Taylor's formula for two variables. (9 + 3)

INTEGRAL CALCULUS: Double integrals — double and iterated integrals over rectangles, double integrals over general regions, Fubini’s theorem, area and volume by double integration, reversing the order of integration, polar form. (9 + 3)

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS: Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, modeling - mixing problems, Newton's law of cooling. (9 + 3)

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS: Homogeneous linear equations of second order, homogeneous linear ODEs with constant coefficients, Euler–Cauchy equations, solution by variation of parameters, free oscillations of mass-spring systems. (9 + 3)

VECTOR CALCULUS: Gradient and directional derivative of a scalar field, divergence and curl of a vector field. Integration in vector field — line integrals, path independence of line integrals, Green's theorem in the plane, divergence theorem of Gauss and Stokes’s theorems. (9 + 3)

Total L: 45 + T: 15 = 60

TEXT BOOKS:
1. Joel Hass, Christopher Heil, Maurice D.Weir “Thomas’ Calculus”, Pearson Education., New Delhi, 2018
2. Erwin Kreyszig “Advanced Engineering Mathematics”, Wiley India Pvt Ltd., New Delhi, 2015

REFERENCES:

19P102 PHYSICS

3 0 0 3


OPTICS: Review of formation of images by lenses, combination of thin and thick lenses, chromatic and spherical aberrations, methods to reduce aberrations. Interference: Superposition principle, intensity distribution, condition for interference, coherent and non coherent source, classification of fringes, system for observing the interference phenomena and engineering application: Interferometric displacement measurement. Diffraction: Fraunhoffer diffraction for Single slit and double slit, diffraction grating, resolving power of a grating, image forming system: optical microscope. (10)

Total L: 45

24
TEXT BOOKS:

REFERENCES:
2. Raymond A. Serway, John W. Jewett "Physics for Scientists and Engineers", Cengage Learning, 2010

19P103 CHEMISTRY


PHASE EQUILIBRIA: Definitions—one component system (water), two component systems—Cu-Ni and Pb-Ag systems—leverage rule. Solubility of gas in liquids. Distribution law—principle of extraction—applications. Binary liquid systems—fractional distillation—azeotropic mixtures. (9)


Total L: 45

TEXT BOOKS:

REFERENCES:

19P104 PROFESSIONAL ETHICS

CONCEPT OF VALUES AND ETHICS: Meaning and Significance — Sources of Individual Values — Value crisis in the Contemporary Indian Society—Moral and Ethical Values. (6)

APPLICATION OF VALUES: Personal Values and Social Values — Role of Codes — Relevance of Values in Profession — Formation and Application of Values for Engineers. (6)

PROFESSIONAL ETHICS: Professional Ethics—Need—Issues—Challenges — Ethical Leadership—Ethical dilemma — Case Study—Application of Personal Core Values in Professional Ethics. (6)

SHARED VALUES IN THE ORGANIZATION AND ITS IMPACT: Need to identify and Construct Shared Values — Promotion of Shared Values and Challenges — Impact of Shared Values in Organization. (6)

SOCIAL EXPERIMENTATION: Engineers as Managers — Impact of Culture and Learning from the Past — Consultant and Leaders. (6)
TEXT BOOKS:

REFERENCES:
2. Harris, Pritchand, Rabins "Engineering Ethics", Cengage Learning, New Delhi, 2013
4. Terrence M Kelly "Professional Ethics – A Trust Based Approach", The Rowman and Littlefield Publishing Group, 2018

19G105 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

GRAMMAR IN CONTEXT: Word Order; Subject Verb Concord; Style features - Tenses, Conditionals, Prepositions, Active and Passive Voice, Modals, Cloze and Spotting Error exercises

GUIDELINES FOR WRITTEN COMMUNICATION: Principles of clear writing, Paragraph writing, Essay writing, Emphasis Techniques, Summarizing and Paraphrasing, Analytical writing

FOCUS ON SPOKEN ENGLISH: Task-based activities: 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 Laboratory

TOTAL L: 30 + T: 15 = 45

TEXT BOOKS:
1. Faculty Incharge "Course Material on "English Language Proficiency", PSG College of Technology, Coimbatore, 2019

REFERENCES:
2. Simon Haines, Mark Nettle and Martin Hewings "Advanced Grammar In Use", Cambridge University Press, New Delhi, 2008

19P110 ENGINEERING GRAPHICS

INTRODUCTION AND PLANE CURVES:
1. Importance of graphics in Engineering applications, Bureau of Indian Standards (BIS), Drawing Instruments.
2. Types of Lines and Lettering, Methods of dimensioning.
5. Drawing of tangents and normal to the curves, Scales — diagonal and vernier scales.

PROJECTION OF POINTS, LINES AND PLANES:
1. Orthographic projection - Principal planes - First angle projection – Third angle projection.
2. Projection of points.
3. Projection of lines - determination of true lengths and true inclination by rotating line method.
4. Projection of planes.

PROJECTION OF SOLIDS:
1. Types of regular solids, solids in simple positions, projection of solids like prisms, pyramids, cylinder, cone and sphere.
2. Visualization principles of three-dimensional objects, freehand sketching.

PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES:
1. Type of sections, hatching - BIS conventions, section of regular solids.
2. Development of lateral surfaces of simple and sectioned solids.

TOTAL L: 30 + T: 15 = 45
3. Development of lateral surfaces of solids with cut-outs and holes. (12)

PICTORIAL PROJECTIONS:
1. Isometric projection / view, isometric scale, isometric projections of lines, planes, solids and sectioned solids.
3. 2D and 3D part modelling, extraction of 2D views using CAD package. (12)

TEXT BOOKS:

REFERENCES:

19P111 BASIC SCIENCES LABORATORY

PHYSICS LIST OF EXPERIMENTS (ANY EIGHT):
1. Determination of Young’s Modulus of a wooden bar — Cantilever method
2. Determination of rigidity modulus of a given material using Torsion pendulum
3. Determination of coefficient of viscosity of water — Poiseuille’s method
4. Determination of fibre thickness — air wedge method
5. Determination of wavelength of mercury spectrum using transmission grating
6. Measurement of vibration frequency of electrically maintained tuning fork using Melde’s apparatus
7. Determination of velocity of sound — Helmholtz resonator
8. Determination of wavelength and beam divergence of laser
9. Determination of Hysteresis loss of a ferromagnetic material
10. Determination of lattice constant using X-ray powder photograph (30)

CHEMISTRY(ANY EIGHT EXPERIMENTS):
1. Determination of rate constant of hydrolysis of an ester
2. Construction of eutectic phase diagram
3. Conductometric estimation of acid strength of a pickling bath
4. Electroplating of nickel and copper and determination of cathode efficiency
5. Anodizing of aluminium and determination of thickness of anodized film
6. Determination of kinematic viscosity of lubricating oil using Redwood viscometer
7. Determination of flash and fire point of lubricating oil
8. Analysis of solid fuel by proximate analysis of coal
9. Mechanism of galvanic corrosion— Determination of corrosion rate by corrosion current measurement
10. Estimation of hardness of water by EDTA method (30)

REFERENCES:
1. Department of Chemistry "Chemistry Laboratory Manual", ., 2019
2. Department of Physics "Physics Practical", ., 2019

19P112 ENGINEERING PRACTICES

LIST OF EXPERIMENTS:
2. Welding - Metal arc welding tools and equipment, exercises by Arc welding and TIG welding Processes.
5. Plumbing - exercises - external thread cutting and joining.
6. Sheet Metal Work & Soldering - Tools, operations, exercises Make a Rectangular Tray in Galvanized Iron sheet
8. Subtractive Rapid Prototyping - Demonstration of prototype development process.

**REFERENCES:**

**19IP15 INDUCTION PROGRAMME**

As per AICTE guidelines

**SEMESTER - 2**

**19P201 COMPLEX VARIABLES AND TRANSFORMS**

<table>
<thead>
<tr>
<th>COMPLEX DIFFERENTIATION</th>
<th>Derivative, analytic function, Cauchy-Riemann equations, Laplace’s equation, linear fractional transformations.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(9 + 3)</td>
</tr>
<tr>
<td>COMPLEX INTEGRATION</td>
<td>Cauchy’s integral theorem, Cauchy’s integral formula, Laurent series, singularities and zeros, residue integration method (Residue integration of complex integrals only).</td>
</tr>
<tr>
<td></td>
<td>(9 + 3)</td>
</tr>
<tr>
<td>LAPLACE TRANSFORMS</td>
<td>Laplace transform, linearity, first shifting theorem, transforms of derivatives and integrals, ODEs, unit step function, second shifting theorem, Dirac’s delta function, periodic functions.</td>
</tr>
<tr>
<td></td>
<td>(9 + 3)</td>
</tr>
<tr>
<td>FOURIER SERIES AND FOURIER TRANSFORMS</td>
<td>Fourier series — arbitrary period, even and odd functions, half range expansions. Fourier transforms, Fourier cosine and sine transforms.</td>
</tr>
<tr>
<td></td>
<td>(9 + 3)</td>
</tr>
<tr>
<td>PARTIAL DIFFERENTIAL EQUATIONS</td>
<td>Basic concepts of PDEs, wave equation, heat equation, steady state two-dimensional heat problems, solution by separating variables and Fourier series.</td>
</tr>
<tr>
<td></td>
<td>(9 + 3)</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**

**REFERENCES:**
1. Dennis G Zill and Patrick D Shanahan "A First Course in Complex Analysis with Applications", Jones and Bartlett Pvt Ltd., New Delhi, 2015

**19P202 MATERIALS SCIENCE**

|                  | (10)                                                                                                               |
| MAGNETIC PROPERTIES | Magnetic dipoles and magnetic field vectors, Dia, para, ferro, anti-ferro and ferrimagnetism, Hard and soft magnets, Hysteresis loss, Low-conducting magnets, super conducting magnets and conducting magnets, magnetorheology, ferrofluids and applications. |
|                  | (9)                                                                                                               |
| ADVANCED MATERIALS | Nanomaterials- Size-dependant properties, applications, Shape Memory Alloys (SMA)- Characteristics, Properties of Ni-Ti alloys, SMA actuated robotics prosthetic, Metallic glasses: properties and applications. Composites: functions of matrix and reinforcement in composites, Polymer, metal and ceramic matrix composites, carbon- carbon composites, Applications of composites in machine tools |
|                  | (9)                                                                                                               |
| LASER PROCESSING OF MATERIALS | Introduction to Laser. Functional requirements for material processing: Wavelength,                                          |


**TEXT BOOKS**:

**REFERENCES**:

**19P203 CHEMISTRY OF ENGINEERING MATERIALS**


**BATTERIES AND FUEL CELLS**: Batteries- characteristics-construction and working of Lechlanche, lead-acid, nickel-cadmium and lithium ion batteries- supercapacitors. Batteries for automobiles, satellites, torpedos, computer standby supplies. Fuel cell-theory, working principle and applications of proton exchange membrane , direct methanol fuel cells and solid oxide fuel cells.

**CORROSION AND PROTECTIVE COATINGS**: Forms of corrosion and their mechanism- galvanic, atmospheric, pitting, crevice and stress corrosion. Corrosion protection by design, cathodic protection, protective coatings, corrosion inhibitors - mention of types and applications.


**TEXT BOOKS**:

**REFERENCES**:

**19P204 ENGINEERING MECHANICS**

**STATIC EQUILIBRIUM OF PARTICLES & RIGID BODIES**: 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. - Rigid bodies:
moment of force about a point and an axis, moment of couple - Equivalent force-couple system, Equilibrium of rigid bodies - Types of supports - reactions on beams and frames

FRICITION: Static and kinetic friction, Co-efficient of friction, Laws of dry friction - Friction in wedges, ladder – Friction in Ropes and Belts

ANALYSIS OF TRUSSES: Types of structures, Simple truss: Assumptions, Roof trusses - Method of joints and Method of sections

CENTROID AND MOMENT OF INERTIA: Centre of gravity: Location of centroid of composite areas and composite solids, - Moment of inertia: Determination of area moment of inertia of composite plane areas, polar moment of inertia, - mass moment of inertia of solids, radius of gyration -

DYNAMICS OF PARTICLES: Kinematics: Motion characteristics, uniformly accelerated motion, rectilinear motion - - projectile motion, circular motion, oscillatory motion, - Kinetics: Applications of Newton’s II law and D'Alembert’s principle, Work done by a force - work energy theorem, conservation of mechanical energy, - Impulse and momentum: conservation of momentum, - Impact of elastic bodies - Direct central impact - oblique central impact

Total L: 45 +T: 15 = 60

TEXT BOOKS:

REFERENCES:

19P205 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

3 0 0 3

ELECTRIC CIRCUITS: Ohm's law, Kirchhoff's Laws, solving simple DC Circuits-single phase AC circuit fundamentals-Power, Power factor-solving simple AC circuits- Introduction to three-phase AC circuits


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

ELECTRONIC CIRCUITS: (Qualitative analysis only) Half wave and full wave rectifier, capacitive filters, zener voltage regulator, RC- coupled amplifier, frequency response, 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, Half adder, full adder, Flip flops, RS,JK,JK Master slave, D and T type, counters and shift registers.

Total L: 45

TEXT BOOKS:

REFERENCES:
1. Bhattacharya S K "Basic Electrical and Electronics Engineering", Pearson., 2012
2. Rajput R K "Basic Electrical and Electronics Engineering", University Science Press., 2012 , 2
19P210 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

LIST OF EXPERIMENTS:
1. Verification of Ohm’s and Kirchhoff’s Laws
3. Mechanical Characteristics of DC Shunt and Compound Motor
4. Load Test on 3 Phase Induction Motor
5. Electric Braking of 3 Phase Induction Motor (Dynamic Braking / Plugging)
6. Study of Half Wave and Full Wave Rectifiers with and without Filters
7. RC Coupled Amplifier
8. Application of Operational Amplifier: Adder, Subtractor, Integrator, and Differentiator
9. Study of Logic Gates and Implementation of Binary Adder / Subtractor
10. Implementation of Modulo – 16 Counter

Total P: 30

REFERENCES:
1. Department of EEE "Manual Prepared by EEE Department", Coimbatore,

19P211 C PROGRAMMING LABORATORY

1. Working with RAPTOR Tool — Flowchart Interpreter
2. Simple programs to understand Operators and expressions.
3. Decision making Statements: simple if, if..else, nested if..else, elseifladder, switch case
4. Loops: while, do..while, for
5. Implementation of one dimensional array
6. Implementation of two dimensional array
7. Working with Strings
8. Functions
9. Recursive functions
10. Structures: Arrays and Structures, Nested Structures
11. Structures and functions
12. Implementation of pointer and pointer arithmetic
13. Types of pointer: const pointer, pointer to a constant, void pointer, null pointer

Total P: 60

REFERENCES:
2. Ajay Mittal "Programming in C - A Practical approach", Pearson., New Delhi, 2010

19P212 INTERNSHIP

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

INDUSTRY ORIENTED ACTIVITIES:
Factory visit to study the layout, organization structure, and various departments. Study of construction, working of the following machine tools and processes
Broaching machine
Boring machine
Grinding machine
Electric discharge machining
Study of manufacturing processes.
Pressure die casting
Sand Casting
Rapid prototyping techniques
Study of assembly processes
Pump assembly
Motor assembly
Lathe assembly
REPORT PREPARATION
Preparation of a comprehensive report by the students for the industry oriented activities that will be assessed by a committee of faculty members.

REFERENCES:
CAD/CAM Centre "Practice of Machine Drawing using CAD Software", PSG College of Technology, Coimbatore, 2018
Sharma P C "Text Book of Production Technology (Manufacturing Processes)", S Chand & Company Ltd., New Delhi, 2014

SEMESTER - 3

19P301 NUMERICAL METHODS

SYSTEM OF LINEAR EQUATIONS, EIGENVALUES AND EIGENVECTORS:
Errors - approximations and round-off errors - truncation errors - system of linear equations-Gauss-elimination method, Crout’s method, Gauss-Seidel method, eigenvalues and eigenvectors - power method. (6 + 3)

NONLINEAR EQUATIONS:
False position method, Newton-Raphson method, modified Newton-Raphson method, Bairstow’s method. (6 + 3)

INTERPOLATION, DIFFERENTIATION AND INTEGRATION:
Lagrange interpolating polynomials, equally spaced data - Newton’s forward and backward interpolating polynomials, numerical differentiation – evenly spaced data, numerical integration- Newton-Cotes formulae, Trapezoidal rule, Simpson’s 1/3 rule. (6 + 3)

NUMERICAL SOLUTION TO ORDINARY DIFFERENTIAL EQUATIONS:

NUMERICAL SOLUTION TO 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. (6 + 3)

Total L: 30 + T: 15 = 45

TEXT BOOKS:

REFERENCES:
3. Amos Gilat and Vish Subramaniam, "Numerical Methods for Engineers and Scientists", Wiley India, New Delhi, 2014.

19P302 ENGINEERING METALLURGY

STRUCTURE OF ENGINEERING MATERIALS:
Amorphous and crystalline materials. Unit cell, lattice, crystal systems and crystal structures - SC, BCC, FCC and HCP structures, Packing factor. Miller indices, crystallographic planes and directions. Crystal imperfections. (8)

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS:

HEAT TREATMENT AND STRENGTHENING MECHANISMS:

MECHANICAL BEHAVIOUR AND TESTING:
Plastic deformation – slip mechanism, condition for slip, schmid factor, twinning. Fracture - definition, types and characteristics. Introduction to mechanical properties - tensile, hardness, impact, fatigue and creep testing - description of testing and physical interpretation of properties. (10)
FERROUS AND NON 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. Copper, Aluminium, Magnesium, Titanium, Lead and Tin alloys - composition, properties and applications. (7)

TEXT BOOKS:

REFERENCES:

19P303 STRENGTH OF MATERIALS

STRESSES AND STRAINS IN AXIALLY LOADED MEMBERS: Normal stress and strain, stress - strain diagram of ductile and brittle materials - Hooke's law, Poisson's ratio, shear stress and strain - proof resilience, factor of safety, thermal stress, volumetric strain, relationship between elastic constants. (10 + 3)

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 - Pressure vessels: Hoop and longitudinal stresses in thin cylindrical and spherical shells under internal pressure. (10 + 3)

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 - maximum bending moment and point of contra flexure. (7 + 3)

TEXT BOOKS:

REFERENCES:

19P304 FLUID MECHANICS AND MACHINERY

FLUID PROPERTIES AND STATICS: Properties of fluids - pressure field - manometry - forces on submerged bodies - buoyancy - flotation and stability (9 + 3)

FLUID KINEMATICS: Velocity field - flow visualization - Acceleration field - Fluid deformation - Control volume and system representations - Reynolds transport theorem - continuity equation (9 + 3)

FLUID DYNAMICS: Momentum equation - Navier – Stokes equation - Bernoulli equation - energy equation. (9 + 3)

REFERENCES:
SIMILARITY STUDIES AND FLUID MACHINERY: Buckingham's π theorem - Reynolds - Froude and Mach number and their application in model testing - Classification and Performance characteristics of fluid machines - Selection and Testing of pumps and blowers

(9 + 3)

Total L: 45 +T: 15 = 60

TEXT BOOKS:

REFERENCES:

19P305 WELDING TECHNOLOGY

3 0 0 3

BASIC WELDING PROCESSES: Comparison between casting and welding processes, definition and classification of welding as per AWS, advantages and disadvantages - basic welding positions, types of joints and weld, fundamental principles - gas welding, arc welding – applications, energy source characteristics, electrodes, flux, safety in welding. principles of soldering, brazing and adhesive bonding.

(9)

SPECIAL WELDING PROCESSES: FUSION: TIG and MIG, submerged arc welding, plasma arc welding, electro-slag welding - equipment and operations, laser beam welding, electron beam welding, thermit welding - applications and selection.
NON-FUSION: resistance welding, friction and friction stir welding, ultrasonic welding, diffusion welding, explosive welding - advantages, limitations, applications and process selection.

(9)


(9)

DESIGN OF WELDED JOINTS, INSPECTION AND TESTING OF WELDMENTS: Basic principles - weld symbols, design of weldments, welding codes, standards and cost estimation, welding procedure specifications (WPS) and procedure qualification record (PQR), welding defects - causes and remedies, residual stresses and distortion destructive and non-destructive testing of weldments.

(9)

AUTOMATION AND CAE IN WELDING: Automation in welding - seam tracking and arc sensing - welding robots. CAE IN WELDING: applications of CAE in modeling welding processes and temperature distributions.

(9)

Total L: 45

TEXT BOOKS:

REFERENCES:

19O306 ECONOMICS FOR ENGINEERS

3 0 0 3


(9)


(9)

PRODUCTION, COST AND REVENUE: Production Function, Total Product, Average Product and Marginal Product, Returns


TEXT BOOKS:

REFERENCES:

19P310 MACHINE DRAWING

SECTION VIEWS: Introduction to machine drawing. Sectioning, Sectional View - Types, Projection, Representation, Hatching and Importance, solid modeling and sectioning of mechanical elements using CAD Software

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, rivets, cotters, pins, keys, circlips, bearings, gears, springs and flanges.

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 and surface roughness symbols on part drawings.

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 CAD Software, creation of bill of materials and balloons, extraction of 2D views and sections.

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.

TEXT BOOKS:

REFERENCES:

19P311 METALLURGY AND STRENGTH OF MATERIALS LABORATORY

METALLURGY LABORATORY:
1. Study of metallurgical microscope.
2. Preparation of specimen for metallographic examination.
3. Identification and study of microstructure of white cast iron, grey cast iron, SG iron and malleable cast iron.
4. Identification and study of microstructure of low, medium and high carbon steel.
5. Identification and study of microstructure of stainless steel and tool steel.
6. Identification and study of microstructure of aluminum alloy and copper alloy. (15)

STRENGTH OF MATERIALS LABORATORY:
1. Tension test on metals: Stress strain characteristics - ductility - resilience - toughness.
2. Shear test on metals: Shear strength - single shear and double shear.
3. Hardness test on metals: Brinell, Vicker and Rockwell hardness tests.
4. Deflection test on beams: Load deformation characteristics, Young's Modulus, Maxwell's reciprocal law verification.
5. Impact test on metals: Charpy impact toughness test.
6. Test on helical springs: Compression, tension Springs - Load deformation characteristics, stiffness, shear stress, modulus of rigidity - strain energy.
7. Torsion test on beams: Torque and angle of twist characteristics, shear stress, modulus of rigidity - strain energy.
8. Study of strain gauges - various types of strain measurements. (15)

REFERENCES:

19K312 ENVIRONMENTAL SCIENCE

INTRODUCTION TO ENVIRONMENT: Environment - Definition, scope and importance. Types and composition of atmosphere – particles, ions and radicals. Ozone layer- significance, formation and depletion. Ecosystems - Structure and functions, components; energy flow, food chains, food web, Biodiversity-levels, values and threats - India as a mega-diversity nation – hotspots of biodiversity – endangered and endemic species of India – conservation of biodiversity. (6)


ENVIRONMENTAL POLLUTION: Definition – Sources, causes, impacts and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) RF hazards - Role of an individual in prevention of pollution. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides – Case studies, consequences and rescue measures. (6)


TEXT BOOKS:

REFERENCES:

SEMESTER - 4

19P401 PROBABILITY AND STATISTICS

PROBABILITY AND DISCRETE RANDOM VARIABLES: Probability, axiomatic approach to probability, Baye's theorem,
discrete random variables, probability distributions and probability mass functions, cumulative distribution functions, mean and variance, binomial, Poisson and geometric distributions. (6 + 3)

CONTINUOUS RANDOM VARIABLES: Continuous random variables, probability distributions and probability density functions, cumulative distribution functions, mean and variance, uniform, exponential and normal distributions. (6 + 3)

JOINT PROBABILITY DISTRIBUTIONS: Two dimensional discrete and continuous random variables, marginal and conditional probability distributions, independence, covariance, correlation and linear regression. (6 + 3)

STATISTICAL INFERENCE: Point estimation - interval estimation – testing of hypotheses for means – large, small samples and matched pairs tests – testing of hypotheses for proportions, chi square test for goodness of fit and independence of attributes. (6 + 3)

VARIANCE TESTS AND ANALYSIS OF VARIANCE: Testing of Hypotheses for variances - analysis of variance - completely randomized design, randomized block design. (6 + 3)

TEXT BOOKS:

REFERENCES:

19P402 THERMAL SYSTEMS AND HEAT TRANSFER

BASIC CONCEPTS OF THERMODYNAMICS: Introduction to thermal systems - properties, state, equilibrium, processes and cycles - forms of energy - temperature and zeroth law of thermodynamics - properties of pure substances - property diagrams - energy transfer by heat and work interactions - applications. (8 + 3)

FIRST AND SECOND LAW OF THERMODYNAMICS: First law - internal energy, enthalpy - first law applied to non-flow systems and flow processes - applications - second law - refrigerators and heat pumps - carnot cycle, entropy and irreversibility - applications. (10 + 3)

POWER CYCLES: Rankine cycle - superheat, reheat and regenerative cycle - steam power plant - boilers - air standard cycles - Otto cycle and Diesel cycle - IC engines - principle of operation - petrol and diesel engines - ignition systems - fuel injection systems, cooling and lubrication systems - calculation of mechanical and thermal efficiencies - heat balance and performances characteristics. (10 + 3)

REFRIGERATION AND AIR CONDITIONING: Refrigeration terminology - vapor compression refrigeration cycle - multistage compression refrigeration and cryogenic systems - psychrometric chart - human comfort - summer and winter air conditioning systems - cooling load calculations. (8 + 3)

HEAT TRANSFER: Modes of heat transfer - heat conduction through planes - cylinder and spherical geometries - critical thickness of insulation - natural and forced convection - radiation heat transfer - Stefan-Boltzmann law - empirical relations for heat transfer coefficients - case studies of manufacturing processes involving application of thermal concepts. (9 + 3)

TEXT BOOKS:

REFERENCES:
19P403 METAL FORMING PROCESSES


FORGING: Classification of forging process - Hand forging equipments and operations - Types of press and hammer - Slab analysis of plane strain and axisymmetric forging problems - Forging defects, causes and remedies. (8)

ROLLING: Terminology of rolling process - Classifications of rolling mills - Forces and geometrical relationship in rolling, analysis of strip rolling process - Special rolling processes - Rolling defects, causes and remedies. (8)


SHEET METAL FORMING AND POWDER METALLURGY: Types of bending, calculations of bending allowance and force. Deep drawing, shearing, stretch forming and metal spinning. Special forming methods: High energy rate forming (HERF) - Explosive forming, electromagnetic forming, electro hydraulic forming; High velocity forming (HVF) - petro forge hammer and dynapak process, super plastic forming. Powder metallurgy (PM): Production of metal powders, powder characteristics. Process fundamentals - powder blending, compacting, sintering and secondary operations. PM product design, recent trends and special PM processes. (11)

TEXT BOOKS:

REFERENCES:

19P404 FOUNDRY TECHNOLOGY

SAND CASTING: Introduction to metal casting, advantages and limitations of casting process. Sand casting - pattern and core box - types and materials. Moulding and coremaking - moulding and core sand-constituents and characteristics, preparation, properties and sand testing techniques. Moulding methods. (10)

GATING SYSTEM: Elements of a gating system, types of gates - applications, advantages and limitations, classification of gating systems, hydraulics and design of gating systems, influence of gating design on casting quality. (9)

SOLIDIFICATION AND RISERING OF CASTINGS: Solidification of pure metal and alloys, need and functions of a riser, design of risering systems - caine, naval research laboratory and modulus approaches, risering aids. (9)

MELTING AND INSPECTION: Furnaces - types, description, advantages and limitations. Selection of furnace for a melting application. Types of pouring equipments, melting and pouring practices. Finishing and inspection operations on castings, non destructive testing of castings. (8)

SPECIAL CASTING PROCESSES AND FOUNDRY PRACTICES: Permanent mould casting, die-casting, centrifugal casting, shell moulding, investment casting, squeeze casting, slush casting and continuous casting processes - characteristics, capabilities, advantages and limitations. Discussion on foundry practices for ferrous and nonferrous alloys. Introduction to casting simulation. (9)

TEXT BOOKS:

REFERENCES:

**19P405 MECHANICS OF MACHINES**

**BASICS OF MECHANISMS:** Terminology and definitions, degrees of freedom, Grashof’s Law - Kinematic inversions – four bar chain, single slider crank chain, double slider crank chain, mechanisms for societal applications - velocity and acceleration analysis of simple mechanisms using graphical method.

**(11 + 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.

**(7 + 3)**

**STATIC FORCE ANALYSIS:** Free body diagram - conditions of equilibrium, two, three and four force members - force analysis of simple mechanisms.

**(5 + 3)**

**GEARS AND FLYWHEEL:** Spur gear terminology and definitions, types of gears - fundamental law of toothed gearing and tooth forms - interchangeable gears, gear tooth action – interference, pressure angle, undercutting and contact ratio - Need of flywheel, turning moment diagram – fluctuation of energy and speed, weight of flywheel required.

**(10 + 3)**

**BALANCING AND VIBRATION:** Balancing of rotating masses in single plane and several planes - balancing of reciprocating masses - primary and secondary forces and couples, balancing of multi–cylinder inline engine - Basic features and types of vibratory systems, degrees of freedom, single degree of freedom system – equations of motion and response of undamped and damped free vibration.

**(12 + 3)**

**Total L: 45 +T: 15 = 60**

**TEXT BOOKS:**

**REFERENCES:**

**19P406 MACHINING TECHNOLOGY**

**THEORY OF METAL MACHINING:** Introduction to materials and manufacturing, overview of 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 and cutting temperature.

**(9)**

**MACHINING OPERATIONS AND MACHINE TOOLS:** Machining and part geometry, turning and related operations, drilling and related operations, milling, machining centres and turning centres, other machining operations, machining operation for special geometries and high speed machining.

**(10)**

**CUTTING TOOL TECHNOLOGY:** Tool wear, tool life and Taylor's tool life equation. Tool materials: HSS, cemented carbides, coated carbides, ceramis, diamond, cubic boron nitride. Manufacturing of cutting tools, tool geometry, cutting fluids, machinability, tolerance and surface finish. Selecting feed and depth of cut and optimizing cutting speed.

**(9)**

**GRINDING AND OTHER ABRASIVE PROCESSES:** Cylindrical, surface, profile grinding machines. Grinding wheel marking and analysis of grinding process. Related abrasive processes: honing, lapping, super finishing, polishing and buffing.

**(8)**

**NONTRADITIONAL MACHINING PROCESSES:** Mechanical energy processes, electrochemical machining processes, thermal energy processes, chemical machining and application considerations.

**(9)**

**Total L: 45**

**TEXT BOOKS:**
REFERENCES:

19P410 THERMAL ENGINEERING AND FLUID MACHINERY LABORATORY

LIST OF EXPERIMENTS:
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. Performance test on reciprocating compressor.
5. Performance test on refrigeration tutor.
6. Performance study on axial flow fan.
7. Calibration of flow meters, venturimeter, orifice meter.
10. Performance test on centrifugal pump.

REFERENCES:

19P411 MACHINING TECHNOLOGY LABORATORY

LIST OF EXPERIMENTS:
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:

19Q413 SOFT SKILLS DEVELOPMENT

SOFT SKILLS DEVELOPMENT:
1. Body Language and Professionalism
2. Interpersonal skills
3. Goal setting
4. Impression Management
5. Team Building
6. Time Management
7. Stress Management
8. Convincing Skills
9. Motivation
10. Change Management
11. Communication Confidence
12. Group discussion basics
13. Personal Interview basics
14. Resume writing

REFERENCES:

19O412 INDIAN CONSTITUTION

2000

INTRODUCTION: Evolution of Indian Constitution; Significance of Constitution; Composition; Preamble and its Philosophy. (4)

RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES: Fundamental Rights - Writs and Duties, Directive Principles of State Policy. (6)

COMPOSITION OF PARLIAMENT AND FEDERALISM: Union Government, President and Vice President, Houses of the Parliament and their functions; Composition of State Legislature; Powers, Functions and Position of Governor, Function of Chief Ministers, Council of Ministers; The Indian Federal System, Administrative Relationship between Union and States. (8)

BILLS AND CONSTITUTION AMENDMENT PROCEDURE: Types of Bills, Stages of passing of Bill into an Act, Veto Power, Constitution Amendment Procedure, Various Amendments made and their significance for India. (6)

JUDICIARY: Supreme Court and High Court; Functions and powers, Judicial Review. (6)

Total L: 30

TEXT BOOKS:

REFERENCES:

SEMESTER – 5

19P501 COMPUTER NUMERICAL CONTROL MACHINES

3003

CONSTRUCTION: Types of CNC machines, turning centre, machining centre, multitask machines, special purpose machines - structures, guide/slideways, LM guide way, ball screws, spindle, bearings, couplings, hydraulic power pack, actuators, pumps, valves, servo motor - drives, feedback devices - encoder, control system, block processing and interpolation. (10)

PART PROGRAMMING - BASICS: ISO and EIA standards, G and M codes, absolute, incremental positioning, work datum, tool offset, process plan, work positioning, clamping procedures, lathe programming, step turning, programming simple components machining centre programming, compensations, drilling, profile and pocket milling. (9)

PART PROGRAMMING - ADVANCED: Turning centre programming, programming for industrial components – cast iron components, bar feeding components, multi-operation components, canned cycles, thread cutting cycle, machining centre programming, work setups, reducing cycle time, automobile components, engine block, dry run, canned cycles, CAM software programming. (9)

CUTTING TOOLS AND WORK HOLDINGS: Cutting tools for turning, milling, drilling, types, inserts, coated tools, cutting fluids, tool
holders, ISO designation, automatic tool changer, tool magazine, turret, automatic pallet changer, chucks, types, hard jaw, soft jaw, degrees of freedom, clamping principles. (8)

TESTING AND MAINTENANCE: Accuracy, repeatability, ISO standards, geometrical alignment test, test charts, standard test specimen, calibration, laser interferometer, ball bar test, machine tool vibration, isolation, test for thermal stability, process capability, preventive maintenance, centralized lubrication system, remote diagnosis, IIoT. (9)

TEXT BOOKS:

REFERENCES:

19P502 PROCESS PLANNING AND COST ESTIMATION


COST ESTIMATION: Estimating the cost of machined components, optimum machining conditions - Taylor's equation, optimum cutting speed for minimum cost, model for maximum production. Cost estimation of welded components, forgings and castings. (9)

COST MANAGEMENT: Cost control, variance analysis - labour, material cost variances. Value engineering (VE) - steps, VE job plan, different phases, function analysis system technique (FAST). Target costing. Benefit/cost analysis. Break even analysis - linear, non-linear models, different areas of applications, multi product break even analysis. Time value of money. (9)

TEXT BOOKS:

REFERENCES:

19P503 MANUFACTURING METROLOGY

DIMENSIONAL METROLOGY: Terminologies, classification of errors, evaluation of uncertainty, ISO and BIS standards for basic measuring instruments. Linear measurement - line and end standard, slip gauges, micrometers, vernier caliper, dial gauges and comparators - types, principle and applications. Angular measurement - sine bar, angle gauges, autocollimator, angle dekker and tool maker's microscope. (9)

SURFACE AND FORM METROLOGY: Surface roughness - causes, need to control surface roughness, functional significance of surfaces, elements of surface texture and surface integrity, surface roughness parameters and their measurement. Measurement of form errors-straightness, flatness, circularity and cylindricity. (9)
DESIGN OF LIMIT GAUGES: Types, Taylor’s principle of gauge design, principles of limit system, design of limit gauges. (8)

SCREW THREAD AND GEAR METROLOGY: Standard thread profiles, best wire size, measurement of major, minor and effective diameter by two and three wire methods. Gear tooth profile measurement, gear pitch measurement, run out and composite error measurement. (9)


TEXT BOOKS:

REFERENCES:

19P504 DESIGN OF MACHINE ELEMENTS

DESIGN AGAINST STATIC AND FATIGUE FAILURES: Types of stresses, design of eccentrically loaded members and curved beams, theories of failure. Fatigue loads, stress concentration and notch sensitivity factors, S-N curve - design for finite and infinite life. Soderberg, Goodman and Gerber equations, modified Goodman diagram, Miner’s rule. (10 + 4)

BELT DRIVES, SHAFTS, AND COUPLINGS: Basic equations of flat belt drives, design of flat and V-belt drives based on manufacturer’s data. Forces on shafts due to gears, belts and chains, estimation of shaft size based on strength and rigidity. Design of keys. Types and applications of couplings, design of rigid couplings and flexible flange couplings. (9 + 3)

DETACHABLE AND PERMANENT JOINTS: Design of bolted joints under static and fluctuating load. Design of riveted joints. Types of welded joints, strength of welds - transverse and parallel fillet welds, design of axially loaded unsymmetrical sections and eccentrically loaded joints. (9 + 3)

GEARS, SPRINGS AND BEARINGS: Design of spur gears - force analysis, tooth stresses, design of spur gears based on strength and wear considerations. Design of helical coil springs under static and fatigue loading. Rolling contact bearings - static and dynamic load carrying capacity, cubic mean load, probability of survival, selection of deep groove ball bearings. Sliding contact bearings - Sommerfeld number, dimensionless parameters, design of hydrodynamic bearings. (8 + 2)

CLUTCHES AND BRAKES: Torque transmitting capacity of clutches - uniform pressure and wear theory, design of different types of clutches - single plate, multi-disc, cone and centrifugal clutch. Energy absorbed and heat dissipation in brakes, design of different types of brakes - single shoe, double shoe, pivoted block, band brakes and internally expanding brakes. (9 + 3)

TEXT BOOKS:

REFERENCES:

19P505 APPLIED HYDRAULICS AND PNEUMATICS

ELEMENTS OF FLUID POWER SYSTEM: Introduction to fluid power - properties: hydraulic fluids, air - Selection of hydraulic fluids - comparison between hydraulics and pneumatics - Symbols - Compressors, Pumps and Motors: types, characteristics - Cylinders:
types, typical construction details - Valves for control of direction, flow and pressure: types, typical construction details - Servo and Proportional Valves.

HYDRAULIC SYSTEM DESIGN: Power pack; elements, design - Pipes: material, pipe fittings, seals and packing - Maintenance of hydraulic systems - Selection criteria for cylinders, valves, pipes - Heat generation in hydraulic system - Losses in a hydraulic system.


FLUID POWER CONTROLS: Electro pneumatics - ladder diagram - PLC: construction, types, operation, and programming - Application with timers and counters.

TEXT BOOKS:

REFERENCES:

19P510 MANUFACTURING TECHNOLOGY LABORATORY

LIST OF EXPERIMENTS:
1. Facing and turning exercise using CNC Lathe.
2. Canned cycle exercise using CNC Lathe.
3. Linear, circular interpolation - Face and end milling exercise using CNC VMC.
4. Canned cycles exercise using CNC VMC.
5. Product development using subtractive rapid prototyping / 3D printing.
6. Improvement of dimensional and geometrical accuracies using milling, surface grinding and lapping processes.
7. Tool and cutter grinding, tool wear measurement and cutting forces measurement using dynamometers.
8. Reduction of circularity and cylindricity error by honing process.
11. Demonstration of welding processes — Ultrasonic and TIG.
12. Demonstration of Internet of Things (IoT) for various machines.

REFERENCES:

19P511 METROLOGY AND COMPUTER AIDED INSPECTION LABORATORY

LIST OF EXPERIMENTS:
1. Calibration of vernier caliper, micrometer and dial gauge.
2. Evaluation of repeatability and reproducibility of comparators.
5. a) Gear metrology - Base tangent measurement and gear composite error measurement. b) Thread inspection - Measurement of major and effective diameter of external screw thread using floating carriage micrometer.
6. a) Surface finish measurement using electronic surface roughness tester. b) Form measurements: Measurement of
straightness, flatness, circularity and cylindricity.
7. Straightness measurement using autocollimator.
8. Measurement of part dimensions using machine vision system.
10. Displacement measurement using Michelson interferometer.

REFERENCES:

19Q513 BUSINESS AND MANAGERIAL COMMUNICATIONS

BUSINESS AND MANAGERIAL COMMUNICATIONS:
1. Advanced Group discussion
2. Advanced Resume writing
3. Mock Group discussion
4. Advanced Personal Interview
5. Mock Personal Interview
6. Cracking special Interviews
7. Essential Grammar for Placements
8. Vocabulary for Placements
9. Email writing
10. Paragraph writing
11. Essay writing

REFERENCES:

SEMESTER - 6
19P601 QUANTITATIVE METHODS IN MANAGEMENT


GAME THEORY: Two person zero sum game, pure and mixed strategies, dominance principle, graphical solution, linear programming solution. (9)

DECISION MAKING THEORY: Decisions under uncertainty, under certainty and under risk, decision trees, expected value of perfect information and imperfect information. (9)

QUEUEING THEORY: Elements of queueing model, relationship between exponential and Poisson queueing models, (M/M/1), (M/M/1/N), (M/M/c) and self-service model. (9)

REPLACEMENT THEORY: Replacement of items that deteriorate, replacement of items that fail, group replacement. (9)

REFERENCES:

REFERENCES:

19P602 JIGS, FIXTURES AND DIE DESIGN

3 0 0 3

PRINCIPLES OF LOCATING AND CLAMPING ELEMENTS: Principles of location, planes of movement, locating from flat surface, internal diameter, external diameter and profile, spring stop buttons and types of clamps. (8)

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 of jig for a given component. (9)

DESIGN OF FIXTURES: Types of fixtures: Milling, lathe, boring, broaching, grinding, welding and modular fixtures - Design of fixture for a given component. (8)

DESIGN OF PRESS TOOLS: Power presses, press working terminologies, operations and computation of press capacity. Basics of die cutting operations, cutting action in punch and die operations, die clearance. Types of die construction: Progressive, compound and combination dies. Die design fundamentals: Blanking and piercing die construction, pilots, strippers and pressure pads, strip layout - Drawing and bending die design. Design and development of dies for simple components. (10)

DESIGN OF PLASTIC INJECTION MOULDS: Mould elements and construction. Types of mould: Two plate and three plate moulds. Feed, ejection and cooling systems, mould materials and manufacturing. (10)

Total L: 45

TEXT BOOKS:

REFERENCES:

19P603 DESIGN FOR MANUFACTURE AND ASSEMBLY

3 0 0 3


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. (6)


DESIGN FOR MACHINING, FORM DESIGN OF CASTINGS AND WELDMENTS: Design features to facilitate machining - component design, machining considerations - redesign for manufacture - examples. Redesign of castings based on parting line considerations - minimising core requirements - redesigning cast members using weldments - use of welding symbols - design of weldments. (8)
TOLERANCE CHARTING TECHNIQUE: Operation sequence for typical shaft type of components - preparation of process drawings for different operations - tolerance worksheets and centrality analysis – examples. Datum features - functional and manufacturing.

TEXT BOOKS:

REFERENCES:

19P604 AUTOMATION AND ROBOTICS

MANUFACTURING AND AUTOMATION: Fundamental concepts in manufacturing and automation - Types and Levels of automation - automation strategies - automation migration strategy - Introduction to CIM - components of CIM - process design for CIM - Automated flow lines - methods of work transport - automated flow lines with and without storage buffers.

AUTOMATED ASSEMBLY: Parts feeding devices - single and multi-station assembly machines - Performance and Economics of assembly systems - Feasibility study for assembly automation.


TEXT BOOKS:

REFERENCES:

19P610 FLUID POWER LABORATORY

FLUID POWER LABORATORY:
1. Study of Fluid power symbols and hydraulic elements
2. Design and simulation of systems using single acting actuator, double acting actuator and Pneumatic elements
3. Design and simulation of pneumatic systems with cycle selection and emergency modules
4. Design and simulation of pneumatic systems using electrical control
5. Design and simulation of pneumatic systems using PLC
6. Design and simulation of hydraulic and pneumatic systems using software

REFERENCES:
19P611 CAD, CAM AND CAE LABORATORY

LIST OF EXERCISES:

1. Constraint based modeling and generation of production drawing
2. Top down modeling
3. Static analysis of a beam
4. Static analysis of a machine tool component
5. Modal analysis of a machine tool component
6. Analysis of a metal casting problem
7. Analysis of simple welding problem
8. Analysis of a sheet metal forming problem
9. NC code generation for prismatic components
10. NC code generation for cylindrical components

Total P: 60

REFERENCES:

19Q613 QUANTITATIVE AND REASONING SKILLS

QUANTITATIVE AND REASONING SKILLS:
1. Number System, Time and Work
2. Percentages, Simple and Compound Interests
3. Time, Speed and Distance
4. Permutation, Combination and Probability
5. Ratio and Proportion
6. Profit, Loss and Partnership
7. Logarithms, Progressions, Geometry and Quadratic Equations
8. Coding and Decoding
9. Series, Analogy and Odd Man Out
10. Visual Reasoning
11. Data Arrangements
12. Blood Relations
13. Clocks, Calendars and Direction Sense
14. Cubes, Logical Connectives and Syllogisms
15. Venn Diagrams, Interpretations and solving

Total P: 30

REFERENCES:
SEMESTER - 7

19P701 ENVIRONMENT CONSCIOUS MANUFACTURING

2002

ENVIRONMENT CONSCIOUSNESS: The human population's effects on the earth - environmentally conscious Manufacturing - components - system effects and assessment. (6)

AIR POLLUTION IN MANUFACTURING SYSTEMS: Origin of airborne particles in manufacturing - traditional and modern particulates mitigation/elimination techniques. (6)

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. (6)

SOLID POLLUTION IN MANUFACTURING SYSTEMS: Origin of solid waste in manufacturing - Industrial solid and hazardous waste management. (6)

ENVIRONMENTAL MANAGEMENT SYSTEMS: Framework and benefits - Concepts of ISO 14001 - requirements of ISO 14001. (6)

Total L: 30

TEXT BOOKS:

REFERENCES:

19P702 PRODUCTION AND OPERATIONS MANAGEMENT

3003

FORECASTING AND PLANT DESIGN: Demand forecasting - techniques of forecasting, forecast errors, forecast control. Long range capacity planning - decision tree analysis, plant location factors, location evaluation methods. Plant layout - types, characteristics, layout design techniques - SLP and CRAFT. (9)

AGGREGATE PLANNING AND MASTER PRODUCTION SCHEDULING: Approaches to aggregate planning - graphical, empirical and optimization, development of master production schedule, material requirement planning, MRP Lot sizing, introduction to MRPII and ERP. (9)

INVENTORY MODELS AND SEQUENCING / SCHEDULING: Classification of fixed order quantity models, deterministic demand models, inventory models with probabilistic demand, price breaks, quantity discount, safety stocks. Selective inventory control techniques - ABC inventory system and vendor managed inventories. Scheduling process - n jobs through one machine, priority dispatching rules, mean flow time, tardiness. Order sequencing - Johnson's algorithm n jobs through 2 machines, extended Johnson's algorithm n jobs through m machines. (9)

WORK SYSTEMS ENGINEERING AND LEAN TOOLS: Method study - recording tools and techniques, principles of motion economy. Work measurement - standard time, stopwatch time study, rating systems, work sampling and predetermined motion time systems. Value stream mapping - The as-is diagram, the future state map, seven wastes of lean manufacturing. SS, kaizen, kanban and line balancing. (9)

MAINTENANCE AND PROJECT MANAGEMENT: Types of maintenance, replacement problems, bathtub curve, TPM - pillars of TPM, six big losses, OEE, OOE, TEEP. PERT/CPM - Principles, applications and time - cost / trade-off crashing. (9)

Total L: 45

TEXT BOOKS:

REFERENCES:

19P710 INDUSTRIAL ENGINEERING AND LEAN PRACTICES LABORATORY

LIST OF EXPERIMENTS:
2. Project management using PERT/CPM.
3. Quality assurance using variable and attribute control charts.
4. Planning and analysis of experiments.
5. Physiological ergonomic evaluation.
6. Anthropometry exercises.
8. Exercise on Kanban using lean simulation kit.

REFERENCES:

19P711 INNOVATION PRACTICES

INNOVATION PRACTICES LABORATORY IS TO IDENTIFY A CONSUMER PRODUCT AS NEEDED BY THE MARKET AND MAKE A PHYSICAL PROTOTYPE BY FOLLOWING THE PRODUCT DEVELOPMENT METHODOLOGY GIVEN BELOW:

3. Model / prototype development.
4. Preparation of a detailed report.
5. In order to enrich the product innovation process this course will be provided with demonstration of the following i) Reverse engineering hardware, software and the procedure. ii) 3D scanning. iii) Rapid prototyping techniques like Fused Deposition Modelling, Selective Laser Sintering, and vacuum casting. iv) Virtual reality hardware, software and their applications in virtual prototyping. v) Failure Mode and Effect Analysis (FMEA) approach

REFERENCES:

19P720 PROJECT WORK I

- Review of fundamentals
- Identification of a problem domain
- Need for the current study
- Literature survey and patent/design registration /trademarks search
- Problem formulation based on the literature survey
- Objectives and feasibility study
• Methodology and Time Line of activities
• Progress of the work
• Conclusions
• Report and technical paper preparation

SEMMESTER - 8

19P820 PROJECT WORK II

0 0 8 4

• Identification of a problem domain
• Need for the current study
• Literature survey and patent/design registration /trademarks search
• Problem formulation based on the literature survey
• Objectives and feasibility study
• Methodology and Time Line of activities
• Progress of the work
• Detailed analysis and interpretation of results
• Validation of results
• Conclusions
• Report and technical paper preparation

LANGUAGE ELECTIVES

19G001 COMMUNICATION SKILLS FOR ENGINEERS

0 0 4 2

COMMUNICATION CONCEPTS :
Process of Communication
Inter and Intrapersonal Communication
Inter and Intrapersonal Communication Activities

FOCUS ON SOFT SKILLS :
Etiquette — Work Place etiquette — Telephone etiquette
Body Language
Persuasive Communication
Public Speaking
Critical Reasoning and Conflict Management based on Case Studies
Group Communication
Meetings
Interview Techniques

TECHNICAL WRITING :
Technical Writing Principles
Style and Mechanics
Technical Definitions – Physical, Functional and Process Descriptions
Technical Report Writing
Preparing Instructions and Manuals
Interpretation of Technical Data

BUSINESS CORRESPONDENCE :
Writing Emails
Preparing Resumes
Memos
Technical and Business Proposals

TECHNICAL COMMUNICATION :
Seminars
Process Description and Group Discussions
Use of Visual Aids

Total P: 60
TEXT BOOKS:
1. Faculty Incharge "Course Material on "Communication Skills for Engineers"", PSG College of Technology., Coimbatore, 2019

REFERENCES:

19G002 GERMAN- LEVEL A1.1

0 0 4 2

GUTEN TAG! :
1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic

FREUNDE, KOLLEGEN UND ICH :
1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural (10)

IN DER STADT :
1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences
2. Vocabulary: related to the topic
3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs (12)

GUTEN APPETIT! :
1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences
2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs (13)

TAG FÜR TAG/ZEIT MIT FREUNDEN :
1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone
2. Vocabulary: related to the topic
3. Grammar: Time related prepositions, Possessive articles, Modalverbs (15)

Total P: 60

TEXT BOOKS:
2. Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCES:
3. Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)*, Max Hueber Verlag., Munchen, 2004

19G003 FRENCH LANGUAGE LEVEL 1

0 0 4 2

PARTS OF SPEECH :
1. inviter et répondre à une invitation, Pronoms sujets
2. L'article défini, l'article indéfini
3. Conjugation : présent, adjectifs possessifs
4. interrogation, décrire les personnes
5. La vie de quatre parisiens de professions différentes (12)

ELEMENTS OF GRAMMAR :
1. Exprimer l'ordre et l'obligation demander et commander
2. l’adjectif possessifs, l’article partitif, l’article démonstratif, négation ne
3. pas, l’article contracté
4. verbe pronominaux
5. prepositions

SENTENCE STRUCTURE :
1. Raconter et reporter-donner son avis
2. Futur simple, pronom complètement d’objet direct, passé composé
3. Plusieurs région de France, imparfait, pronom y/en, imparfait

TENSES AND NUMBERS :
1. Demander l’autorisation-passé récent, futur proche
2. La vie administrative et régionale, Pluriel des noms, moyens de transport

DISCOURSE :
1. le discours rapporté, décrire un lieu, exprimer ses préférences
2. décrire la carrière, discuter d’système éducation de France
3. parler de la technologie de l’information

TEXT BOOKS:

REFERENCES:
2. Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French", ..
3. Simone Renaud, Dominique van Hooff "En bonne forme", ..

19G004 BASIC JAPANESE

JAPANESE PEOPLE AND CULTURE :
1. Basic greetings and responses
2. Basic script — Method of writing hiragana and katakana — Combination sounds and simple words
4. Possessive noun particle “no” — Japanese apartments: Greeting your neighbor

PATICLE “NI (AT)“ FOR TIME :
1. kara (from) ~ made(until) — Particle “to (and)”
2. Time periods: Days of the week, months, time of day —Verbs (Present / future and past tense)
3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle “e”.

LIKES AND DISLIKES :
1. Potential verbs (wakarimasu and dekimasu) — “Kara (~ because)”
2. Adverbs — Asking some one out over the phone-Verbs denoting presence
3. Introduction to Adjectives (na and ii type) -Verb groups — I, II and III — Exercises to group verbs- Please do (te kudasai)
4. Present continuous tenses (te imasu) — Shall it? (~ mashou ka)— Describing a natural phenomenon (It is raining)

DIFFERENT USAGES OF ADJECTIVES :
1. Comparison — Likes and dislikes — Going to a trip- Need and desire (ga hoshii) — Wanting to . . . (Tabeti desu)- Going for a certain purpose (ni —ni ikimasu)
2. Choosing from a menu-Adjectives (“i” and “na” type) — Adjectives (Positive and negative useage)

ROLE PLAYS IN JAPANESE :
1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party

TEXT BOOKS:
REFERENCES:
3. Minna No Nihongo “Translation & Grammatical Notes In English Elementary”, .

PROFESSIONAL ELECTIVES

19P001 MECHATRONICS

INTRODUCTION TO MECHATRONICS SYSTEM: Key elements - Mechatronics Design process - Types of Design - Traditional and Mechatronics designs – Advanced approaches in Mechatronics - Man machine interface, industrial design and ergonomics, safety.

REAL-TIME INTERFACING: Introduction - Elements of data acquisition and control - Overview of I/O process, Analog signals, discrete signals and Frequency signals – Over framing.


ADVANCED APPLICATIONS IN MECHATRONICS: Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics – Fuzzy Logic Applications in Mechatronics – Microsensors in Mechatronics.

TEXT BOOKS:

REFERENCES:

19P002 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.


Total L: 45

54
19P003 MAINTENANCE AND SAFETY ENGINEERING

3 0 0 3

MAINTENANCE: Types of maintenance - breakdown, preventive, predictive, condition based maintenance, total productive maintenance, maintenance prevention, reliability centered maintenance - MTBF, MTTR - elements of preventive maintenance - checklist, schedule, procedure. (9)

TOTAL PRODUCTIVE MAINTENANCE: Principles - preparatory stages of TPM implementation - TPM organization structure, TPM policies and aids, master plan - small group activities, autonomous maintenance, establishing planned maintenance, training, developing equipment management program. (11)

SAFETY SYSTEMS ANALYSIS: Introduction of safety systems, safety information system, industrial safety engineering, job safety analysis, OSHA regulations - design for safety, lock out / tag out system, work permit system - safety in power press, cranes and boiler operations - safety in foundry, forging, welding, hot working, cold working and electroplating. (10)

FIRE PROTECTION SYSTEM: Chemistry of fire - water sprinkler - fire hydrant - alarm and detection system - fire suppression system - CO2 system, foam system, Dry Chemical Powder (DCP) system, halon system, portable extinguisher. (8)


Total L: 45

TEXT BOOKS:

REFERENCES:

19P004 FINITE ELEMENT APPLICATIONS IN MANUFACTURING

3 0 0 3

BASIC CONCEPTS: Background study on Finite Element Method (FEM) - need for application of FEM in various engineering domains - transforming physical model in to mathematical model - strong and weak form of 1D physical problems - approximation using interpolation or trial functions - solving 1D structural and thermal problem - approach to solve 2D and 3D models. (12)

DISCRETIZATION: Introduction, concept of elements - 1D, 2D and 3D elements - plane stress and plane strain models - shape functions - direct stiffness approach - stiffness matrix - element assembly - solving for unknowns - global and natural coordinate systems and Jacobian for transformations. (9)

GOVERNING EQUATIONS: Mathematical modeling 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. (6)
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 - modelling of rolling and extrusion processes. (9)

FEA OF METAL CASTING AND WELDING PROCESSES: Overview of transport phenomena in metal casting - simple case studies on sand mould casting using CAE software - introduction to Computer-aided design and analysis of Injection moulded components using CAE software - model for manual metal arc welding - FEA analysis of welding distortion and residual stress using CAE software. (9)

TEXT BOOKS:

REFERENCES:

19P005 DESIGN AND MANUFACTURE OF GEARS

3 0 0 3

INTRODUCTION TO GEARS: Types of gears, classification, application of gears, gearboxes, gear drawing. Review of gear fundamentals - Law of gearing, nomenclature, interference, minimum number of teeth, gear correction - So and S, Gear tooth forces.

GEAR DESIGN: Design of spur gears, design of helical gears, design of worm and worm wheel, design of bevel gears. (11)

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. (8)


GEAR FINISHING AND OTHER PRODUCTION 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. 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. (9)

TEXT BOOKS:

REFERENCES:

19P006 PRODUCT LIFECYCLE MANAGEMENT

3 0 0 3

PRODUCT DEVELOPMENT AND PRODUCT LIFECYCLE: Product development process and functions, present market constraints, need for collaboration, collaborative product development, use of internet class technologies and data transfer, various developments on internet technology that support product development and its impact on business. Concept of product lifecycle - different phases of product lifecycle and corresponding technologies, its uses and examples. (9)
PRODUCT DATA MANAGEMENT (PDM): PDM functions, PDM system and importance, architecture of PDM systems, 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: Product Lifecycle Management (PLM) architecture, components of PLM, lifecycle problems to resolve, Workflows - lifecycle and work flow integration, product configuration, bill of materials management, product structure, configuration management and engineering change management. Introduction to Product Manufacturing Information (PMI) and Model Based Definition (MBD). (10)

PRODUCT VISUALISATION: Use of CAD neutral approach and visualization techniques in product development, capabilities of PLM visualization software - light weight representations, markup method, representation information repository, use of visualization in different stages of lifecycle, case studies. Introduction to virtual reality, digital mock-up, virtual testing and validation. (9)

INTEGRATION OF PLM WITH OTHER SYSTEMS: Benefits of integrating PLM system with other systems, different ways to integrate PLM systems with other systems, integration with CAD and ERP - use of middleware in integrating business applications in product development. PLM software customisation. (8)

TEXT BOOKS:

REFERENCES:

19P007 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. (9)

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. (9)


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. (11)

TEXT BOOKS:

REFERENCES:
19P008 MANUFACTURE OF AUTOMOTIVE COMPONENTS

ENGINE AND ENGINE COMPONENTS: Casting of engine block - conventional and expendable pattern, machining of engine block - casting of cylinder heads, forging of crank shaft, connecting rod and gudgeon pin, 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, AXLES, SPRINGS AND BODY PANELS: Casting and extrusion of propeller shaft, extrusion dies and its materials, heat treatment - forging of front axle and rear axle, casting of rear axe casing - leaf spring materials and its requirements, manufacturing of leaf spring - forming of body panels-hydro forming and press forming, welding of body panels - injection moulding of instrument panel, moulding of bumper, tooling and requirements.

AUTOMOTIVE COMPONENTS USING COMPOSITES: Need for composites in automotive parts, types of composite and its characteristics - 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 COMPONENTS: Tyre and tube manufacturing, materials and its requirements - painting booth and coach work - safety aspects in component manufacturing, guide lines - case study examples.

TEXT BOOKS:

REFERENCES:

19P009 LEAN MANUFACTURING


TEXT BOOKS:
1. Devadasan S R, Mohan Sivakumar V, Murugesh R, Shalij P R, "Lean and Agile Manufacturing: Theoretical, Practical and

CONVEYORS: Belt Conveyors: Definition - General Characteristics - Types - Parts - Design Aspects – Pneumatic Conveyors: Definition - Advantages and Disadvantages - Types - Parts of Pipeline Conveyors. - Hydraulic Conveyors: Definition and Uses - Advantages and Disadvantages - Design Considerations. (9)

HOIST AND WINCHES: Hoists - Definition - Characteristics and Uses - Constructional Features - Specification - Parts of Hoisting Equipments - Chain and Chain Sprockets - Steel Wire Ropes and Drums - Pulleys and Pulley Systems - Arresting Gears and Breaks - Load Handling Attachments - Winches - Definition and Uses - Constructional Features. (9)


CRANES: Definition - Basic Principles - Types of Cranes - Jib Cranes - Overhead Travelling Cranes/Bridge Cranes - Gantry Cranes - Wharf Cranes - Pillar Cranes - Tower Cranes - Truck And Wagon Cranes - Crawler Cranes - Railroad/Locomotive Cranes - Floating Cranes - Derricks. (9)

REFERENCES:
ELECTRICAL DISCHARGE MACHINING: Introduction - mechanism of material removal - description - electrodes - dielectric fluids - different types of flushing - material removal rate - process characteristics and applications – Wire - Electric Discharge Machining (Wire-EDM): Equipments - process variables - process capabilities and applications in die making. (9)


TEXT BOOKS:

REFERENCES:

19P012 SUPPLY CHAIN MANAGEMENT

SUPPLY CHAIN MANAGEMENT AND INVENTORY CONTROL: Meaning and definition - development chain - key issues in supply chain management (SCM) - introduction to inventory control - 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. (8)


LOGISTICS AND INTERNATIONAL SUPPLY CHAIN MANAGEMENT: Logistics related business function - framework for strategic alliance - third-party logistics - retailer supplier partnerships - distributor integration - procurement and outsourcing strategies - e-procurement - global market forces - managing global risks - requirements for global strategy implementation - issues in international supply chain management. (10)

COORDINATED PRODUCT AND SUPPLY CHAIN DESIGN: General framework - design for logistics - supplier integration into new product development - mass customization - the dimensions of customer value. (7)

INFORMATION TECHNOLOGY FOR SCM: Goals of supply chain information technology - information technology standards - information technology infrastructure - Radio Frequency Identification (RFID) - point of sale data - benefits - supply chain efficiency. (8)

TEXT BOOKS:

REFERENCES:

19P013 PLC PROGRAMMING AND APPLICATIONS


TEXT BOOKS:  

REFERENCES:  

19P014 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.  


TEXT BOOKS:  

REFERENCES:  

19P015 PRECISION MANUFACTURING  


PRECISION MEASUREMENT TECHNIQUES: Classification of measuring system - laser based system - interference methods - surface profilers - S E M - Scanning Tunneling Microscope (STM) - AFM and on line measurement of dimensional features - examples. (9)

TEXT BOOKS:

REFERENCES:

19P016 PRODUCT DEVELOPMENT STRATEGIES

3 0 0 3


CONCEPT ENGINEERING: QFD - FMEA - Fault tree analysis - Design for six sigma - DFMA - design for safety, reliability and environment - product tear down approach - bench marking - Reengineering: Scanning methods - cloud points - NURBS surfaces - examples. (9)

PROTOTYPE AND TESTING: Prototype development - digital prototyping - physical prototyping - rapid prototyping - dimensional analysis and similitude - assembly and testing - Task: Types - selecting team members - collaborators and consultants - examples. (9)


TEXT BOOKS:

REFERENCES:

19P017 COMPOSITE MATERIALS PROCESSING

3 0 0 3

POLYMER MATRIX COMPOSITES: Need for composite development, classification of composite materials and advantages. Types and role of reinforcement. Characteristics of polymer matrix composites, matrix materials, rule of mixtures. Processing methods - manual lay-up, automated lay-up using tape laying machines, fibre placement machines, vacuum bag moulding, spray-up, filament winding, pultrusion and resin transfer moulding. (9)

MICROMECHANICS OF POLYMER MATRIX COMPOSITES: Evaluation of elastic moduli - strength of unidirectional and angle composite lamina. (9)

MACROMECHANICS OF POLYMER MATRIX COMPOSITES: Macro mechanical analysis of unidirectional and angle polymer matrix composite lamina - evaluation of stiffness matrices of polymer matrix composite laminates. (10)
**METAL MATRIX COMPOSITES:** Characteristics of metal matrix composites, matrix materials, processing methods solid state, liquid state and vapour deposition methods - applications. (8)

**CERAMIC MATRIX COMPOSITES AND SECONDARY OPERATIONS ON COMPOSITES:** Characteristics of ceramic matrix composites, matrix materials, processing methods - conventional mixing and pressing, slurry techniques, matrix transfer molding, sol-gel processing and deposition methods - applications. Secondary operations - cutting, machining and drilling to fabricate composite parts - adhesive bonding and mechanical fastening methods - challenges involved in secondary processing of composites. (9)

**TEXT BOOKS:**

**REFERENCES:**

**19P018 INDUSTRIAL ERGONOMICS**

**3 0 0 3**

**INPUT MODALITIES:** Ergonomics for productivity, safety, health and comfort, history of ergonomics, multi-disciplinary engineering, human-machine system - characteristics, information theory, coding, compatibility, memory, decision making, attention, text, graphics, symbols, selection of display modality - visual and auditory display, representational display, tactual and olfactory display, design of controls. (10)

**ANTHROPOMETRY:** Need for anthropometry, sources of human variability, data collection methodology, measuring procedures and tools, statistical analysis of measured data - percentile calculation, principles of applied anthropometry, ergonomic design guidelines for products, equipment and accessories, applications of anthropometry. (8)

**WORK ERGONOMICS:** Work station design for standing and seated workers, manual material handling, design of hand tools, muscles, structure, function and capacity, physical work capacity, measurement of physiological work, stress and fatigue, work-related musculoskeletal disorders, ergonomic interventions to prevent injuries, human thermoregulation, measurement, protection and thermal comfort. (10)

**ILLUMINATION, NOISE AND VIBRATION:** Vision and the eye, measurement of light, lighting design, visual fatigue, eyestrain, psychological aspects of indoor lighting, the ear, measurement of sound, ear protection, design of acoustic environment, industrial noise control, auditory environment outdoors, effects of noise on task performance and health, vibration, human error, safety and equipment design. (9)

**VIRTUAL ERGONOMICS:** Digital Human Modeling (DHM), anthropometric models, models for production design, biomechanical and anatomical models, DHM packages – selection strategies and functionalities, virtual ergonomics evaluation techniques – Rapid Upper Limb Assessment (RULA), field of vision, reach envelopes, accessibility and clearance analysis, discomfort analysis, applications of DHM. (8)

**TEXT BOOKS:**

**REFERENCES:**
19P019 COMPUTATIONAL FLUID DYNAMICS

**BASICS OF FLUID FLOW:** Derivation of fluid flow governing equations - conservation of mass, momentum and energy - relationship between mathematical terms and characteristics of fluid flow, mathematical classification of flow, hyperbolic, parabolic, elliptic and mixed flow types. (9)

**DISCRETISATION:** Choice of grid - finite difference method – finite volume method- forward, backward and central difference schemes, explicit and implicit methods - properties of numerical solution methods, stability analysis, error estimation. (9)

**NEED FOR CFD TECHNIQUES:** Impact of non-conservation terms over the solution, artificial viscosity, upwind schemes, Cell Reynolds number, Courant number- Lax - Wendroff technique, MacCormack’s technique, relaxation technique, ADI technique. (9)

**CFD TECHNIQUE FOR INCOMPRESSIBLE FLUID FLOW:** Checker board distribution, staggered grid – pressure correction technique, SIMPLE algorithm. (9)

**APPLICATIONS:** In heat transfer and fluid flow problems (9)

**TEXT BOOKS:**

**REFERENCES:**

19P020 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. (8)


**IMPROVE AND CONTROL PHASES:** Improvement decisions - category importance weights - optimization using simulation - risk assessment tools - design review - fault - tree analysis - safety analysis - FMEA. 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. (11)

**DESIGN FOR SIX SIGMA (DFSS):** Design for six sigma quality - Quality Function Deployment (QFD) - TRIZ. (7)

**TEXT BOOKS:**

**REFERENCES:**

19P021 ADDITIVE MANUFACTURING

3 0 0 3

BASICS AND CLASSIFICATION OF ADDITIVE MANUFACTURING: Fundamentals of Additive Manufacturing (AM) - historical development of AM - classifications of AM systems - information workflow in AM - impact of AM on product development - reverse engineering - digitization techniques - model construction. (9)

DATA PROCESSING FOR ADDITIVE MANUFACTURING: Additive Manufacturing data formats - STL Format - STL file problems - consequences of building a valid and invalid tessellated model - STL file repair - other translators - newly proposed formats standard for representing layered manufacturing objects. (9)

SOLID AND LIQUID BASED ADDITIVE MANUFACTURING SYSTEMS: Fused Deposition Modeling (FDM) - Laminated Object Manufacturing (LOM) - Stereolithography (SLA) - Solid Ground Curing (SGC) - Shape Deposition Manufacturing (SDM) - JP-System 5 - polyjet printing - principle, details of processes, process variables, types, products, materials, advantages and applications. (9)

POWDER BASED AND OTHER ADDITIVE MANUFACTURING SYSTEMS: Selective Laser Sintering (SLS) - Selective Laser Melting (SLM) - Electron Beam Melting (EBM) - powder based beam deposition processes - printing processes - Three Dimensional Printing (3DP) - droplet formation technology - printing process modeling - principle, details of processes, process variables, types, products, materials, advantages and applications. (9)

ADDITIVE MANUFACTURING APPLICATIONS AND RAPID TOOLING: Applications of AM in aerospace industry, automotive manufacturing industry, biomedical field - magics software - rapid tooling - direct and indirect tooling - soft tooling vs hard tooling - process optimization - factors influencing accuracy - data preparation errors - part building errors - errors in finishing - influence of part build orientation. (9)

TEXT BOOKS:

REFERENCES:

19P022 MEASUREMENT SYSTEMS

3 0 0 3

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 - 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 (10)

MOTION MEASUREMENT: Linear and rotary encoders - Linear and angular velocity measurements - Seismic motion transducers - Seismic instrument for vibrational displacement and velocity - Seismic accelerometer - Piezoelectric accelerometers (8)

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. (9)

TEMPERATURE MEASUREMENT: Liquid-in-glass thermometers - Bi-metal temperature sensing elements - hermists - Thermocouples - RTD and thermopiles - Pyrometry - Optical and total radiation pyrometer – Infrared thermography - Calibration of temperature measuring devices (8)

FLOW AND PRESSURE MEASUREMENT: Variable area meter - Turbine type meter - Magnetic flow meter - Pulse producing methods - Pressure probes - Anemometry - Static and dynamic pressures - Elastic transducers - Secondary transducers used with elastic transducers - Strain gauge pressure cells - High pressure measurement gauges - Low pressure measurement (10)
19P023 STATISTICAL QUALITY CONTROL

3 0 0 3

**BASIC STATISTICS FOR QUALITY CONTROL:** Introduction to quality - definition of quality - basic and modern quality tools - measures of location and dispersion - statistics and parameters - causes of variation and their characteristics - constant and variable system of chance causes - patterns of variation. (9)

**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 variables and attributes. (9)

**ACCEPTANCE SAMPLING:** Importance of sampling - weakness of certain traditional practices in acceptance sampling - single sampling - Operating Characteristic (OC) curve of an ideal sampling plan - Average Outgoing Quality (AOQ) and Average Outgoing Quality Limit (AOQL) - double sampling, multiple sampling, and sequential sampling - use of Dodge-Romig Tables in sampling inspection. (9)

**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. (9)

**DESIGN AND ANALYSIS OF EXPERIMENTS:** Classical design of experiments - single factor experiments - multiple factor experiments - 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. (9)

19P024 AUTOMATED ASSEMBLY SYSTEM DESIGN

3 0 0 3

**AUTOMATED ASSEMBLY:** Assembly process - historical perspective - why and when automated assembly - parts of automated assembly system (5)

**PART FEEDING AND ORIENTING:** Vibratory and mechanical feeder - mechanics - design parameters - feed rate considerations - Design of orientor - performance analysis of orienting system (12)

**FEED TRACK, ESCAPEMENT AND PLACEMENT:** selection and design of feed tracks - analysis - Types of escapements - placing mechanisms - robots in assembly (8)

**QUANTITATIVE ANALYSIS OF ASSEMBLY SYSTEMS:** Analysis of assembly systems with synchronous transfer - free transfer - Economics of automated assembly (10)
DESIGN FOR ASSEMBLY: Manual assembly design guidelines - handling time considerations - Automated assembly feeding orienting - insertion. Design rules for automated assembly - design for robot assembly - Feasibility study (10)

TEXT BOOKS:

REFERENCES:

19P025 SUSTAINABLE MOBILITY AND LOGISTICS

EVOLUTION OF MOBILITY AND LOGISTICS: Need for sustainability in mobility and logistics - Multidisciplinary approach - Traffic and transport system - Accessibility - Travel behavior and travel resistance - Evolution of Indian road and rail network - Significance of Metro and Mono rails in mobility - role of ship, rail and air cargo in logistics - loading and unloading of goods - E-commerce: Authenticity and related policies. (12)

MOBILITY DETERMINANTS: Travel needs and demands - Demographical - Spatial and economic factors - Brever law - Growth rate of sustainable mobility - Calibration of Green Technologies - ECO score - Model choice determinants - Traffic simulation models. (9)

LOGISTICS AND TRENDS: Requirement - General framework - Trends, Determinants, Indicators - Pre and post liberalization in India - Globalization and interdependency of economy - Centralization and rationalization of production and distribution - Changes in consumption patterns - Technological innovations (9)

INDICATORS: Link between GDP and transport - Competition between Traffic modes - Growth rate of sustainable logistics - Transported weight - Transport performance - Vehicle kilometer (6)

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. (9)

TEXT BOOKS:

REFERENCES:

19P026 WORK SYSTEM DESIGN

Productivity: Concept and importance of productivity – work-study and productivity - Taylor’s scientific management - Gilbreth’s contributions to work measurement –Types - measurement of productivity – models of productivity – scope of motion and time study – working conditions – OSHA - occupational safety – accidents –work methods design. (10)

Method study: Steps in method study - the movement of workers and material - string diagram, flow process chart, multiple activity chart, travel chart - principles of motion economy - classification of movements - two-handed process chart, micromotion study, THERBLIGS, cyclegraph and Chrono cyclegraph, SIMO chart. (10)

Work measurement I: Purpose - uses -basic procedure - techniques of work measurement -steps involved in time study - time study equipment - stopwatch time study - performance rating - allowances - computation of standard time - case studies. (10)
Work measurement II: Work sampling and group timing technique, predetermined motion time system (PMTS), methods time measurements (MTM), Maynard Operation Sequence Technique (MOST). (7)


Total L: 45

TEXTBOOKS:

REFERENCES:

ONE-CREDIT COURSES

19PF01 PRECISION MACHINING

CNC TURNING: Principles, types, machines, tools. (2)
CNC MILLING: Basic principles of milling, concepts of 3/4/5 axes, high speed milling, machine and controller types. (2)
ELECTRIC DISCHARGE MACHINING (EDM): Wire and sinking EDM, principles, application. (1)
WORK AND TOOL HOLDING: Types, applications. (1)
COMPUTER-AIDED MANUFACTURING (CAM): Principles, softwares, examples. (2)
METROLOGY: Principles, measurements, examples. (1)
GEOMETRIC DIMENSIONING AND TOLERANCING (GD&T): Principles, examples. (1)
QUALITY MANAGEMENT: Principles, purpose, ISO, process orientation, non-quality dispositions. (1)
CONVENTIONAL PRECISION MANUFACTURING METHODS: For jig boring, jig milling, jig surface and cylindrical grinding. (2)
PRODUCTIVITY IMPROVEMENT: Types, measurement, overall equipment effectiveness /total effective equipment performance OEE/TEEP measurements, machine utilisation. Shop visit. (2)

Total L: 15

TEXT BOOKS:

19PF02 NON DESTRUCTIVE TESTING OF AIRCRAFT STRUCTURES

INTRODUCTION TO NON DESTRUCTIVE TESTING: Liquid penetrant testing, magnetic particles testing, ultrasonic testing, eddy current testing, radiography, thermography, working principle, procedure of testing and analysis. (6)
RECENT TRENDS IN NDT: Vibration monitoring, holography and speckle methods, acoustic emission technique, other emerging methods, working principle and procedure of testing. (4)
NDT OF COMPOSITES: Various methods of testing, procedure and results, case studies. (2)
NDT IN MANUFACTURING AND MAINTENANCE: Importance of aircraft maintenance, procedure, critical issues and case studies. 

NDT AND DAMAGE TOLERANCE PHILOSOPHY: Importance of damage tolerant design and case studies. 

REFERENCES:

Total L: 15
19PF03 INTRODUCTION TO DESIGN AND MANUFACTURE OF ARMOUR SYSTEMS

**INTRODUCTION:** Historical perspective, basic concepts of armour systems  

**MECHANICAL BEHAVIOUR:** Dynamic behaviour of materials, dynamic impact testing, projectile characteristics.  

**MECHANICS:** Penetration mechanics, stress waves and shock behaviour.  

**ARMOUR MATERIALS:** Metallic armour, ceramic armour, composite armour, hybrid systems, personnel armour - design and testing.  

**ARMOUR FOR VEHICLES:** Design and testing, reactive armour systems, blast and ballistic testing  

**REFERENCES:**  

19PF04 ADVANCED MATERIALS FOR ARMOUR APPLICATIONS

**INTRODUCTION:** Basic concepts, early applications of armour, fundamentals of materials and structures.  

**MECHANICAL BEHAVIOUR:** Static and Dynamic Behaviour of Materials, Projectile Materials and Behaviour.  

**METALLIC ARMOUR MATERIALS:** Processing and Properties of Steel, Aluminium, Mg and Ti.  

**CERAMIC ARMOUR MATERIALS:** Processing and Properties.  

**COMPOSITES ARMOUR MATERIALS:** Processing and Properties, Hybrid Armour Materials.  

**REFERENCES:**  
19OFA1 EXPORT – IMPORT PRACTICES

INTRODUCTION: Export – Import Business – Preliminaries for starting Export – Import Business Registration. (3)

EXPORT PROCEDURES: Obtaining an Export License – Export Credit Insurance – Procedures and Documentation. (4)

FOREIGN EXCHANGE: Finance for Exports – Pricing - Understanding Foreign Exchange Rates. (3)

IMPORT PROCEDURES: Import Policy – License - Procedure and Documentation. (3)

EXPORT INCENTIVES: Incentives - Institutional support (2)

REFERENCES:

19OFA2 INSURANCE - CONCEPTS AND PRACTICES

INTRODUCTION TO INSURANCE AND RISK MANAGEMENT: Origin, History, Nature and Scope of insurance – Meaning, types and significance of risk. (3)

INSURANCE LAWS AND REGULATIONS: Insurance Act, IRDA Act, Consumer Protection Act, Ombudsman Scheme. (2)

INSURANCE UNDERWRITING AND RISK MANAGEMENT: Meaning of underwriting and underwriter, guidelines and steps in the process of underwriting – characteristics, significance and principles of risk management. (4)

FINANCIAL ASPECTS OF INSURANCE MANAGEMENT: Role and functions of financial institutions, determination of premium for various insurance products. (3)

SETTLEMENT OF INSURANCE CLAIMS: Documents needed during various claims, Factors affecting insurance claims (3)

REFERENCES:

19OFA3 PUBLIC FINANCE

INTRODUCTION: Nature and Scope of public finance – Principles of taxation. (2)

PUBLIC REVENUE AND TAXATION: Sources of Revenue – Tax and non-tax revenue – Classification of Taxes, GST. (4)

PUBLIC EXPENDITURE: Importance – Types – Causes of increase in public expenditure – Effects of public expenditure in India. (3)

DEFICIT FINANCING AND BUDGET: Sources of public debt – Debt redemption – Budget – Types – Preparation of Budget in India. (3)

FEDERAL FINANCE: Centre-State financial relations – Finance commissions. (3)

TOTAL: 15
REFERENCE BOOKS:

19OFA4 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

TYPES OF SECURITIES: Trading – Orders, Margin Trading – Clearing and Settlement Procedures. (5)
SECURITY ANALYSIS I: Industry Analysis – Estimation of Rates of Return. (2)
SECURITY ANALYSIS II: Company Analysis — Estimation of Rates of Return. (2)
PORTFOLIO MANAGEMENT: Measuring Risk and Returns and Treatment in Portfolio Management. (4)

Total L: 15

REFERENCES:

19OFA5 SOCIAL ENTREPRENEURSHIP

INTRODUCTION TO SOCIAL ENTREPRENEURSHIP: Social Entrepreneur - Meaning, qualities and skills. Social Entrepreneurship – Characteristics, process and ecosystem – Case Studies. (3)

SOURCES OF FUNDING FOR SOCIAL ENTREPRENEURSHIP: The Social Entrepreneurship Frame work. Start-ups and funding - Internal and External. Schemes for social entrepreneurship. (4)

STRATEGIES IN SOCIAL ENTREPRENEURSHIP: Industry and Market Analysis, Business planning, concepts of value creation, new ideas and risk taking. (4)

PROSPECTS AND PROBLEMS IN SOCIAL ENTREPRENEURSHIP: Opportunities for Social entrepreneurs, an overview of legal structure, tax structure and other liabilities. (4)

TOTAL: 15

REFERENCE BOOKS:
ENGLISH

19GF01 INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

1 0 0 1

INTRA ORGANIZATIONAL COMMUNICATION : Communication Networks in an Organization; Intra-organizational communication
(2)

INTER ORGANIZATIONAL COMMUNICATION : Flow Nomenclature; Workplace diversity and intercultural aspects of communication
(2)

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:

19GF02 HUMAN VALUES THROUGH LITERATURE

1 0 0 1

PROSE : Kalam’s vision of college education in Wings of fire - Emerson’s advocation of independence of Human will in Self-reliance - Harmony in Education-views of Bernad Russel
(4)

POETRY : Maintaining Human relations in Robert Frost’s Mending Wall - Quest for identity and freedom in Kamala Das’s An Introduction
(2)

DRAMA : Statesmanship and friendship in Girish Karnad’s Tughlaq
(3)

ONE-ACT PLAY : The theme of love in Chekhov’s The Bear
(3)

SHORT STORY : Empathy in Somerset maugham’s Mr. Know-all - Family bond in Anita Desai’s Devoted son
(3)

Total L: 15

TEXT BOOKS:
1. Faculty - Department of English, "Course materials", PSG College of Technology, Coimbatore, 2019.

REFERENCES: