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<td>PROCESS PLANNING AND COST ESTIMATION</td>
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<td>DISASTER MITIGATION AND MANAGEMENT</td>
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<td>PROFESSIONAL ETHICS AND HUMAN VALUES</td>
<td>MGMT</td>
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</table>

**ENGINEERING MATHEMATICS**

(COMMON TO THE BRANCHES MECH, ECE, CSE, CSSE, EEE, EIE, CIVIL, IT, MECHTRONICS, AERONAUTICAL, ETC, AUTOMOBILE)

(PART TIME)
UNIT I

MATRICES

Characteristic equation – Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form.

UNIT II

ORDINARY DIFFERENTIAL EQUATIONS

Solutions of First and Second order linear ordinary differential equation with constant coefficients – Method of variation of parameters – Simultaneous first order linear equations with constant coefficients.

UNIT III

MULTIPLE INTEGRALS AND VECTOR CALCULUS


UNIT IV

LAPLACE TRANSFORMS


UNIT V

APPLICATIONS OF LAPLACE TRANSFORMS

Inverse Laplace transform – Convolution theorem – Initial and Final value theorem-Solution of linear

ODE of second order with constant coefficients and first order simultaneous equation with constant coefficients using Laplace transforms.

Total hours : 60
Lecture Hours: 45
Tutorial Hours: 15

TEXT BOOKS
1. “Engineering Mathematics” by Department of Mathematics, VMU
   New Delhi, 2006.
3. Prof. Dr. A. Singaravelu, Engineering Mathematics Volume I & Volume II by Meenakshi
   Publications.

REFERENCE BOOKS
OBJECTIVE: It is the branch of science which deals with the effects of human activities & modern technology on environment. It creates awareness among the engineering students about environmental pollution and the role of the engineers in conservation of environment.

OUT COME: The students will get the knowledge about environment and they will work their corresponding field with eco friendly. It will protect our environment from pollution.

UNIT – I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance – need for public awareness- forest resources: use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems-mineral resources: use effects on forests and tribal people-water resources: use and over-utilization of surface and exploitation, environmental effects if extracting and using mineral resources, case studies-food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies-energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies –land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification –role of an individual in conservation of natural resources-equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets-river/forest/grassland/hill/mountain.

UNIT – II ECOSYSTEMS AND BIODIVERSITY

Concept of and ecosystem –structure and function of an ecosystem-producers, consumers and decomposers-energy flow in the ecosystem-ecological succession-food chains, food webs and ecological pyramids-introduction, types, characteristic features, structure and function of the (a)forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)-introduction to biodiversity- definition: genetic, species and ecosystem diversity- biogeographical classification of India-value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values-biodiversity at global, national and local levels-India as a mega-diversity nation-hot-spots of biodiversity-threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts-endangered and endemic species of India –conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.
UNIT - III ENVIRONMENTAL POLLUTION
Definition-causes, effects 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 – solid waste management: caused, effects and control measures of urban and industrial wastes-role of an individual in prevention of pollution-pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site-urban / rural / industrial / agriculture

UNIT - IV SOCIAL ISSUES AND THEIR ENVIRONMENT

UNIT – V HUMAN POPULATION AND THE ENVIRONMENT

Total Hours : 45

TEXT BOOK:
1. Raman Sivakumar, Environmental Science and Engineering, Vijay Nicole imprints Pvt.Ltd.

REFERENCE BOOKS :
1. Bharucha Erach, The Biodiversity of India, publishing Pvt. Ahmedabad, India,
**MANUFACTURING ENGINEERING**

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<thead>
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<tr>
<td>I</td>
<td>CASTING</td>
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<tr>
<td>II</td>
<td>METAL FORMING AND POWDER METALLURGY</td>
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<tr>
<td>III</td>
<td>COVENTIONAL MACHINING</td>
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<td>IV</td>
<td>WELDING</td>
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<td>V</td>
<td>UNCONVENTIONAL MACHINING PROCESSES</td>
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</table>

**UNIT I CASTING**

**UNIT II METAL FORMING AND POWDER METALLURGY**
Basic concepts and classification of forming processes- principles- Application of the following processes- Forging, rolling, extrusion, wire drawing, spinning, sheet metal forming- powder metallurgy- steps involved, applications.

**UNIT III COVENTIONAL MACHINING**
General principles(with schematic diagrams only) of working, types and commonly performed operations in the following machines- Lathe, shaper, planer, milling machining, drilling machines-basic of CNC machines.

**UNIT IV WELDING**
Classification of welding processes- principles and equipment used in the following processes- gas welding- Arc welding- Resistance welding- Thermit welding- soldering, brazing.

**UNIT V UNCONVENTIONAL MACHINING PROCESSES**
Need for unconventional machining processes- principles and applications of the following processes- Abrasive jet machining, Ultrasonic machining, Electro discharge machining, Electrochemical machining, Chemical machining, LASER beam machining, Electro beam machining, plasma arc machining

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

**REFERENCE BOOKS**
UNIT 1. BASICS & STATICS OF PARTICLES 9

UNIT 2. EQUILIBRIUM OF RIGID BODIES 9
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples.

UNIT 3. PROPERTIES OF SURFACES AND SOLIDS 9
Determination of Areas and Volumes - First moment of area the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principle moments of inertia of plane areas - Principle axes of inertia - Mass moment of inertia - Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle - Relation to area moments of inertia.

UNIT 4. DYNAMICS OF PARTICLES 9

UNIT 5. FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9
Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE BOOKS:
List of Experiments

1. Plain Turning and Step Turning on a Lathe.
2. Taper Turning on a lathe
3. Thread Cutting on a lathe
4. Drilling, reaming and tapping in a drilling machine
5. Plain Milling
6. Undercut Step Milling
7. Hexagonal Milling
8. Cutting Keyways in a Slotting Machine

TOTAL: 30 PERIODS
OBJECTIVES:
The syllabus for the Advanced Engineering Mathematics has been framed catering to the needs of the Engineering students. It is purely application oriented. To mention a few (i) Partial differential equations arises in most of the Engineering discipline when the number of independent variables in the given problem under discussion is two or more. (ii) Fourier series has the wide application in the field of heat propagation and diffusion, wave propagation and in signal and systems analysis. (iii) Transform techniques are very useful in the field of signal and system analysis. Z - transform plays an important role in analysis of Discrete signals. This is a prelude to learn higher semester courses.

1. PARTIAL DIFFERENTIAL EQUATIONS
Formation - Solutions of standard types f(p,q)=0, clairauts form, f(z,p,q)=0,f(p,x)=g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

2. FOURIER SERIES
Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity – Harmonic Analysis.

3. BOUNDARY VALUE PROBLEMS
Classification of second order linear partial differential equations - Solutions of one-dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

4. FOURIER TRANSFORMS

5. Z - TRANSFORM

Tutorial : 15;
Total hours: 60

TEXT BOOK:
A.Singaravelu,”Transforms and Partial Differential Equations”, Meenakshi Agencies,Chennai

REFERENCES:
STRENGTH OF MATERIALS

UNIT –I -STRESS- STRAIN AND DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies – Strength- Stiffness and Stability – Stresses; Tensile- Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT –II -BEAMS - LOADS AND STRESSES 9

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever-Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Shear stresses in beams.

UNIT –III -TORSION 9


UNIT –IV -DEFLECTION OF BEAMS 9


UNIT –V -ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TOTAL: 45 PERIODS

TEXT BOOKS


REFERENCES

UNIT –I - BASIC CONCEPTS AND PROPERTIES
Fluid – Definition - solid and fluid - Units and dimensions - Properties of fluids – Temperature - Viscosity - Compressibility - Vapour pressure - Capillary and surface tension - Fluid statics: concept of fluid static pressure - Pressure measurements by manometers and pressure gauges. Introduction to CFD, geophysical fluid dynamic.

UNIT –II - FLUID KINEMATICS AND SIMILARITIES
Fluid Kinematics - Flow visualization - Lines of flow - Types of flow - Velocity field and acceleration - Continuity equation (one and three dimensional differential forms)- Equation of streamline - Stream function - Velocity potential function - Circulation - Flow net – Fluid dynamics - Equations of motion - Euler's equation along a streamline - Bernoulli's equation – Applications - Venturi meter - Orifice meter - Pitot tube - Dimensional analysis - Buckingham's $\pi$ theorem- Applications - Similarity laws and models.

UNIT –III - INCOMPRESSIBLE FLUID FLOW
Viscous flow - Navier-Stoke's equation (Statement only) - Shear stress - Pressure gradient relationship - Laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - Flow through pipes - Darcy - Weisback's equation - Pipe roughness -Friction factor- Moody's diagram - Minor losses - Flow through pipes in series and in parallel - Power transmission - Boundary layer flows - Boundary layer thickness - Boundary layer separation - Drag and lift coefficients.

UNIT –IV - HYDRAULIC TURBINES
Fluid machines: definition and classification - Exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - Head and specific work - Components of energy transfer - Degree of reaction.
Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - Working principles - Velocity triangles - Work done - Specific speed - Efficiencies - Performance curve for turbines.

UNIT –V - HYDRAULIC PUMPS

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
ENGINEERING THERMODYNAMICS

UNIT 1. BASIC CONCEPT AND FIRST LAW
Basic concepts: concept of continuum, macroscopic approach, thermodynamic systems-closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT 2. SECOND LAW, ENTROPY AND AVAILABILITY
Second law of thermodynamics – Kelvin’s and Clausius statement of second law. Reversibility and irreversibility. Carnot cycle reversed Carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, and principle of increase of entropy – Carnot theorem, absolute entropy, and availability.

UNIT 3. PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

UNIT 4. IDEAL & REAL GASES AND THERMO DYNAMICS RELATIONS
Gas mixtures-Properties of ideal and real gases, equation of state, Avagadro’s law, Vander Waal’s equation of states, compressibility, chart. Dalton’s law of partial pressure, Exact differentials, TDS relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

UNIT 5. PSYCHROMETRY

TOTAL: 45 PERIODS
(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted).

TEXT BOOKS:

REFERENCE BOOKS:
UNIT –I - INTRODUCTION TO DRAFTING SOFTWARE
Drawing- Editing- Dimensioning- Plotting Commands- Layering concepts- Limits- Fits and Tolerances.

UNIT –II - PREPARATION OF 2-D DRAWINGS
Orthographic views of standard machine components: Brackets- V Blocks- Stop Block- Screw threads and Threaded fasteners.

UNIT –III - ASSEMBLY DRAWING (Preparation of assembled view)
- Flange coupling
- Plummer block bearing
- Lathe Tailstock
- Universal Joint.
- Machine vice
- Stuffing box
- Piston and connecting rod

UNIT –IV - INTRODUCTION TO SOLID MODELING.
Conversion of basic 2D diagrams into 3D models – flange coupling, universal joint and piston and connecting rod

TOTAL: 30 PERIODS
Objectives:

- Computing the trajectory of a spacecraft requires the accurate numerical solution of a system of ordinary differential equations.
- It is used in Kinematics Simulation, Complex System Optimization.
- Car companies can improve the crash safety of their vehicles by using computer simulations of car crashes. Such simulations essentially consist of solving partial differential equations numerically.
- Numerical linear algebra is important for data analysis.
- Airlines use sophisticated optimization algorithms to decide ticket prices, airplane and crew assignments and fuel needs. Historically, such algorithms were developed within the overlapping field of operations research.

UNIT-I

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS


UNIT-II

INTERPOLATION AND APPROXIMATION

Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling’s and Bessel’s).

UNIT-III

NUMERICAL DIFFERENTIATION AND INTEGRATION


UNIT-IV

INITIAL VALUE PROBLEMS OF ODE

Solution of equations related to simple harmonic motion, Oscillations of a spring mass system, Simple pendulum, Oscillatory electrical circuit and Deflection of beams with initial conditions - using Taylor series. Euler, Modified Euler and Runge-Kutta methods.

UNIT-V

BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (both implicit and explicit). One dimensional wave equation and two dimensional Laplace and Poisson equations.
Lecture Hours: 45
Tutorial Hours: 15
Total hours : 60

TEXT BOOK

1. N.Subramanian,Numerical Methods,SCM Publishers,Erode.

REFERENCES

Aim
To integrate the basic laws of thermodynamics into thermal systems towards applications.

Scope
1. To provide thorough knowledge on internal combustion engines.
2. To inculcate advanced topics of internal combustion engines.
3. To understand the function and applications of air compressors and steam turbines.
4. To provide an in-depth knowledge of refrigeration systems functioning and applications.
5. To provide details of air conditioning methodologies available for domestic and industrial applications.

Outcome
The students would be able to understand the working principle of IC Engines, refrigeration systems.

UNIT 1: VAPOUR POWER CYCLES, STEAM NOZZLES, STEAM TURBINES  9
Rankine cycles, effect of operating conditions on Rankine cycle efficiency, Modified Rankine cycle, regenerative cycle, reheat cycle, Binary Vapour cycle. Problems on Rankine cycle with reheat and regeneration conditions.
Steam nozzles, property calculation of steam flow through nozzles, metastable expansion of steam in a nozzle, steam injector. Problems for velocity and discharge calculation of steam.
Steam turbines, classifications, impulse and reaction turbine, compounding of steam turbines, bleeding, governing & control.

UNIT 2: GAS POWER CYCLES AND INTERNAL COMBUSTION ENGINES  9
Air standard cycles, Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, problems on determination of efficiency, mean effective pressure and work. Comparison of air standard cycles. Atkinson cycle, Ericsson cycle, Stirling cycle.

UNIT 3 BRAYTON CYCLE, GAS TURBINES AND AIR COMPRESSORS  9
Brayton cycle, gas turbines, classification, open cycle and closed cycle, Gas turbine fuels, Calculation of work output and efficiency on Brayton cycle, Application of gas turbine, problems on Brayton cycle.
Air compressors- classification, reciprocating air compressor, staging, calculation of work and efficiency, clearance in compressors, intercooler, applications. Rotary compressor, classification, centrifugal compressor, axial flow compressor, compressor characteristics – surging, choking and stalling. Problems on air compressor – single stage and multi stage.

UNIT 4: REFRIGERATION  9
Refrigeration – refrigeration systems, methods of refrigeration, Air refrigeration system, Reversed Carnot cycle, reversed brayton cycle, vapour compression refrigeration cycle- components and functions, factors affecting the performance, vapour absorption systems- components and functions,
COP calculations, refrigerant- classifications, properties of an ideal refrigerant, common refrigerants and its applications.

UNIT 5: PSYCHROMETRICS AND AIRCONDITIONING

TEXTBOOKS:

REFERENCES
1. ARORA.C.P."Refrigeration and Air-conditioning,” Tata McGraw Hill,
5. MANOHAR PRASAD, Refrigeration and Air-conditioning – New Age International (P) Ltd, 1995

Content beyond the syllabus
- Six stroke engine
- Liquefaction of gases
SEMESTER | SUBJECT | L | T | P | C
---|---|---|---|---|---
III | COMPUTER INTEGRATED MANUFACTURING | 3 | 0 | 0 | 3

**Aim** The aim of the subject is to provide knowledge in computer integrated manufacturing

**Scope**
1. To understand the importance of CIM and business aspects
2. To gain knowledge about GT and CAPP
3. To enable student to learn about FMS and SFC
4. To understand about architecture and network concepts
5. To learn about automation protocol and database

**Outcome** The students would be able to understand the various concepts viz. group technology, CAPP, FMS.

**UNIT I INTRODUCTION TO CAD/CAM**
9
The design process Morphology of design, Product cycle Computer Aided Design, Benefits of CAD. Role of computers - principles of computer graphics - Current trends in manufacturing engineering - - Design for Manufacturing and Assembly - Sequential and concurrent engineering,- Rapid prototyping

**UNIT II SOLID MODELING**
9
Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernel system (GKS) - Initial graphics exchange system (IGES) - Graphic packages. Geometric Modeling - Wire frame, Surface and Solid models - Constructive Solid Geometry (CSG) and Boundary Representation (B-REP) Techniques - Features of Solid Modeling Packages.

**UNIT III FUNDAMENTALS OF CNC MACHINES**
9

**UNIT IV GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING**
10

**UNIT V SHOP FLOOR CONTROL AND INTRODUCTION OF FMS**
9
Shop floor control-phases -factory data collection system -automatic identification methods- Bar code technology-automated data collection system. MS-components of FMS - types -FMS workstation - material handling and storage systems- FMS layout -computer control systems-application and benefits.
Total Hours : 45

TEXT BOOKS


REFERENCES


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<td>KINEMATICS OF MACHINES (Common to MECH &amp; MECHAT)</td>
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Aim | The aim of the subject is to provide a fundamental knowledge in kinematics of machines
---|---
**Scope** | 1. To learn the basic mechanisms of kinematics.  
2. To learn to calculate the velocity and acceleration of links using graphical and vectorial approach.  
3. To study about Cams and to draw their profiles.  
4. To learn about Gear terminology and types of gear trains  
5. To study about effect of friction in Transmission devices
**Outcome** | The students would understand the basic link mechanisms and would draw cam profiles

UNIT –I -BASICS OF MECHANISMS
Terminology and Definitions-Degree of Freedom -Mobility-Kutzbach criterion-Grashoff’s law-  

UNIT –II -KINEMATICS OF LINKS

UNIT –III -KINEMATICS OF CAM
Classifications - Displacement diagrams-parabolic- Simple harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

UNIT –IV -GEARS
Spur gear Terminology and definitions - Fundamental Law of toothed gearing and involute gearing-  

UNIT –V –FRICITION
Surface contacts-Sliding and Rolling friction - Friction drives – Friction in screw threads - Friction clutches - Belt and rope drives- Friction aspects in Brakes – Friction in vehicle propulsion and braking

**TOTAL HOURS:** 45 PERIODS

**TEXT BOOKS**

**REFERENCES**
STANDARDS

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<td>III</td>
<td>ENGINE TESTING LAB</td>
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Aim The aim of the subject is to provide knowledge in performance characteristics of
internal combustion engine.

<table>
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<tr>
<th>Scope</th>
<th>To understand about characteristics of conventional and alternative fuels</th>
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<td>Outcome</td>
<td>The students would be able to understand the importance of alternate fuels and their capability as alternate to fossil fuels.</td>
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</table>

1. Determination of Viscosity of the given specimen oil by using Red Wood Viscometer.
2. Determination of Flash Point and Fire Point of the given fuel sample.
3. Construction of actual valve timing diagram of a four stroke engine and comparison with Theoretical valve timing diagram.
4. Construction of actual port timing diagram of a two stroke engine and comparison with Theoretical port timing diagram.
5. Performance test on a four stroke single/ twin cylinder diesel engine.
6. Determination of frictional power of a four cylinder petrol engine by conducting a Morse test.
7. Conduct a retardation test and determine frictional power in a diesel engine.
8. Determination of the COP of a LPG refrigerator test rig.

**TOTAL HOURS** : 30

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_Aim_ The aim of the subject is to provide basic knowledge in working of CNC machines.

_Scope_ 1. To gain knowledge about CNC programming
2. To get the hands on training in CNC trainer machines
3. To simulate various CNC machining and generate codes using CAM software
Outcome  The students would be able to operate CNC machine using part programming.

Introduction:

1. Study of G and M codes
3. Machining practice on Trainer Type CNC Machines-
4. Simulation of tool path using any CAM Software

Part programming in CNC Milling:

1. Point to point motions
2. Linear motions
3. Circular interpolations
4. Contour motions
5. Rectangular pocketing
6. Mirroring
7. Circular Pocketing
8. Fixed /canned cycles
9. Subroutines

Part programming for CNC Turning :

1. Turning and facing
2. Step turning, Taper Turning
3. Grooving
4. Fixed/Canned Cycles :
5. Thread cutting Cycles
6. Peek Drilling Cycles

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(Use of approved Design Data Book is permitted in the University examination)

Aim  The aim of the subject is to provide basic knowledge in designing various machine elements.

Scope  1. To understand basic design procedures, steady and variable stresses, failure Theories.
       2. To study the design concepts of shafts and couplings.
       3. To study the design parameters of fasteners and welded joints.
4. To learn the design parameters of different types of springs and levers.
5. To understand the design concepts of bearings and flywheel.

Outcome The students would be able to design any machine elements with standard procedures and formulae.

UNIT 1: STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9
Introduction to the design process - factor influencing machine design- Direct- Bending and torsional stress equations -Calculation of principal stresses for various load combinations- Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg- Goodman and Gerber relations

UNIT 2: DESIGN OF SHAFTS AND COUPLINGS 9
Design of solid and hollow shafts based on strength- rigidity and critical speed – Design of rigid and flexible couplings

UNIT 3: DESIGN OF FASTENERS AND WELDED JOINTS 9

UNIT 4 :DESIGN OF SPRINGS 9
Design of helical- leaf- disc and torsional springs under constant loads and varying loads – Concentric torsion springs

UNIT 5: DESIGN OF BEARINGS AND FLYWHEELS 9
Design of bearings – sliding contact and rolling contact types– Design of journal bearings calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

TUTORIAL :15 TOTAL HOURS :60

TEXT BOOKS

REFERENCES
The aim of the subject is to provide knowledge in various mechanisms, vibrations and balancing of masses.

**Scope**

1. To study about forces acting on various parts of mechanisms.
2. To learn static and dynamic balancing of masses.
3. To study the characteristics of free and forced vibrations.
4. To study and analyze various types of Governors and effect of gyroscopic forces.
5. To learn about Cam Dynamics - velocity and displacement and acceleration.

**Outcome**

The students would be able to understand the operations of governors, cam dynamics and vibrations.

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**UNIT 1 Force Analysis**

UNIT –II BALANCING
Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines.

UNIT -III FREE VIBRATIONS
Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration- critical speeds of simple shaft - Torsional vibration - Natural frequency of two and three rotor systems.

UNIT –IV FORCED VIBRATIONS

UNIT – V MECHANISMS FOR CONTROL
Gyroscopic Forces: Gyroscopic couple, Effect of Gyroscopic couple on vehicle; Applicatons of Gyroscopic forces. - Ships and airplanes

TUTORIAL :15

TOTAL HOURS :60

TEXT BOOKS

REFERENCES
Aim
The aim of the subject is to provide an overview of availability of renewable energy.

Scope
1. To impart the importance of solar energy.
2. To inculcate the importance of wind energy.
3. To know the importance of bio energy.
4. To know various renewable energy power plants.
5. To impart the necessity of latest and modern energy sources.

Outcome
The students would be able to understand the availability, utilization and conservation of renewable energy sources.

UNIT I SOLAR ENERGY
9
Introduction to solar energy conversion, principle-solar insolation-instrument- solar radiation data-
measurement & analysis – fundamentals of solar cells, types of semiconducting materials-solar cell
property-solar PV cell interconnection-thin film solar cell-solar thermal conversion-principle and
application.
UNIT II WIND ENERGY
Fundamentals of wind resource-site selection criteria-instruments-data analysis, frequency distribution
Wind energy conversion principles; General introduction- Aerodynamic principle-types and
classification of wind electric conversion system-water pumping wind mill performance
characteristics-small wind turbine design and performance characteristics study.

UNIT III BIO–ENERGY
Biomass, Biogas, Source, Composition, biomass conversion technologies– Biomass direct
Combustion – Biomass gasifier – Biogas plant – Digesters – Alternative liquid fuels (Ethanol,
Methonal, & Bio-Diesel production) - Environment impact of bio-energy. Biomass conversion
technologies, Methonal production, Environment impact of bio-energy.

UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY
Tidal energy – Wave energy –Open and closed OTEC Cycles – Small hydro plant turbines –
Geothermal energy sources- Environmental issues.

UNIT V NEW ENERGY SOURCES
Hydrogen generation, storage, transport and utilization, Applications – Fuel cells – technologies, types
- Power generation & transport – Hybrid systems.

TOTAL: 45 hours

TEXT BOOKS:
1997.

REFERENCES:
3. G.N. Tiwari, solar Energy – Fundamentals Design, Modelling and applications,
### Aim

The aim of the subject is to provide basic knowledge in materials behavior and metallurgy.

### Scope

1. To understand the classification, properties and application of various engineering materials.
2. To learn the heat treatment methodologies and mechanical treatment methodologies.
3. To understand the various deformation mechanisms, failure modes and phase diagram.
4. To understand the various forms of corrosion, protection methods.
5. To understand the basic concepts in powder metallurgy, composite materials and working of SEM.

### Outcome

The students would be able to understand the behavior of materials, their heat and mechanical treatment.

### UNIT I METALLIC & NON-METALLIC MATERIALS


### UNIT II BEHAVIOR OF MATERIALS
Introduction to plastic deformation - Slip and twinning – Types of fracture-brittle, ductile, creep & fatigue.

UNIT III MATERIAL TREATMENT
Heat treatment- annealing, Normalizing- hardening and Tempering, Case hardening, Hardenability - Jominy end quench test.
Mechanical Treatment-strengthening mechanisms-strain hardening, solid solution hardening, grain size reduction

UNIT IV CORROSION
Introduction- forms of corrosion-pitting, intergranular, stress corrosion, corrosion fatigue, dezincification, erosion-corrosion, Crevice Corrosion, Fretting-Protection methods-PVD, CVD.

UNIT V ADVANCED MATERIALS & CHARACTERIZATION
Powder metallurgy –powder production, blending, compaction, sintering-applications
Composites-Types-MMC, PMC, CMC-properties & applications
SEM-working principle, set-up, sample preparation method-evaluation mode-EDAX

TOTAL HOURS :45
TEXT BOOKS

REFERENCE BOOKS
2. George E.Dieter, “Mechanical Metallurgy”
**Aim**  
The aim of the subject is to provide knowledge in mechanisms related to machine dynamics.

**Scope**  
To understand about governors, Gyroscopes, Speed measurement, spring mass system and compound pendulum

**Outcome**  
The students would be able to understand the working principle of vibrations, balancing of masses.

1. To perform an experiment on Watt and Porter Governor to prepare performance characteristic curves and to find stability and sensitivity.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis and determine gyroscopic couple.
4. Determine the Moment of Inertia by compound pendulum and tri-filar suspension.
5. To determine the frequency of undamped free vibration and damped forced vibration of an equivalent spring mass system.
6. To determine whirling speed of shaft theoretically and experimentally.
7. To analyse forced vibrations of a cantilever beam.
8. To determine the natural frequency of undamped torsional vibration of a single rotor shaft system.
9. To perform an experiment for static balancing on a static balancing machine.
10. To perform an experiment for dynamic balancing on a dynamic balancing machine.

**TOTAL HOURS**  
: 30
**SEMESTER** | **SUBJECT** | **L** | **T** | **P** | **C**
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IV | METALLURGY LAB | 0 | 0 | 4 | 2

**Aim**
The aim of the subject is to provide basic knowledge in physical metallurgy - metallography

**Scope**
1. To get a basic understanding of microstructures of specimens of different materials
2. To understand the process of heat treatment.

**Outcome**
The students would be able to understand the characteristics, applications of various metals and also about the heat treatment processes.

**LIST OF EXPERIMENTS**

1. Introduction to Metallography
2. Preparation of Metallographic specimen
3. Identification of Ferrous specimens (minimum 4)
4. Identification of Non-Ferrous specimens (minimum 2)
5. Heat treatment – Annealing- comparison between annealed and un heat treated specimen
6. Heat treatment – Normalizing- comparison between normalized and un heat treated specimen
7. Heat treatment – Hardening- comparison between hardened and un heat treated specimen
8. Heat treatment -Tempering- comparison between hardened and un heat treated specimen
   (For heat treatment experiments low carbon steel could be used)
### Aim
The aim of the subject is to provide knowledge in heat and mass transfer.

### Scope
1. To study about conduction mode of heat transfer.
2. To study about transient mode of heat transfer.
3. To study about convection mode of heat transfer.
4. To study about radiation mode of heat transfer.
5. To study heat transfer with mass transfer.

### Outcome
The students would be able to understand the basic concepts in heat power systems, integration of thermodynamics in heat power systems.

---

**UNIT –I CONDUCTION - I**

Fourier law of conduction, General equation in Cartesian, Cylindrical and Spherical coordinates one dimensional steady state conduction across plane wall- composite wall – Composite cylinder – Composite sphere with convection boundaries, overall heat transfer coefficients, and critical thickness of insulation, conduction with generation, thermal contact resistance, and variable conductivity.

---

**UNIT –II CONDUCTION - II**

Fins or extended surfaces- Pin fins, annular fins, longitudinal fins. Unsteady state conduction – lumped capacity system, semi – infinite solids and multi dimensional systems, numerical solutions of two-dimensional steady and unsteady conduction.

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**UNIT –III CONVECTION**


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**UNIT –IV RADIATION AND HEAT EXCHANGERS**


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**UNIT –V MASS TRANSFER AND HEATPIPES**

Fick’s law, Equimolar diffusion, Stefan’s law, mass transfer coefficient, non-dimensional number used in mass transfer, atmospheric evaporation. Problems.

Heat pipes – Introduction, Types and applications.

---

**TUTORIAL HOURS: 15; TOTAL HOURS: 60**

**TEXT BOOKS**

1. KOTHANDARAMAN C.P “Fundamentals of Heat and Mass Transfer” New Age International-
2. SACHDEVA R C- “Fundamentals of Engineering Heat and Mass Transfer” New Age International

**REFERENCES**

Aim

The aim of the subject is to provide basic knowledge in instrumentation and measurements.

Scope

1. To understand the basic measurement system.
2. To understand the various instruments used for linear and angular measurement.
3. To understand the various instruments used for form measurement and surface finish.
4. To understand the principle, applications and advancements of laser.
5. To understand the various instruments to acquire the data and store in computer.

Outcome

The students would be able to understand the working principle of various measuring instruments.

UNIT 1. BASIC PRINCIPLES & LINEAR / ANGULAR MEASUREMENT


UNIT 2 : DISPLACEMENT, SPEED & ACCELERATION / VIBRATION MEASUREMENT


UNIT 3 : TEMPERATURE, PRESSURE AND FLOW MEASUREMENT


UNIT 4: FORCE, TORQUE, & STRAIN MEASUREMENTS

Measurement of force: Load cells, cantilever beams, proving rings, differential transformers.

UNIT 5: FORM MEASUREMENTS AND OPTICAL MEASUREMENTS


TOTAL HOURS

TEXTBOOKS:

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<td>V</td>
<td>DESIGN OF TRANSMISSION SYSTEMS</td>
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(Use of approved Design Data Book is permitted in the University examination)

**Aim**
The aim of the subject is to provide knowledge in various transmission system design principle.

**Scope**
1. To study the design procedure for power transmission by belt, ropes and pulleys.
2. To study the design procedure for spur and helical gears.
3. To study the design procedure for bevel, worm and cross helical gears.
4. To study the design procedure for various types of gear box.
5. To study the design procedure for clutches and brakes.

**Outcome**
The students would be able to understand the design of belts, gears and gear boxes.

### UNIT – I - DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 9
Selection of Flat belts and pulleys-Selection of V belts and pulleys – Wire ropes and pulleys – Selection of Transmission chains.

### UNIT – II -SPUR GEARS AND HELICAL GEARS 9
Gear Terminology-Gear materials -power rating calculations based on strength and wear considerations - Parallel axis Helical Gears. Simple gear design procedure.

### UNIT – III –BEVEL GEARS AND WORM GEARS 9

### UNIT – IV -DESIGN OF GEAR BOXES 9
Geometric progression - Standard step ratio - Ray diagram- kinematics layout — Design of multi speed gear box, simple gear box design problems (No. of speeds not more than 14).

### UNIT – V -DESIGN OF CLUTCHES AND BRAKES 9
Design of plate clutches –axial clutches-cone clutches- internal and external shoe brakes-simple problems.

**TUTORIAL** : 15
**TOTAL HOURS** : 60

**TEXT BOOKS**

**REFERENCES**
The aim of the subject is to provide basic knowledge in working principles of various measuring instruments.

To expose the students the measurement systems and its procedures.

The students would be able to understand the working principle of various equipments and their applications.

1. Temperature measurement using a Thermocouple.
2. Displacement measurement using a Linear Variable Differential Transformer (LVDT).
3. Speed measurement using Stroboscope.
6. Angular Measurements using Bevel Protactor and Sine Bar.
8. Straightness measurement using an autocollimator.
10. Fundamental dimension measurement of a gear using a contour projector.
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<td>VI</td>
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<th>Aim</th>
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<tr>
<td>The aim of the subject is to provide basic knowledge in heat transfer systems.</td>
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<td>Scope</td>
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<td>To gain knowledge in various heat transmissions systems and modes viz, conduction, convection and radiation.</td>
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<td>Outcome</td>
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<td>The students would be able to understand the modes of heat transfer with hands on training.</td>
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1. To determine the thermal conductivity of a lagged pipe.
2. To determine the thermal conductivity of a solid by the guarded hot plate method.
3. To determine the heat transfer through composite wall apparatus.
4. To find the effectiveness of a pin fin in a rectangular duct under natural convective & forced convective condition and plot temperature distribution along its length.
5. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
6. To determine average heat transfer coefficient for an externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
7. To measure the emissivity of the gray body (plate) at different temperature and plot the variation of emissivity with surface temperature.
8. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel & counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
9. To verify the Stefan-Boltzmann constant for thermal radiation.
10. Study and demonstration of boiler.

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<td>VI</td>
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</table>
Aim: The aim of the subject is to provide knowledge about various fluid power systems.

Scope: 1. To study about basics of fluid power systems  
2. To gain knowledge about components used in hydraulic and pneumatic systems  
3. To learn various valves and actuators  
4. To learn about different hydraulic circuits  
5. To learn about different pneumatic circuits

Outcome: The students would be able to understand the applications of hydraulics and pneumatic systems.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS

Introduction to fluid power, Advantages and Applications of fluid power system. Types of fluid power systems, Properties of fluids – General types of fluids – Fluid power symbols. Basic Laws in Fluid power system. Low cost automation.

UNIT II HYDRAULIC SYSTEM & PNEUMATIC SYSTEMS

Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps– Variable displacement pumps.  
Pneumatic Components: Compressors-types. Filter, Regulator, Lubricator Unit, Muffler– Air control valves, Quick exhaust valves.

UNIT III VALVES AND ACTUATORS


UNIT IV DESIGN OF HYDRAULIC CIRCUITS


UNIT V DESIGN OF PNEUMATIC CIRCUITS


TOTAL HOURS: 45

TEXT BOOKS:
1. Hydraulicas And Pneumatic Controls, Srinivasan, TMH  

REFERENCES:

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<td>VI</td>
<td>AUTOMOBILE ENGINEERING</td>
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Aim  The aim of the subject is to provide an overview of a complete automobile
Scope

1. To study construction and working of different engine components.
2. To study about the different auxiliary systems of an automobile.
3. To study about the transmission system of an automobile.
4. To understand the different types of steering, brakes and suspension systems of an automobile.
5. To study the various modern alternate technologies of automobiles.

Outcome

The students would be able to understand the various parts of automobiles and mechanisms.

UNIT I VEHICLE STRUCTURE AND ENGINES
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms, functions and materials

UNIT II ENGINE AUXILIARY SYSTEMS
Electronically controlled gasoline injection system for SI engines. Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system, Turbo chargers, Engine emission control by three way catalytic converter system.

UNIT III TRANSMISSION SYSTEMS
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel-torque converter, propeller shaft, slip joints, universal joints, Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock. Braking System and Traction Control

UNIT V ALTERNATIVE TECHNOLOGIES

TOTAL HOURS : 45

TEXT BOOKS
4. REFERENCES:
Aim  The aim of the subject is to provide overall knowledge about automobile engineering.
Scope  To study about the various parts of an automobile.
Outcome  The students would be able to understand the assembly and disassembly of various automobile Parts and also about other mechanisms.

List of Experiments:

1. Dismantling and assembling of Compression Ignition diesel engine.
2. Dismantling and assembling of Petrol engine.
3. Dismantling and assembling of Mesh Type gear box.
4. Dismantling and assembling of Rear Axle assembly with Differential.
5. Study of simple Carburetor by dismantling and assembling.
7. Study of engine Self Starting system.
10. Study of Differential Gear.
11. Study of diesel fuel supply system.
Aim: The aim of the subject is to provide overall knowledge about automation sector.

Scope: To train the students with hands on experience in fluid power systems and automation.

Outcome: The students would be able to understand the operation of various logical sequence with software.

LIST OF EXPERIMENTS:

1. Design and testing of fluid power circuits to control
   (i) Velocity (ii) direction and
   (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4. Design and Testing of Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
OBJECTIVE

❖ The objective of the project work is to enable the students to form the groups of not more than 3 members on a project involving theoretical and experimental studies related to the branch of study.

❖ Formation of Group as follows
  ❖ Group A : 8.5CGPA and above
  ❖ Group B : 7 to 8.49 CGPA
  ❖ Group C : 5 to 6.9 CGPA
    Group A Student will have a choice to take 2 students from Group B&C

❖ Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

❖ The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

❖ The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

❖ Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.

❖ This final report shall be typewritten form as specified in the guidelines.

❖ The continuous assessment shall be made as prescribed in the regulations.
# ELECTIVE SUBJECTS

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<td>OPERATIONS RESEARCH</td>
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</table>
Objectives:

- Linear Programming is useful in finding either maximum or minimum of an expression subject to given constraints
- To minimize the cost of transporting items from various sources to different destinations
- When number of activities are to be carried out most economical way with less time consumptions can be found
- Inventory is essential to provide flexibility in operating a system or organization.
- Decision making is an integral part of any business organization. It uses to select the best among several decisions through a proper evaluation of the parameters of each decision environment

1. Linear programming

2. Transportation model
   Transportations problem – Assignment problem – Under Assignment - Traveling salesman problem

3. Network model

4. Inventory Models
   Inventory Model – Economic Order Quantity Model – Purchasing Model (with and without shortages) – Manufacturing Model (with and without shortages) - Stochastic Inventory Model (Stock in discrete and continuous units).

5. Decision Model

   Tutorial : 15
   Total Hours : 60

TEXT BOOK

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<tr>
<td>REFRIGERATION AND AIRCONDITIONING</td>
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Objectives:
1. To understand the importance of refrigeration cycle.
2. To know about various refrigerants.
3. To explain the principles of psychrometry.
4. To understand various AC systems.
5. To understand various new and unconventional refrigeration systems.

UNIT I  REFRIGERATION CYCLE

UNIT II  REFRIGERANTS AND SYSTEM COMPONENTS

UNIT III  PSYCHROMETRY

UNIT IV  AIR CONDITIONING SYSTEMS
Cooling load calculation - working principles of centralized air conditioning systems, split, ductable split, packaged air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNIT V  UNCONVENTIONAL REFRIGERATION CYCLES
Vapor Absorption system – Ejector jet, Steam jet refrigeration, and Thermo electric refrigeration - applications. Ice plant – food storage plants – milk – chilling plants.

TOTAL HOURS :45

TEXT BOOKS:

REFERENCES:

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<tr>
<td>UNCONVENTIONAL MANUFACTURING PROCESSES</td>
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Objectives:
1. To gain knowledge and understanding of basic concepts of unconventional machining processes
2. To impart the knowledge and understanding of various mechanical methods
3. To impart the knowledge and understanding of electrical energy based processes
4. To impart the knowledge and understanding of chemical and hybrid processes
5. To impart the knowledge and understanding of thermal energy based processes

UNIT I  INTRODUCTION  6

UNIT II  MECHANICAL ENERGY BASED PROCESSES  9

UNIT III  ELECTRICAL ENERGY BASED PROCESSES  10

UNIT IV  CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES  10
Chemical machining and Electro-Chemical Machining- Electro Chemical Grinding and Electro chemical Honing-working principle and applications-Process Parameters -Surface finish and MRR - Etchants–Maskants.

UNIT V  THERMAL ENERGY BASED PROCESSES  10
Laser Beam Machining and drilling, Plasma Arc Machining and Electron Beam Machining Working principles & Applications – Equipment –Types - Beam control techniques. Micromachining and Nanofabrication Techniques

TOTAL HOURS  :45

TEXT BOOKS:

REFERENCES:
Objectives:
1. To learn the basics about Robotics and Robot manipulation in space.
2. To understand the controlling of Robots and devices system.
3. To learn the Sensor technology
4. To learn the knowledge of Robot programming and Expert system.
5. To understand about Robot cell design, applications and economics

UNIT I  FUNDAMENTALS OF ROBOT

UNIT II  ROBOT DRIVE SYSTEMS AND END EFFECTORS

UNIT III ROBOT SENSORS

UNIT IV  ROBOT KINEMATICS AND ROBOT PROGRAMMING
Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End Effectors commands and simple programs.

UNIT V  CELL DESIGN APPLICATIONS AND ECONOMICS OF ROBOTICS

TOTAL HOURS : 45

Text Books:

Reference Books:


Objectives:
1. To learn about SI engines.
2. To learn about CI engines.
3. To learn to control various pollutants.
4. To know about various alternative fuels.
5. To know various latest trends in automobiles.

1. SPARK IGNITION ENGINES


2. COMPRESSION IGNITION ENGINES


3. POLLUTANT FORMATION CONTROL


4. ALTERNATIVE FUELS


5. RECENT TRENDS


TOTAL HOURS: 45
TEXT BOOK:

REFERENCES:
1. R.B.Mathur and R.P.Sharmal- “Internal Combustion Engines ".
Objectives:
1. To introduce the importance of cryogenic engineering.
2. To study the low temperature refrigeration system.
3. To study the gas separation systems.
4. To know the vacuum technology.
5. To understand about cryogenic storage.

UNIT 1 CONSTRUCTION DETAILS AND HEAT TRANSFER 9

UNIT II LIQUEFACTION AND LOW TEMPERATURE REFRIGERATION 9

UNIT III SEPARATION AND PURIFICATION SYSTEMS 9
General characteristics of mixtures-composition diagrams. Gas separation-principles of rectification-flash calculations - Rectification column analysis- Flash calculations.

UNIT IV INSULATION AND VACUUM TECHNOLOGY 9
Thermal insulation and their performance at cryogenic temperatures- Super Insulations- Vacuum insulation- Powder insulation- Cryo pumping Applications.

UNIT V STORAGE AND INSTRUMENTATION 9
Cryogenic Storage vessels and Transportation- Transfer devices. Pressure flow-level and temperature measurements.

TOTAL HOURS :45

TEXT BOOK:

REFERENCES:
Objectives:

1. To understand Rapid prototyping history and its development.
2. To gain knowledge about liquid and powder based RP process
3. To enable student to learn about solid based RP process
4. To inherit knowledge about Rapid Tooling
5. To elaborate about principles of reverse engineering

UNIT I INTRODUCTION

UNIT II LIQUID AND POWDER BASED RP PROCESSES
Liquid based process: Principles of STL and typical processes such as the SLA process, solid ground curing and others - Powder based process: Principles and typical processes such as selective laser sintering and some 3D printing processes.

UNIT III SOLID BASED RP PROCESSES
Principles and typical processes such as fused deposition modeling laminated object modeling and others.

UNIT IV RAPID TOOLING
Principles and typical processes for quick batch production of plastic and metal parts though quick tooling.

UNIT V REVERSE ENGINEERING
3D scanning, 3D digitizing and Data fitting, high speed machining- Hardware and software - Applications: Evaluation, bench marking and various case studies.

TOTAL HOURS: 45

Text Books:

REFERENCES:

UNIT I
Introduction: Energy resources and their availability, types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants: Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

Unit II
Steam Power Plants: Layout and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

Gas Turbine and Combined Cycle Power Plants: Constant pressure gas turbine power plants, Arrangements of combined plants (steam & gas turbine power plants), re-powering systems with gas production from coal using PFBC systems, with organic fluids, parameters affecting thermodynamic efficiency of combined cycles.

Unit III
Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal.

Non-Conventional Power Generation: Solar radiation estimation, solar energy collectors, Low, medium & high temperature power plants, OTEC, wind power plants, tidal power plants, geothermal power plants.

Unit IV
Power Plant Economics: Load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, input-out put curves, efficiency, heat rate, economic load sharing, Problems.

Unit V
Direct Energy Conversion Systems: Fuel cell, MHD power generation-principle, open & Closed cycle’s systems, thermoelectric power generation, thermionic power generation.

TOTAL HOURS :60

Text Books:

Reference Books:
Lean Manufacturing Systems

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Objectives:
1. To gain the knowledge and understanding of basic concepts of lean manufacturing process
2. To understand the various quality improvement methods in lean manufacturing.
3. To gain the knowledge and understanding of basic concepts of scheduling systems.
4. To gain the knowledge and understanding of basic concepts of JIDOKA
5. To gain the knowledge and understanding of basic concepts of employee involvement and systematic planning

UNIT I INTRODUCTION
The mass production system – Origin of lean production system – Necessity – Lean revolution in Toyota – Systems and systems thinking – Basic image of lean production – Customer focus – Muda (waste).

UNIT II STABILITY OF LEAN SYSTEM

UNIT III JUST IN TIME

UNIT IV JIDOKA (AUTOMATION WITH A HUMAN TOUCH)

UNIT V WORKER INVOLVEMENT AND SYSTEMATIC PLANNING METHODOLOGY
Involvement – Activities to support involvement – Quality circle activity – Kaizen training - Suggestion Programmes – Hoshin Planning System (systematic planning methodology) – Phases of Hoshin Planning – Lean culture.

TOTAL HOURS: 45

TEXTBOOKS:
1. Pascal Dennis, Lean Production Simplified: A Plain-Language Guide to the
3. Mike Rother and John Shook, Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA, Lean Enterprise Institute, 1999.

REFERENCES:
UNIT –I INTRODUCTION  

UNIT –II - TQM PRINCIPLES  

UNIT –III - STATISTICAL PROCESS CONTROL (SPC)  
The seven tools of quality- Statistical Fundamentals – Measures of central Tendency and Dispersion- Population and Sample- Normal Curve- Control Charts for variables and attributes- Process capability- Concept of six sigma- New seven Management tools.

UNIT –IV - TQM TOOLS  

UNIT –V - QUALITY SYSTEMS  

Total Hours : 45

TEXT BOOK:

REFERENCES:
Objectives:
1. To gain knowledge about surfaces and to study the different types of friction in materials.
2. To gain knowledge in wear mechanisms, types of wear for different environment and materials.
3. To study the properties of fluid film for bearing applications.
4. To have a theoretical understanding of the film lubrication theory.
5. To learn the various ways of modifying the surface of the materials for bearing.

UNIT I  SURFACES AND FRICTION  

UNIT II  WEAR  

UNIT III  LUBRICANTS AND LUBRICATION TYPES  

UNIT IV  FILM LUBRICATION THEORY  
Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual Co-efficient of friction - The Sommerfield diagram/.

UNIT V  SURFACE ENGINEERING AND MATERIALS FOR BEARINGS  

TOTAL HOURS: 45

TEXT BOOK:

REFERENCES:
Objectives:
1. To know about the combustion process.
2. To explain about the thermo chemistry.
3. To explain about the kinetics of combustion.
4. To explain about various flames.
5. To know the combustion process in an engine.

UNIT I COMBUSTION OF FUELS

UNIT II THERMODYNAMICS OF COMBUSTION
Thermo-chemistry- First law analysis of reacting systems- Adiabatic combustion temperature- Second law analysis of reacting systems- criterion for chemical equilibrium- Equilibrium constant for gaseous mixtures- Evaluation of equilibrium composition- chemical availability.

UNIT III KINETICS OF COMBUSTION
Rates of reaction- Reaction order and molecularity complex reactions- chain reactions- Arrhenius rate equation- Collection theory- activated complex theory- Explosive and general oxidative characteristics of fueled.

UNIT IV FLAMES
Laminar and Turbulent flames- Premixed and Diffusion flames- Burning velocity and its determination- Factors affecting burning velocity- Quenching- Flammability and Ignition- Flame stabilization in open burners.

UNIT V ENGINE COMBUSTION
Combustion in SI and CI engines- stages of combustion in SI and CI engines- Normal combustion and abnormal combustion- Emissions from premixed combustion- Emission from Nonpremixed combustion- Control of emissions

TOTAL HOURS : 45

TEXT BOOK:

REFERENCES:
Objective:
1. To understand the classification of Engineering Materials and their relevant applications.
2. To understand the powder metallurgy concepts, process techniques, applications.
3. To understand the basics in composites, fabrication methods, types and applications.
4. To understand the various forms of Smart Materials, applications.
5. To understand the various types of Nano-material’s, production & applications.

UNIT 1: ENGINEERING MATERIALS CLASSIFICATION, PROPERTIES & APPLICATIONS

UNIT 2: POWDER METALLURGY

UNIT 3: COMPOSITES
Composites – Types of composites - Naturally occurring, synthetic & engineered composites - MMC – CMC – PMC - Fibre and whisker reinforced composites (continuous and discontinuous) - particulate composites layered or sheet composites, composite coating or thin fibre, inter metallic composites - properties and characteristics of composites – commercially important components and their applications

UNIT 4: SMART MATERIALS
Introduction to intelligent/smart materials, shape memory alloys-types, NiTiNol-origin, properties, martensitic transformation, Memorization process- applications-medical, satellite etc.

UNIT 5: NANO MATERIALS

TEXTBOOKS:
2. M.V.Gandhi., Thomson - Smart Materials and Structures- Chapman and Hall
3. A.K.Bandhopadyay-Nanomaterials-New Age
REFERENCES:
Objectives:

1. To understand the basic fundamentals of Nanotechnology and applications.
2. To understand the basic fundamentals of Nanoparticles and applications.
3. To understand the various properties of nanomaterials.
4. To understand the basic fundamentals of Nanopowders.
5. To understand the recent developments in Nanotechnology and latest applications.

UNIT I  INTRODUCTION AND DEFINITION OF NANOTECHNOLOGY

UNIT-II  NANO PARTICLES

UNIT-III PROPERTIES
Mechanical properties: Strength of Nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties. Electrical properties: Switching glasses with nanoparticles, Electronic conduction with nanoparticles. Optical properties: Optical properties, special properties and the coloured glasses

UNIT-IV NANO-POWDERs
Process of synthesis of Nano powders, Electro deposition, Important Nanomaterials

UNIT -V LATEST DEVELOPMENTS IN NANOTECHNOLOGY & APPLICATIONS

TEXT BOOKS:
2. Nano Essentials- T.Pradeep, TMH
3. Springer Handbook of Nanotechnology - Bharat Bhusan
Objectives:

1. To impart about automotive components.
2. To know various ignition systems and emission.
3. To know how to use various instruments.
4. To know about the use of electronics in brakes and clutches.
5. To know about the engine management system.

UNIT – I: INTRODUCTION TO AUTOMOTIVE SYSTEMS

Introduction to Electronic – “Intensive automobile”
Use of electronic in vehicles today – communications networks and protocols – software applications –
control of engine and transmission – Electronic controls in “Electric – Drive Vehicles” – Vehicle
starting and charging systems navigation and communications partially and fully automated vehicle.

UNIT – II: IGNITION SYSTEMS AND EMISSION

Ignition systems: Ignition fundamental, Electronic ignition systems, Programmed ignition, Distribution
less ignition, direct ignition, Spark plugs.

UNIT – III: INSTRUMENTATION SYSTEMS

Instrumentation Systems: Introduction to instrumentation systems-application of various sensors-
Driver instrumentation systems – Dash board instrumentation - vehicle condition monitoring-different
types of visual Display.

UNIT – IV: ELECTRONIC BRAKING CLUTCHES AND STEERING

Traction and stability control – Adoptive cruise control - Electronic control of Automatic
Transmission:
Introduction and description Control of gear shift and torque converter lockup-Break power assistance
and lockup control – Breaking and stability control in Electric vehicle – suspension control – power
steering assist.

UNIT V. VEHICLE MANAGEMENT SYSTEM

Combined ignition and fuel management systems-Exhaust emission control - Artificial intelligence and
Engine management - Lighting and Security Systems: Vehicles lighting Circuits, - Central locking and
electric windows- security systems - Alarm occupant protection system – self diagnostics – event data
recorders – next generation systems: - Steering – by wire and break – by – wire – vehicle to vehicle
and vehicle to infrastructure communications – ($V_2V$) & ($V_2I$).

TOTAL HOURS: 45
TEXT BOOKS:
1. Human factors in the design of automotive electronics systems, Lane departure warning and keeping parallel packing assistance.

REFERENCES:
2. TOM DENTON, Automobile Electrical and Electronic Systems, Edward Arnold PB. 1995.
Objectives:
1. To understand the basics of governing equations and boundary conditions
2. To gain knowledge about finite difference method
3. To enable student to learn about FVM – Diffusion.
4. To inherit knowledge about FVM- Convection diffusion.
5. To elaborate about FVM flow field calculation

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

UNIT II FINITE DIFFERENCE METHOD 9

UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 9
Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 9
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V CALCULATION FLOW FIELD BY FVM 9
Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, simple algorithm and its variants. Turbulence models, mixing length model, two equation (k-ië) models – High and low Reynolds number models

TOTAL :45
TEXT BOOKS:

REFERENCES:
5. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.
Objectives:
1. To learn the principles of fluid machinery.
2. To understand various fans and blowers.
3. To understand the concept of compressors.
4. To learn the concept of axial flow compressors.
5. To understand the concept of various turbines.

UNIT I  PRINCIPLES
Energy transfer between fluid and rotor-classification of fluid machinery-dimensionless Parameters-specific speed-applications-stage velocity triangles-work and efficiency.

UNIT II  CENTRIFUGAL FANS AND BLOWERS
Types-stage and design parameters-flow analysis in impeller blades-volute and Diffusers, losses, characteristic curves and selection, fan drives and fan noise.

UNIT III  CENTRIFUGAL COMPRESSOR
Construction details, impeller flow losses, slip factor, diffuser analysis, losses and Performance curves.

UNIT IV  AXIAL FLOW COMPRESSOR
Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work Done simple stage design problems and performance characteristics.

UNIT V  AXIAL AND RADIAL FLOW TURBINES
Stage velocity diagrams, reaction stages, losses and coefficients, blade design Principles, testing and performance characteristics.

TOTAL HOURS  45

TEXT BOOK:

REFERENCES:
Objectives:
1. To understand the importance of entrepreneurship for engineering students.
2. To inculcate entrepreneurship skills for engineering students.
3. To create awareness of business and train in preparing the project report and crate awareness for engineering students.
4. To understand the importance of finance and its transactions.
5. To develop the skills of consequences of business sickness and take corrective measures.

UNIT I ENTREPRENEURSHIP

UNIT 2 MOTIVATION

UNIT 3 BUSINESS AND ENTERPRISE MANAGEMENT

UNIT 4 FINANCIAL MANAGEMENT

UNIT 5 BUSINESS SICKNESS AND GROWTH STRATEGIES

TOTAL HOURS: 45

TEXT BOOKS:

REFERENCES:
1. EDII – “A manual for Entrepreneurs”– Entrepreneurship Development Institute of India, Ahmedabad- Tata McGrawHill-2006...
Objectives:
1. To learn marketing skills for engineering students.
2. To understand the behavioural pattern of customers
3. To learn marketing research and develop skills of sales forecasting.
4. To learn the skills of developing a market plan and formulation of strategies.
5. To understand various promotion mix details.

UNIT I MARKETING ENGINEERING APPROACH 9


UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION 9

Customer value assessment and valuing customers- Understanding customer needs and wants-
Customer Buying behavior- Motives- types- Buying decisions- segmentation factors- Demographic-Psychographic & Geographic Segmentation- Buying Patterns-Social and Ethical considerations.

UNIT III MARKETING RESEARCH & SALES FORECASTING 9


UNIT IV MARKETING PLANNING & STRATEGY FORMULATION 9


UNIT V POSITIONING AND PROMOTION MIX 9


TOTAL HOURS :45
TEXT BOOKS:

REFERENCES:
Objectives:
1. To understand the importance of work study methods and its importance in various fields.
2. To develop the skills of selection of a plant and also material handling equipment required.
3. To learn PPC and its functions.
4. To learn the skills of purchasing materials and their management.
5. To learn the awareness on various labour acts and management principles.

UNIT-I WORK STUDY
Evolution and importance of industrial engineering – Production-Classification-Productivity- Factors influencing productivity, Work study - Definition-Procedure and benefits of work study –Method study-Charting techniques-Time study-Procedure and techniques of work measurement –Stop watch time study-Motion study –SIMO chart.

UNIT-II PLANT LAYOUT AND MATERIALS HANDLING
Plant location-Factors influencing the location-selection of site-Plant layout- Types of layout-Plant layout procedure- Material handling –Scope and Principles of Material Handling-Types of Material Handling equipment–Relationship to plant layout.

UNIT-III: PRODUCTION PLANNING AND CONTROL
Introduction-Advantages of PPC-Functions of PPC-Demand Forecasting- Types of Forecasting- Routing-Objectives and procedure of routing-Scheduling-purpose and preparation of schedules- Scheduling techniques like CPM and PERT-Functions and types of dispatching-

UNIT-IV: MATERIAL MANAGEMENT
Procurement of materials-codification of materials-Inventory control-Objectives of inventory control- EOQ-Inventory models-ABC analysis-Material requirements planning (MRP)-Enterprise resource planning (ERP)-supply chain Management (SCM)-Inspection and quality control-SQC-control charts- sampling procedures-Bench marking.

UNIT-V: INDUSTRIAL LEGISLATION AND MANAGEMENT CONCEPTS
Importance and necessity of Labour acts-principles of labour legislation-various acts-Industrial Ownership and various types-Functions of management-Manpower Planning-Recruitment and Selection-Break Even Analysis-Managerial applications of breakeven point-Decision making -Techniques of decision making.

TOTAL HOURS : 45
TEXT BOOKS:

REFERENCES:
3. Vijay Seth-“Industrial Engineering-methods and practices”-Pernam International publishing,Mumbai-2005
At the end of this elective, student shall be able to:
1. Get an exposure to the Aerospace Industry.
2. Understand the Basics of Aircraft Systems and Aircraft Structures.

Chapter-1 –Aircraft industry overview, Duration- 3 hours

Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Manufacturing, Industry Supply Chain, Prime contractors, Tier 1 Suppliers, Key challenges in Industry Supply Chain, OEM Supply Chain Strategies, Mergers and Acquisitions, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario

Chapter-2 –Introduction to Aircrafts, Duration- 5 hrs

Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices. Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Configurations- Biplane, Variable Sweep, Canard Layout, Twin Boom Layouts, Span loaders, Blended Body Wing Layout, STOL and STOVL Aircraft, Stealth Aircraft. Advantages and disadvantages of these Configurations.

Chapter-3-Introduction to Aircraft Systems, Duration- 16 hrs


Chapter-4-Basic Principles of Flight, Duration- 10 hrs

Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli’s Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching moments, Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag, Center of Pressure and its effects. Aerofoil Nomenclature,
Types of Aerofoil, Wing Section- Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag.

**Chapter-5-Basics of Flight Mechanics , Duration 6 hrs**

Mach Waves, Mach Angles, Sonic and Supersonic Flight and its effects

**Stability and Control**
Degree of Stability- Lateral, Longitudinal and Directional Stability and controls of Aircraft. Effects of Flaps and Slats on Lift Coefficients, Control Tabs, Stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves

**Aircraft Performance and Maneuvers**
Power Curves, Maximum and minimum speeds of horizontal flight, Effects of Changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on aAeroplane during a Turn, Loads during a Turn, Correct and incorrect Angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability

Reference Books:
4. Introduction to Flight by Dave Anderson
5. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge
6. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann
At the end of this elective, student shall be able to:

1. Industry Practices on Design of Aircraft Structures.
2. Understand the applicability of Design aspects in Aircraft Design.
3. Relate the theoretical knowledge with the design of Aircraft Structures.

Chapter-1-Overview of the Aircraft Design Process, Duration- 2hrs


Chapter 2-Fundamentals of Structural Analysis, Duration 2 hrs

Review of Hooke’s Law, Principal stresses, Equilibrium and Compatibility, Determinate Structures, St Venant’s Principle, Conservation of Energy, Stress Transformation, Stress Strain Relations

Chapter 3-Introduction to Aircraft Structures, Duration 3 hrs

Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints

Chapter-4 Aircraft Loads, Duration- 4 hrs

Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, VN diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads

Chapter-5-Aircraft Materials and Manufacturing processes Duration- 4 hrs

Chapter-6-Structural Analysis of Aircraft Structures Duration-20

Theory of Plates- Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of Stiffened panels in Post buckling, Post buckling under shear. Sample Exercises.

Theory of Shells-Analysis of Shell Panels for Buckling, Compression loading, Shear Loading / Shell Shear Factor, Circumferential Buckling Stress, sample exercises

Theory of Beams-Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Plastic Bending of beams, Shear Stresses due to Bending in Thin Walled Beams, Bending of Open Section Beams, Bending of Closed Section Beams, Shear Stresses due to Torsion in Thin Walled Beams. Sample Exercises.

Theory of Torsion - Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Multi Cell Sections, Sample Exercises.

Chapter-7 Airworthiness and Aircraft Certification, Duration- 4 hrs
Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements, Airframe Requirements, Landing Requirements, Fatigue and Failsafe requirements, Emergency Provisions, Emergency Landing requirements

Chapter-8 Aircraft Structural Repair, Duration- 3 hrs
Types of Structural damage, Nonconformance, Rework, Repair, Allowable damage Limit, Repairable Damage Limit, Overview of ADL Analysis, Types of Repair, Repair Considerations and best practices

Reference Books:
Objectives:

1. To understand the basics of pipes and their material’s selection.
2. To understand the various pipeline accessories and fittings.
3. To know about various valves and their selection.
4. To know about various special piping elements.
5. To understand about various flows of fluids and frictional losses through pipes due to the flow.

UNIT 1: FUNDAMENTALS OF PIPING

Introduction and Scope of Piping – Definition and Application of Pipes – Pipe networks – Selection of Materials – Codes and Standards.

UNIT 2: ACCESSORIES AND FITTINGS


UNIT 3: VALVES

Definition – Types – Functions – Operators – Valves Layout Considerations – Valve Data Sheet – Valve Selection

UNIT 4: PIPING SPECIAL ELEMENTS


UNIT 5: FLOW THROUGH PIPES


TOTAL HOURS : 45
BOOKS:

REFERENCES:
Objectives:

1. To make the students to understand the importance of ceramics in various advanced fields.
2. The application of ceramic in bio and medical field will help the students to gain knowledge in those fields.
3. To familiarize the ceramics applications in electronic industries.
4. To understand the application of ceramics in special and precious items
5. To enable students to understand about the Nano technology in ceramic field.

UNIT 1: CERAMICS USED IN ADVANCED APPLICATIONS: 9


UNIT 2: CERAMICS FOR MEDICAL AND SCIENTIFIC PRODUCTS: 9


UNIT 3: CERAMICS FOR OPTICAL APPLICATIONS: 9

CRT and TV picture tubes - Telecommunication and related uses - Information display - Laser – Fibre optics - Electromagnetic windows.

UNIT 4: MAGNETIC CERAMICS: 9

Spinel Ferrites - Hexagonal Ferrites - Garnet - Processing -Single crystal ferrite -Applications.

UNIT 5: CERAMIC SUPERCONDUCTORS AND NANOCERAMICS: 9


Total Hours : 45
BOOKS:-

REFERENCES:
2. The ceramic society of Japan-“Advanced ceramic technologies & Products”-Springer.
4. Laurent sedal,Christian Rey-“Bio ceramics”-volume 10,proceedings of ceramics in medicine,1997
Objectives:

1. To understand the various types of vibration and analyses.
2. To understand the basics of Noise and the relevant parameters.
3. To understand the noise sources relevant to automotives.
4. To understand the various vibration control techniques.
5. To understand the various noise control techniques.

UNIT I    BASICS OF VIBRATION

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies - Vibration Analyses.

UNIT II    BASICS OF NOISE

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III   AUTOMOTIVE NOISE SOURCES


UNIT IV    CONTROL TECHNIQUES

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V    SOURCE OF NOISE AND CONTROL

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

Total Hours : 45
TEXT BOOKS:

REFERENCES:
AIM
To study the critical need for ensuring Cyber Security in real time problems

OBJECTIVES
1. To understand the basics of Cyber Security
2. To know the legal, ethical and professional issues in Cyber Security
3. To know the various attacker techniques

UNIT I CYBER SECURITY FUNDAMENTALS

UNIT II ATTACKER TECHNIQUES AND MOTIVATIONS
Antiforensics – Tunneling techniques – Fraud Techniques - Threat Infrastructure.

UNIT III EXPLOITATION
Techniques to gain a foot hold – Misdirection, Reconnaissance, and disruption methods.

UNIT IV MALICIOUS CODE

UNIT V DEFENSE AND ANALYSIS TECHNIQUES

TEXT BOOK

REFERENCE BOOKS
OBJECTIVE:
To provide knowledge of production operations in the oil and gas wells such as artificial lifts and subsurface equipments.

UNIT I Components of the petroleum systems

UNIT II Well Production

UNIT III Surface Equipment and Operations
Flow control and well heads. Gathering systems; service and cleaning systems; design and testing of flow lines. Separation and separators; separator components, stage separation; design and construction of separators. Meeting-Oil and gas metering techniques.

UNIT IV Flow Measurement System

UNIT V Completion Techniques
Well completion techniques and equipment, drill stem test (DST) flowing well performance, vertical lift performance, optimum size tubing and chokes, production forecast for a pool. Design and analysis of artificial methods of petroleum production. Work over and sand exclusion technique.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE:
UNIT I COAL FACE MECHANISATION
Recent Trends, mechanised bord and pillar mining, case studies.

UNIT II MINING OF THICK SEAMS
Problems, past experiences in India, current methods, mining of thick, contiguous, and steep seams

UNIT III HYDRAULIC MINING
Applicability, operating parameters, equipment, layouts, Indian experience. Computer applications such as remote control and environmental monitoring in hydraulic mining.

UNIT IV LONGWALL MINING
Powered supports, development of powered supports, their types and designs, selection for different conditions, last drivages for longwall panelling, remotely operated powered support and longwall faces, Indian experiments, salvaging in longwall.

UNIT V UNDERGROUND COAL GASSIFICATION
Scope, application, methods of gasification, design of gasification plants, coal bed methane. Environmental monitoring techniques and computer applications in coal gasification techniques.

TEXT BOOKS:
1. Das S.K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1994

REFERENCES:
1. Peng S.S. and Chiang, H.S., Longwall Mining, John Willey and Sons, New York, 1992
UNIT I IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT 8

UNIT II ELECTRICAL SYSTEMS 12

UNIT III THERMAL SYSTEMS 10

UNIT IV ENERGY CONSERVATION 8
Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.

UNIT V ENERGY MANAGEMENT, ECONOMICS 7

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
OBJECTIVES:
• To study and understand the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

UNIT I OVERVIEW OF NDT
NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection –Unaided and aided.

UNIT II SURFACE NDE METHODS

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION(AE)

UNIT V RADIOGRAPHY (RT)
Principle , interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films -graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy - Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
   2. Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4,

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Objective:
1. To study tools and technique of work study.
2. To understand process planning concepts.
3. To understand cost estimation.
4. To know about depreciation and ladder cost.
5. To study production cost estimation.

1. WORK STUDY AND ERGONOMICS 9
Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques-
Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time

2. PROCESS PLANNING 9
Definition – Objective – Scope – approaches to process planning- Process planning activities –
Finished part requirements - operating sequences - machine selection – material selection parameters-
Set of documents for process planning - Developing manufacturing logic and knowledge- production
time calculation – selection of cost optimal processes – Introduction to ERP

3. INTRODUCTION TO COST ESTIMATION 9
Importance and aims of cost estimation – functions of estimation – costing – importance and aims of
costing – difference between costing and estimation – importance of realistic estimates – estimation
procedure. Types of estimates – methods of estimates – data requirements and sources- collection of
cost- allowances in estimation.

4. ELEMENTS OF COST 9
Expenses – Factory Expenses – Depreciation – Methods – Administrative Expenses – Marketing
Expenses - Ladder of Cost.

5. PRODUCTION COST ESTIMATION 9
Estimation for forging - estimation for welding and gas cutting – estimation in foundry shop –
estimation for machining – estimation for drilling and other metal removal operations - Illustrative
Examples.

TOTAL HOURS:45

TEXT BOOKS

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<td>DISASTER MITIGATION AND MANAGEMENT</td>
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Aim | To impart awareness on disasters and preparedness during disasters
Scope | 1.To Understand basic concepts in Disaster Management
UNIT 1 INTRODUCTION
Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Natural and man-made hazards

UNIT 2 RISK ASSESSMENT AND VULNERABILITY ANALYSIS
Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

UNIT 3 DISASTER MANAGEMENT MECHANISM
Concepts of risk management and crisis management -Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness-Planning for relief

UNIT 4 DISASTER RESPONSE
Mass media and disaster management-Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan-Logistics Management-Psychological Response-Trauma and Stress Management-Rumour and Panic Management-Minimum Standards of Relief-Managing Relief-Funding

UNIT 5 DISASTER MANAGEMENT IN INDIA
Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans

Text books

References
Aim  The aim of the subject is to create ethics and inculcate right virtues.

Scope  To create an awareness on Ethics and Human Values in engineering professions and to inspire moral and social values and Loyalty to appreciate the rights of others

Outcome  The students would be able to understand the responsibility of every citizen and right virtues.

Unit – I: HUMAN VALUES  9

Unit – II: ENGINEERING ETHICS  9

Unit – III: ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

Unit – IV: SAFETY, RESPONSIBILITIES AND RIGHTS  9
Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and Chernobyl case studies.

Unit – V: GLOBAL ISSUES  9
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India, etc.

Total Hours  45

TEXT BOOK
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India,

REFERENCES