## CURRICULUM & SYLLABUS

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Dr.K.G.MUTHURAJAN       Prof.K.V. KRISHNASATRY       Prof.N.LAKSHMI NARAYANAN       Prof.N.RAJAN
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ENGINEERING MATHEMATICS
(COMMON TO THE BRANCHES MECH, ECE, CSE, CSSE, EEE, EIE, CIVIL, IT, MECHTRONICS, AERONAUCTICAL, ETC, AUTOMOBILE)
(PART TIME)

The syllabus for Engineering Mathematics common to all branches except Bio info and Bio tech approved by the Board of studies held on 28th and 29th July 2012 at VMKV Engineering College, Salem.

UNIT I
MATRICES 09
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 09
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 09

UNIT IV
LAPLACE TRANSFORMS 09

UNIT V
APPLICATIONS OF LAPLACE TRANSFORMS 09
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
TEXT BOOKS

1. “Engineering Mathematics” by Department of Mathematics, VMU

REFERENCE BOOKS

ENVIRONMENTAL SCIENCE AND ENGINEERING Credit: 3  
(Common to B.E all branches)

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: 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

UNIT I CASTING

UNIT II METAL FORMING AND POWDER METALLURY
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
ENGINEERING MECHANICS

UNIT 1. BASICS & STATICS OF PARTICLES  

UNIT 2. EQUILIBRIUM OF RIGID BODIES  
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 and axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimension - Equilibrium of Rigid bodies in three dimensions - Examples.

UNIT 3. PROPERTIES OF SURFACES AND SOLIDS  
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  

UNIT 5. FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  
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
   Credits : 04
TEXT BOOK:
A. Singaravelu, "Transforms and Partial Differential Equations", Meenakshi Agencies, Chennai

REFERENCES:
STRENGTH OF MATERIALS

UNIT –I -STRESS- STRAIN AND DEFORMATION OF SOLIDS
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
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

UNIT –IV -DEFLECTION OF BEAMS

UNIT –V -ANALYSIS OF STRESSES IN TWO DIMENSIONS
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:
In reality all equations cannot be solved in complete form. Hence the next best solution is only Numerical Methods. Therefore Numerical Methods plays a pivotal role in the field of Engineering.

1. SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS

2. 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).

3. NUMERICAL DIFFERENTIATION AND INTEGRATION

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

5. 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.

Tutorial: 15
Total hours: 60

TEXT BOOK
Credits: 04

1. A. Singaravelu ,”Numerical Methods” , Meenakshi Agency, Chennai

Dr.K.G.MUTHURAJAN       Prof.K.V. KRISHNASATRY       Prof.N.LAKSHMI NARAYANAN       Prof.N.RAJAN
REFERENCES
Objective:

1. To understand the various deformation mechanism, failure modes and phase diagram.
2. To inculcate the heat treatment methodologies and mechanical treatment methodologies.
3. To understand the classification, properties and application of various engineering materials.
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.

UNIT I BEHAVIOR OF MATERIALS

Introduction to plastic deformation - Slip and twinning – Types of fracture-brittle, ductile, creep & fatigue. Phase diagrams- Iron – Iron carbide equilibrium diagram-TTT & CCT curve

UNIT II MATERIAL TREATMENT

Heat treatment- annealing, Normalising- hardening and Tempering, Case hardening, Hardenability - Jominy end quench test
Mechanical Treatment-strengthening mechanisms-strain hardening, solid solution hardening, grain size reduction

UNIT III METALLIC & NON-METALLIC MATERIALS


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 -Manufacturing-compaction-sintering-applications
Composites-MMC,PMC,CMC-properties & applications
SEM-working principle, set-up, sample preparation method-evaluation mode-EDAX

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCE BOOKS
2. George E. Dieter, “Mechanical Metallurgy”
Objective:
1. To inculcate fundamental basic mechanisms of kinematics.
2. To provide input to analyze simple mechanisms using graphical and vectorial approach.
3. To study about Cams and to draw their profiles.
4. To learn about Gear terminology and types of gears.
5. To study about friction occurring in Clutches and Brakes.

UNIT –I -BASICS OF MECHANISMS

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. Write programs to Solve and Plot Cam profiles using C Programming language.

UNIT –IV -GEARS

UNIT –V -FRICTION
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
1. IS 2458 : 2001 - Vocabulary of Gear Terms – Definitions Related to Geometry
Objective:
1. To learn about influence of computer in Design and Manufacturing
2. To understand the importance of curves, transformations in CAD
3. To inherit concepts of modeling and Graphics
4. To gain knowledge about CNC and its Tooling
5. To elaborate about CNC coding

UNIT 1 INTRODUCTION TO CAD/CAM
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 2 INTERACTIVE COMPUTER GRAPHICS
Analytic curves and surfaces, Hidden line elimination, 2D and 3D homogenous transformations - translation, rotation, reflection, scaling, shearing and combined transformation, 3D viewing transformation – panning, rotation, reflection, shearing and zooming.

UNIT 3 SOLID MODELING
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 4 FUNDAMENTALS OF CNC MACHINES

UNIT 5 PART PROGRAMMING FOR CNC MACHINES

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCE BOOKS
Objective: To provide an hands on experience to do conduct testing of materials.

List of Experiments:

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
.METALLURGY  LAB

OBJECTIVES:
To provide an basic understanding of microstructures of specimens of different materials and also to understand the process of heat treatment.

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)

LIST OF EQUIPMENTS

1. Metallurgical Microscope
2. Disc Polishing Machine
3. Muffle furnace
4. Hardness testing machine

REFERENCE MANUAL:

Metallurgy Laboratory Manual-Faculty of Mechanical Engineering, Vinayaka Missions University
Objective:
1. To study about forces acting on various 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.

UNIT 1  Force Analysis

Objective: To study about forces acting on various mechanisms

UNIT –II  BALANCING

Objective: To learn static and dynamic balancing of masses
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 -111  FREE VIBRATIONS

Objective: To study the characteristics of free and forced 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

Objective : To study and analyze various types of Governors and effect of gyroscopic forces

Governors: Types of Governors; force analysis of Porter, Proel and spring controlled governors.

Gyroscopic Forces: Gyroscopic couple, Effect of Gyroscopic couple on vehicle; Uses of Gyroscopic forces. - Ships and airplanes

TUTORIAL PERIODS : 15
TOTAL HOURS PERIODS : 60

TEXT BOOKS

REFERENCES
Objective:
1. To study about basic fluid power systems
2. To gain knowledge about hydraulic systems and its applications
3. To learn to draw hydraulic circuits
4. To study the basics of pneumatics and to learn about pneumatic systems
5. To learn to draw pneumatic circuits

UNIT –I BASICS OF FLUID POWER

UNIT –II HYDRAULIC SYSTEMS

UNIT –III HYDRAULIC CIRCUITS

UNIT –IV PNEUMATIC SYSTEMS
UNIT –V  PNEUMATIC CIRCUITS
Design of Pneumatic circuits - Classic-Cascade-Step counter - Combination -Methods - PLC-
Microprocessors - Uses - Selection criteria for Pneumatic components - Installation and
Maintenance of Hydraulic and Pneumatic power packs - Faultfinding-Principles of Low Cost
Automation  and Applications

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Andrew Parr- " Hydraulics and Pneumatics (HB) "- Jaico Publishing House- 2005

REFERENCES:
4. Majumdar S.R.- “Pneumatic systems – Principles and maintenance”- Tata McGraw Hill-
1995
Aim: To integrate the basic laws of thermodynamics into thermal systems towards applications.

Objective:
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.

UNIT – I  INTERNAL COMBUSTION ENGINES


UNIT –II  IC ENGINES ADVANCED TOPICS AND PERFORMANCE

Supercharging, Turbo charging of IC engines and their effects on various parameters, Stratified charge engines, Multipoint and electronic fuel injection systems, measurement of power- brake indicated, Fuel consumption, Air consumption, Heat carried away by exhaust gases. Performance test – Heat balance test and Morse test on IC Engines, standard testing procedure of IC Engines, Performance curves and effect of various parameters on the performance of the engines.

UNIT –III

AIR COMPRESSORS


UNIT –IV REFRIGERATION


Cryogenic engineering – Introduction, Application and liquefication of gases.

UNIT –V AIR-CONDITIONING

Introduction to Psychrometric – Psychrometric chart – Psychrometric process – summer and winter air- conditioning, cooling load calculations, SHF, RSHF, GSHF, EHSF components used in air conditioners – Types of air-conditioning units. Problems.

TUTORIAL : 15 PERIODS
TOTAL : 60 PERIODS

TEXT BOOKS
1. ARORA.C.P.”Refrigeration and Airconditioning,”, Tata McGraw Hill,

REFERENCES
4. GILL. SMITH and ZURYA, Fundamentals of Internal Combustion Engines – ford & IBH.
5. MANOHAR PRASAD, Refrigeration and Air-conditioning – New Age International (P) Ltd, 1995
7. RAMALINGAM, International Combustion Engines – Scitech Publications India (P) Ltd
Objective:
1. To understand basic design procedures, steady and variable stresses, failure theories.
2. To understand the design parameters of shafts and couplings.
3. To understand the design parameters of fasteners and welded joints.
4. To understand the design parameters of springs and levers.
5. To understand the design parameters of bearings and flywheel.

UNIT 1: STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS
9

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 – design of knuckle joints.

UNIT 3: DESIGN OF FASTENERS AND WELDED JOINTS
9
Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures - Theory of bolted joints.

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

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 PERIODS
TOTAL : 60 PERIODS
TEXT BOOKS

REFERENCES
5. Md.Jalaludeen- Machine Design-
LIST OF EXPERIMENTS:

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. To conduct a performance test on a four stroke single/ twin cylinder diesel engine.
6. To conduct a heat balance test on a four stroke single / twin cylinder diesel engine.
7. To determine frictional power of a four cylinder petrol engine by conducting a Morse test.
8. To conduct a retardation test and determine frictional power in a diesel engine.
9. To conduct a load test on an air compressor.
10. To determine coefficient of performance of a refrigeration test rig.
Objective:
1. To study the design procedure for 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 speed gear box.
5. To study the design procedure for clutches and brakes.

UNIT – I - DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS  9

Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT – II -SPUR GEARS AND PARALLEL AXIS HELICAL GEARS  9


UNIT – III -BEVEL, WORM AND CROSS HELICAL GEARS  9


UNIT – IV -DESIGN OF GEAR BOXES  9

Geometric progression - Standard step ratio - Ray diagram- kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box, simple gear box design problems.

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 PERIODS
TOTAL : 60 PERIODS
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 cycles systems, thermoelectric power generation, thermionic power generation.

**Text Books :**


**Reference Books :**

Objective:
1. To study about conduction mode of heat transfer.
2. To study about the transient mode of heat conduction.

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.

UNIT –III CONVECTION
Boiling – Pool Boiling and regimes flow boiling through horizontal and vertical pipes. Condensation – Film and dropwise - derivation of the basic equations.

UNIT –IV RADIATION AND HEAT EXCHANGERS
Electromagnetic spectrum, black body emission, Emissive power, Laws of radiation, radiation shape factor, electrical analogy, Radiation shields, gas radiation.
Heat exchangers – types of derivation of LMTD and NTU – effectiveness equation, Fouling factor, Compact heat exchangers.

UNIT –V MASS TRANSFER AND HEAT PIPES
Fick’s law, Equimolol diffusion, Stefan’s law, mass transfer coefficient, non-dimensional number used in mass transfer, atmospheric evaporation. Problems.
Heat pipes – Introduction, Types and applications.
TEXT BOOKS

REFERENCES
LIST OF EXPERIMENTS

1. To determine the thermal conductivity of an insulating powder.

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 natural convective condition and plot temperature distribution along its length.

5. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.

6. 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.

7. To determine the average heat transfer coefficient for a 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.

8. To measure the emissivity of the gray body (plate) at different temperature and plot the variation of emissivity with surface temperature.

9. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.

10. To find overall heat transfer coefficient and effectiveness of a heat exchange under counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.

11. To verify the Stefan-Boltzmann constant for thermal radiation.

12. Determine the COP by using LPG refrigerant test rig.

13. Study and demonstration of boiler.
Objective: To provide an overview of a complete automobile

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.

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: 60 PERIODS
TEXT BOOKS

REFERENCES:
Objective:
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 impart the knowledge of PPC and its functions.
4. To inculcate the skills of purchasing materials and their management.
5. To create 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-Rating concept and allowances-Motion study –SIMO chart-Work sampling.

UNIT-II PLANT LAYOUT AND MATERIALS HANDLING

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-Despatching-Functions and types of dispatching-Follow up or Expediting- Product design and development-Process Planning.

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 : 60 PERIODS

TEXT BOOKS:

REFERENCES:
3. Vijay Seth-“Industrial Engineering-methods and practices”-Pernam International publishing,Mumbai-2005
Objective:
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 used for measuring power, temperature and sensor measurement.

1. Concept of Measurement 9

2. Linear and Angular Measurement 9

3. Form Measurement 9

4. Laser and Advances in Metrology 9
Precision instruments based on laser – principles - Laser interferometer - application in linear and angular measurements and machine tool metrology
Coordinate measuring machine (CMM) - Constructional features – Types - Applications – Digital devices - Computer aided inspection.
5. DATA LOGGING AND AQUISITION

Objective: To understand the various instruments to acquire the data and store in computer

Data logging and acquisition, use of intelligent instrument for error reduction, elements of micro-computer interfacing, intelligent instruments in use.

TOTAL: 60 PERIODS

TEXTBOOKS:

REFERENCES:
A. DYNAMICS LAB

1. Determination of sensitivity & effort - Governors.
3. Determination of critical speed of shaft with concentrated loads - Whirling of shaft
4. Determination of damping co-efficient of single degree of freedom system - Spring Mass System
5. Determination of damping co-efficient of multi degree of freedom system - Bifilar & Trifilar Suspension System.
7. Study of Four bar mechanism

Equipments:
1. Universal Governor
2. Motorized Gyroscope
3. Whirling of shaft
4. Spring Mass System
5. Bifilar & Trifilar Suspension System.
6. Compound Pendulum

Manual:
Dynamics Laboratory Manual - Faculty of Mechanical Engineering, Vinayaka Missions University

B METROLOGY LAB

Experiments:

2. Measurement of angle using bevel protractor
3. Checking dimensions of a part using slip gauge.
4. Use of sine bar for measuring angles and taper.
5. Fundamental dimension of a gear using contour projector.
6. Testing squareness of a try square using slip gauge.
7. Checking straightness of a surface plate using autocollimeter.
8. Study of CMM
Equipments:
1. Vernier caliper
2. Vernier height gauge
3. Micrometer
4. Bevel protractor
5. Sine bar
6. Slip gauge
7. Surface plate
8. Autocollimator
9. Profile projector

Manual:

Metrology Laboratory Manual-Faculty of Mechanical Engineering, Vinayaka Missions University
LIST OF ELECTIVE SUBJECTS
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:
OBJECTIVES:

1. To familiarize the principles of fluid machinery.
2. To understand various fans and blowers.
3. To understand the concept of compressors.
4. To impart the concept of axial flow compressors.
5. To impart 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 explain the basics about Robotics and Robot manipulation in space.
2. To understand the controlling of Robots and devices system.
3. To familiarize the Sensor technology
4. To inherit the knowledge of Robot programming and Expert system.
5. To elaborate 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 Effector commands and simple programs.
UNIT V  CELL DESIGN APPLICATIONS AND ECONOMICS OF ROBOTICS 9

Economic Analysis of Robots – Pay back Method, EUAC Method, and Rate of Return Method.

TOTAL CONTACT HOURS: 45

Text Books:

Reference Books:
Objectives:
1. To explain about SI engines.
2. To explain about CI engines.
3. 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.Sharma- “Internal Combustion Engines”.
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

Decision Model – Game theory – Two Person Zero sum game – Algebraic solutions

Tutorial

: 15

Total Hours : 60
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  9

UNIT II  WEAR  9

UNIT III  LUBRICANTS AND LUBRICATION TYPES  9

UNIT IV  FILM LUBRICATION THEORY  9
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
TEXT BOOK:

REFERENCES:
Objectives:
1. To introduce the importance of cryogenic engineering.
2. To explain the low temperature refrigeration system.
3. To explain the gas separation systems.
4. To know the vacuum technology.
5. To explain about cryogenic storage.

UNIT 1 CONSTRUCTION DETAILS AND HEAT TRANSFER


UNIT II LIQUEFACTION AND LOW TEMPERATURE REFRIGERATION


UNIT III SEPARATION AND PURIFICATION SYSTEMS

General characteristics of mixtures-composition diagrams. Gas separation-principles of rectification-flash calculations - Rectification column analysis- Flash calculations.

UNIT IV INSULATION AND VACUUM TECHNOLOGY

Thermal insulation and their performance at cryogenic temperatures- Super Insulations- Vacuum insulation- Powder insulation- Cryo pumping Applications.

UNIT V STORAGE AND INSTRUMENTATION

Cryogenic Storage vessels and Transportation- Transfer devices. Pressure flow-level and temperature measurements.

TOTAL HOURS
TEXT BOOK:

REFERENCES:
**SUBJECT** | **L** | **T** | **P** | **C**  
---|---|---|---|---  
EMERGING MATERIALS | 3 | 0 | 0 | 3  

**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 nanomaterial’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”

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.

Dr.K.G.MUTHURAJAN       Prof.K.V. KRISHNASATRY       Prof.N.LAKSHMI NARAYANAN       Prof.N.RAJAN
UNIT V. VEHICLE MANAGEMENT SYSTEM


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


UNIT II FINITE DIFFERENCE METHOD


UNIT III FINITE VOLUME METHOD (FVM) FOR DIFFUSION

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

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

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-\(\varepsilon\)) models – High and low Reynolds number models.
TEXT BOOKS:

REFERENCES:
5. Introduction to Computational Fluid Dynamics Anil W. Date Cambridge University Press, 2005.
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
demerits–Applications

UNIT II MECHANICAL ENERGY BASED PROCESSES 9
Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic
Machining. Working Principles & Applications – equipment used – process parameters –
MRR - Variation in techniques used.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 10
Electric Discharge Machining - working principle and applications – equipments - process
parameters - surface finish and MRR- Power and control circuits–Wire cut EDM – working
principle and Applications.

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:
Subject: 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: 45 PERIODS

TEXTBOOKS:
2. Mike Rother and John Shook, Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA, Lean Enterprise Institute, 1999.

REFERENCES:
### Objectives:

1. **TO STUDY ABOUT THE AIR POLLUTION FROM AUTOMOBILES, INDUSTRIES AND THEIR MEASURING SYSTEMS**
2. **TO STUDY ABOUT WATER POLLUTION AND ALTERNATIVE TREATMENTS**
3. **TO STUDY ABOUT THE SOIL POLLUTION AND CONTROLLING SYSTEMS**
4. **TO HAVE KNOWLEDGE ON THE HAZARDOUS SOLID WASTE AND CONTROLLING MEASURES**
5. **AIM:- TO KNOW ABOUT THE INDUSTRIAL DIASETERS, POLLUTIONS AND REMEDIAL MEASURES**

### UNIT - I

**Structure of the atmosphere, Sources and Classification of Air Pollutants.** Transport and Diffusion of Pollutants. Plume behavior and stack dispersion, Reactions of hydroxyl radical with O2, N2, CO2 and Oxides of Nitrogen, Sulphur and Carbon. Sinks of Air pollutants – Acid rain: Ozone depletion – Montreal protocol; Global warming – Kyoto protocol; Gaseous pollution control measures; photo chemical smog; Automobile pollution in India; Zero emission standards; Noise pollution – Sensing, Measurement, Abatement measures.

### UNIT – II

**Properties of water** – Characteristics of water bodies; Heavy metals, Speciation and Complexation, water quality. DO, BOD, COD, acidity, alkalinity, salinity, hardness; drinking Water quality standards; Water pollution; Classification of water pollutants, Ground water Pollution, Sources and sinks, Eutrophication. Purification of water by adsorption, flocculation, ion exchange and reverse osmosis methods. Alternatives of end of pipe treatments, Radioactive Pollution and control measures.

### UNIT – III

**Soil pollution:** Sources, sinks and broad classification, movement and sorption mechanisms of Organic and inorganic contaminants and their impacts on physio-chemical and biological Properties of soil and plants, Sediment Pollution – Black carbon – formation and fate, Black Carbons as adsorbents for organics, Soil pollution control measures – Physical-chemical and
Biological methods.

UNIT – IV

**Hazardous Solid Wastes** – Hospital Wastes, Radioactive Wastes - Sources, Transport, Disposal.
Municipal solid wastes - hazards, disposal and energy production- Case studies; Light pollution
And control measures; and Thermal pollution and control measures.

UNIT V

**Industrial Disasters and Pollution** - remedial measures – Case studies-Chemical Industries 
- Pesticide Industries, Bhopal Disaster, Chernobyl accident, Love canal Disaster, Oil Disasters 
- Exxon, British Petroleum- Gulf of Mexico; e-wastes, Impact and Remedial Measures.

**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 create 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

Need and objectives of financial management for engineers-Sources of Finance- Term Loans-Capital structure- Financial Institutions- Management of working capital- Costing - Breakeven Analysis- Managerial uses of Breakeven analysis-Network analysis Techniques – Problems on PERT &CPM – Taxation

TOTAL HOURS : 45

TEXT BOOKS:

REFERENCES:
1. EDII - “A manual for Entrepreneurs”- Entrepreneurship Development Institute of India, Ahmedabad- Tata McGrawHill-2006...
### Subject: Marketing Techniques for Engineers

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#### Objectives:
1. To inculcate marketing skills for engineering students.
2. To understand the behavioural pattern of customers.
3. To create awareness on marketing research and develop skills of sales forecasting.
4. To nurture the skills of developing a market plan and formulation of strategies.
5. To understand various promotion mix details.

#### UNIT I  MARKETING ENGINEERING APPROACH

- Definition and introduction to Marketing Process
- The emerging marketing decision environment
- Trends that favour marketing engineering
- Examples of Marketing success
- Tools for marketing engineering
- Business values of marketing engineering
- B2B marketing

#### UNIT II  BUYING BEHAVIOUR & MARKET SEGMENTATION

- 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

- Objectives and Process of Marketing Research
- Forecasting Methods
- Judgment Methods
- Time series
- Product Life cycle
- Forecasting methods for new products Models

#### UNIT IV  MARKETING PLANNING & STRATEGY FORMULATION

- Components of a marketing plan
- Strategy formulation
- New Product and Service Design
- New product development process Models for idea generation and evaluation
- Implementation
- Portfolio analysis
- Marketing Mix
- Pricing Decisions and Pricing methods
- Pricing Management
- Introduction Uses
UNIT V   POSITIONING AND PROMOTION MIX


TOTAL HOURS: 45

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
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.

UNIT I SOLAR ENERGY


UNIT II WIND ENERGY


UNIT III BIO – ENERGY


UNIT IV OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY


UNIT V NEW ENERGY SOURCES

Hydrogen generation, storage, transport and utilization, Applications - power generation-transport – Fuel cells – technologies, types – economics and the power generation

TOTAL: 45 hours
TEXT BOOKS:

REFERENCES:
OBJECTIVES:

1. To generate good understanding of RP 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 CONTACT HOURS:  45

Text Books:

REFERENCES:
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
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:


UNIT 2: CERAMICS FOR MEDICAL AND SCIENTIFIC PRODUCTS:


UNIT 3: CERAMICS FOR OPTICAL APPLICATIONS:

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

UNIT 4: MAGNETIC CERAMICS:

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

UNIT 5: CERAMIC SUPERCONDUCTORS AND NANO CERAMICS:

Total Hours: 45

BOOKS:-

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

REFERENCES: