MECHANICAL ENGINEERING

V & VI SEMESTER

With
Scheme of Teaching
& Examination
<table>
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<tr>
<th>No.</th>
<th>Name</th>
<th>Designation</th>
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<tr>
<td>1</td>
<td>Dr. Shrinivasa Rao B.R.</td>
<td>Prof./Vice Principal / COE</td>
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<tr>
<td>2</td>
<td>Vinaya B R</td>
<td>Asso. Prof/1st year co-ordinator</td>
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<tr>
<td>3</td>
<td>Dr. Subrahmanya Bhat</td>
<td>Prof./HOD</td>
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<td>4</td>
<td>Dr. Sudesh Bekal</td>
<td>Professor, Dean(R&amp;D)</td>
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<tr>
<td>5</td>
<td>Dr. Shashikanth Karinka</td>
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<td>Dr. Srinivas Pai P</td>
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<td>7</td>
<td>Dr. Narasimha Marakala</td>
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<td>Dr. Muralidhar</td>
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<td>Dr. Mallikappa</td>
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<td>Manjunath Shenoy</td>
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<td>Narasimha Bailkeri</td>
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<tr>
<td>40</td>
<td>Nithin Kumar</td>
<td>Asst. Prof, Gd I</td>
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Department of Mechanical Engineering, NMAMIT, Nitte

Vision:
To produce Mechanical engineers of the highest quality who are professionally competent and highly qualified to suit the needs of industries and organizations by promoting excellence in teaching, learning and research.

Mission:
The Dept. of Mechanical Engineering is committed to –

- Provide high quality education to the students, to fulfill the requirements of a ‘Global Engineer’.
- Constantly strive to improve the teaching-learning methods, in order to deliver good academic programs.
- To respond to the fast evolving scientific and technological challenges in a highly competitive world.
- To inculcate, ethics, integrity, honesty, credibility, social and environmental consciousness.

Programme Educational Objectives (PEO’s):

To satisfy the mission of the mechanical engineering program, the graduates will:
1. Be able to research, design, develop, test, evaluate, and implement engineering solutions to problems that are of a complexity encountered in professional practice.
2. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments.
3. Consider the ethical implications and societal impacts of engineering solutions.
Programme Outcomes (PO’s):

- An ability to apply knowledge of mathematics, science, and applied sciences.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to formulate or design a system, process or program to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve imaging/printing problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of solutions in a global, and social context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.
# DEPARTMENT OF MECHANICAL ENGINEERING
## SCHEME OF TEACHING
### V Semester

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<tr>
<th>Sl. No.</th>
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### Total:

- **Contact hrs/week:** 30
## DEPARTMENT OF MECHANICAL ENGINEERING
### SCHEME OF TEACHING

#### VI Semester

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FLUID MACHINERY
Subject Code : 12ME 501  Credits : 04
Hrs /Week : 5  Total Hours : 52

UNIT - I
Introduction, Energy transfer in Turbo function.
Definition of a turbo machine. Parts, Classification, Comparison with positive displacement machine. Euler Turbine equation, alternate form of Euler turbine equation, components of energy transfer, degree of reaction, general analysis of a turbine – effect of blade discharge angle, Utilization factor, Vane efficiency, relationship between utilization factor and degree of reaction, Condition for maximum utilization factor, Optimum blade speed ratio for different types of turbines.
Velocity triangles for different values of degree of reaction.
General analysis of compressors and pumps, effect of blade discharge angle, expression for degree of reaction.  12 Hrs

UNIT - II
Hydraulic turbines: Classification, Pelton turbine components, design, turbine efficiency, Francis and Kaplan turbines, Runner shapes for different blade speeds, Theory of draft tube, efficiency of draft tube.  12 Hrs

UNIT - III
Steam and gas turbines: Impulse staging, need for compounding, types of compounding, condition for maximum utilization for multistage turbines, effect of blade and nozzle losses, reaction staging, reheat factor in turbines.
Axial flow compressors: Classification, Expression for pressure ratio per stage, work done factor, radial equilibrium conditions, determination of air angle distribution with respect to blade height, using free vortex flow theory, and constant reaction theory, blade design procedure using single air foil theory.  12 Hrs

UNIT - IV
Centrifugal Compressors: Principle of operation, expression for overall pressure ratio, blade angles at impeller eye root and eye tip, slip factor and power input factor, overall pressure ratio, pressure coefficient, width of the impeller channel, compressibility effects, need for pre-whirl vanes, diffuser design, determination of diffuser inlet vane angle, surging and choking.
**Centrifugal pumps:** Working principle, Terminology, Types of casing, Pump losses, Efficiencies, Work done, Pre-rotation, slip and slip coefficient, Minimum starting speed, Priming, Cavitation, NPSH.

*Multi stage centrifugal pumps.*

**UNIT - V**

**Thermodynamics of Fluid flow and Thermodynamic analysis of compression and expansion processes:** Brief discussion of stagnation and static properties and their relations. **Compression process** – Work done overall isentropic efficiency, stage efficiency, comparison and relation between them, polytropic efficiency of compression.

**Expansion process:** Work done, overall isentropic efficiency, stage efficiency, comparison and relation between them, polytropic efficiency of expansion.

**TEXT BOOKS:**

1. An Introduction to energy conversion, Volume III-Turbo Machinery, V. Kadambi and Manohar Prasad, Wiley Eastern Ltd. (1977)


**REFERENCE BOOKS:**


**Scheme Examination:**

TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
DESIGN OF MACHINE ELEMENTS - I

Subject Code: 12 ME 502  Credits: 04
Hrs /Week: 5  Total Hours: 52

UNIT - I

Introduction:
Meaning of design with special reference to machine design- Definition and understanding of several of types of designs. Concept of design, Engineering Materials and their Mechanical properties. Selection of materials, General Design considerations: codes and Standards, Review of basics of mechanics of materials- Types of stresses and strains. Stress-Strain diagrams, Stress Analysis of simple components, Principal Stresses.

Design for Static Strength: Static Strength, Static loads and factor of safety; Theories of failure – Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory; Failure of brittle materials, Failure of ductile materials. Stress concentration, Determination of Stress concentration factor. 10 Hrs

UNIT - II

Design for Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Endurance limit modifying factors: size effect, surface effect, Stress concentration effects; Fluctuating stresses, Goodman, Modified Goodman and Soderberg’s relationship; stresses due to combined loading, cumulative fatigue damage. Design for Impact strength: Introduction, Impact stresses due to axial, bending and Torsional loading, effect of inertia. 10 Hrs

UNIT - III

Shafts and Keys: Torsion of shafts, design for strength and rigidity with steady loading, ASME & BIS codes for design of transmission shafting, shafts under fluctuating loads and combined loads. Keys: Types of keys, Design of keys and design of splines. 12 Hrs

UNIT - IV

DESIGN of transmission systems: Design of Rigid & Flexible couplings, Design & Selection of flat and V belts. 10 Hrs

UNIT - V

Scheme Examination:
TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

Design Data Hand Book:
1. Design Data Hand Book by K. Mahadevan and Balaveera Reddy, CBS Publication

TEXT BOOKS:

REFERENCE BOOKS:

DYNAMICS OF MACHINERY

Subject Code : 12 ME 503 Credits : 4
Hrs /Week : 4 Total Hours : 52

UNIT - I
STATIC FORCE ANALYSIS: Reaction between members without friction. Analysis of engine mechanism, four bar mechanism (without friction) and other mechanisms. 9 Hrs
UNIT - II
DYNAMICS OF ENGINE MECHANISM: Turning Moment Diagrams and flywheel design. 9 Hrs

UNIT - III
BALANCING OF MACHINERY: Static and dynamic balancing: Balancing of single rotating mass in same plane and in different planes - Balancing of several rotating masses in same plane and in different planes- Balancing of reciprocating masses. Inertia effects of crank and connecting rod. Balancing of single cylinder engine, multi cylinder engine, Inline engine (primary & secondary forces), V-type engine and radial engine - Direct and reverse crank methods. Balancing of rigid and flexible rotors. 12 Hrs

UNIT - IV
GOVERNORS: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronisms, effort and power (only definitions). 6 Hrs
ANALYSIS OF CAMS: Analytical methods for Tangent cam with roller follower and Circular cam operating flat faced follower. 6 Hrs

UNIT - V
INERTIA FORCE ANALYSIS of Engine mechanism. 4 Hrs
GYROSCOPE: Vectorial representation of angular motion, gyroscopic couple, Effect of gyroscopic couple on ship, plane, two wheelers and four wheelers. 6 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
1. Theory of Machines by Thomas Bevan, CBS Publication 1984
4. Theory of Machines by Ballaney, Khanna Publication 1985
5. Theory of Machines by Jagadish Lal, Jain Brothers 1982
Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

METROLOGY & MEASUREMENTS

Subject Code : 12ME 504  Credits : 04
Hrs /Week : 4  Total Hours : 52

UNIT - I
12 Hrs

UNIT - II
10 Hrs

UNIT - III
System of limits, Fits, Tolerances and gauging: Definition of tolerance and its Specification in assembly, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919 -
Principle of interchangeability and selective assembly, limits of size, standards, concept of limits of size and tolerances, definition of fits, types of fits, hole basis system, shaft basis of system, Design of clearance, transition and interference fit. Design of gauges, principles of gauge design.

UNIT - IV

UNIT - V
Measurement of Force, Torque and pressure: Principle of analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Mcloed gauge, Pirani Gauge. Temperature and strain measurement: Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge preparation and mounting of strain gauges, gauge factor, methods of strain measurement

TEXT BOOKS:

REFERENCE BOOKS:
1. “Engineering Metrology” by I.C.Gupta, Dhanpat Rai Publications,

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP

Subject Code : 12ME 505  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39  

UNIT – I  


Forms of Business Organization: Types of ownership (Characteristics, merits and demerits of Proprietorship, Partnership, Private limited Company, Public limited Company, Public sector organizations and Co-Operative enterprises), Incorporation of joint stock company, Methods of raising capital.  

7 Hrs  

UNIT - II  

Functions of Management:  
Planning [Definition, importance and characteristics of planning, Types of plans, Steps in planning] Organization [Principles of organizing, Types of organization, Characteristics, advantages and disadvantages of Line, Line and Staff, Functional, Matrix, Departmentation type of organization, Management of Change, Management of Conflict, Management by Objectives, Management by Exception, Span of control, Authority, Responsibility and Delegation, Centralization and decentralization)  

9 Hrs  

UNIT - III  

Functions of Management:  
Controlling [Nature and purpose of control, Steps in control process, Critical control points, Types of managerial control, Operations control, Requirements of good control system]  
Staffing [Objectives and Functions of human resource management, Sources and Policy of recruitment, Selection and Steps in selection process, Training and development, Performance appraisal]  
Leading [Communication process, barriers to effective communication, formal and informal communication, principles of effective communication, motivation, theories of motivation; Herzberg’s theory, Maslow’s theory, Mcgrager’s theory X and theory Y, leadership styles]  

9 Hrs
UNIT - IV

ENTREPRENEURSHIP: Concept of Entrepreneurship, Evolution of Entrepreneurship, Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers. Meaning of Entrepreneur; Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.

Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study. 9 Hrs

UNIT - V

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC. 8 Hrs

TEXT BOOKS:
1. Industrial and Business Management by Martand T. Telsang, S. Chand & Company Ltd.
2. Industrial Management by Earnest dale, McGraw Hill Publication

REFERENCE BOOKS:
1. Principles of Management by Koontz and O’Donnell, TMH
Scheme of Examination:
Two questions to be set from each unit. Students shall answer Five full questions choosing at least One full question from each unit.

**FLUID MACHINERY LAB**

Subject Code : 12ME 506  
Credits: 02  
Hrs/Week : 3

**PART – A**
1. Determination of coefficient of friction of flow in a pipe.
2. Determination of minor losses in flow through pipes.
3. Determination of force developed by impact of jets on vanes.
   a) Orifice plate  
   b) Flow nozzle  
   c) Venturimeter  
   d) Rotometer  
   e) V-notch  


**PART – B**
5. Performance testing of Turbines
   a) Pelton wheel  
   b) Francis Turbine  
   c) Kaplan Turbine  

6. Performance testing of Pumps
   a) Single stage and Multi stage centrifugal pumps  
   b) Reciprocating pump  

7. Performance test of a two stage Reciprocating Air Compressor  
8. Performance test on an Air Blower

**Scheme for Examination:**
One Question from Part A - 15 marks  
One Question from Part B - 25 marks  
Viva-Voce - 10 marks  
Total - 50 marks
METROLOGY & MEASUREMENTS LAB

Subject Code : 12ME 507  
Credit : 1  
Hrs /Week : 2

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge  
2. Calibration of Thermocouple  
3. Calibration of LVDT  
4. Calibration of Load cell  
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

7. Measurements of angle using Sine Center / Sine bar / bevel protractor  
8. Measurements of alignment using Autocollimator / roller set  
9. Measurements of cutting tool forces using  
   a) Lathe tool Dynamometer  
   b) Drill tool Dynamometer.  
10. Measurements of Screw thread Parameters using two wire or three wire method.  
12. Measurements of gear tooth profile using gear tooth vernier / gear tooth micrometer.  
13. Calibration of micrometer using slip gauges  
14. Measurement using Optical Flats

Scheme of Examination:
ONE question from Mechanical Measurements (part -A) 20 Marks  
ONE question from Metrology (part -B) 20 Marks  
Viva –Voce 10 Marks
OPERATIONS MANAGEMENT

Subject Code : 12ME511  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

UNIT - I

Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity,

Decision Making: The decision process, characteristics of operations decisions, use of models – B.E.P and Transportation models, decision making environments. Decision trees.  

UNIT - II

Forecasting: Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, Regression and Correlation methods, accuracy and control of forecasts, choosing a forecasting technique, elements of a good forecast.  

UNIT - III

Capacity & Location Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.  

UNIT - IV

Aggregate Planning & Master Scheduling: Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods.  

UNIT - V

Material Requirement Planning (MRP): Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing: An overview of MRP-II and ERP capacity requirement planning, benefits and limitations of MRP.  

7 Hrs
TEXT BOOKS:

REFERENCES:
1. Production and Operations Management, Norman Gaither & Greg Frazier,

MATERIAL SELECTION FOR ENGINEERING DESIGN

Subject Code : 12ME512       Credits : 03
Hrs /Week    : 3            Total Hours : 39

UNIT - I
The design process: types of design, design tools, conceptual and configuration design of products, statistical and reliability aspects;

4 Hrs

Families of engineering materials and mechanical properties: Ferrous and Non-ferrous metals and Alloys, Ceramics, Polymers, Composites;

4 Hrs

UNIT – II
Effects of composition and processing on material properties; Material property charts, Basis of material selection,

4 Hrs

Case studies in materials selection: design for fracture, toughness, fatigue resistance, corrosion resistance, and high temperature applications,

4 Hrs

UNIT - III
Wear resistance; case studies for design of plastics, ceramics and composites; performance based design;

8 Hrs
UNIT - IV
Manufacturing aspects of design: assembly, cost, Processes and process selection; case studies in process selection; case studies: design for casting, design for deformation processes, 10 Hrs

UNIT - V
Designing for machining and joining, design for ceramic and plastic processing; case studies with multiple constraints and conflicting objective; Hybrid design. 8 Hrs

TEXT BOOK:

REFERENCE BOOK:
1. ASM Hand book of Materials Selection and Deign, 1996

STATISTICAL QUALITY CONTROL
Subject Code : 12ME513 Credits : 03
Hrs /Week : 3 Total Hours : 39

UNIT - I
INTRODUCTION: The Meaning of Quality and Quality Improvement; Statistical Methods for Quality Control and Improvement; TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM. Principles of TQM: Leadership - Deming’s philosophy, Customers’ satisfaction - Customers perception, Feedback, Employee involvement - quality circles, Continuous Improvement- Juran’s Trilogy, PDSA cycle, Kaizen, Six sigma 8 Hrs

UNIT – II
MODELING PROCESS QUALITY: Mean, Median, Mode, Standard deviation, Calculating area, Normal distribution tables, Finding the Z score, Central limit theorem, 7QC Tools
METHODS AND PHILOSOPHY OF STATISTICAL PROCESS CONTROL: Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, sample size and sampling frequency, rational
subgroups, analysis of pattern on control charts, warning limits, Average Run Length-ARL) 8 Hrs

UNIT - III

CONTROL CHARTS FOR VARIABLES: Control Charts for X-Bar and R- Charts, Type I and Type II errors, the probability of Type II error. Simple Numerical Problems. 6 Hrs

PROCESS CAPABILITY: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_pk, p_p – process performance index, summary of process measures. Numerical problems 4 Hrs

UNIT - IV

Control Charts For Attributes: Binomial distribution, Poisson distribution (from the point of view of Quality control) Control Chart for Fraction Nonconforming, Control Chart for number Nonconforming, Control Charts for Nonconformities or Defects, Control Chart for Number of non conformities per unit. Numerical problems 7 Hrs

UNIT - V

LOT-BY-LOT ACCEPTANCE SAMPLING FOR ATTRIBUTES: The acceptance sampling problem, single sampling plan for attributes, Double, Multiple, and Sequential sampling, AOQL, LTPD, OC curves, Numerical problems. 3 Hrs

RELIABILITY AND LIFE TESTING: Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations. 3 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

4. **Principles of Quality Control:** Jerry Banks, Wiley & Sons, Inc. New York.

### METAL FORMING THEORY & PRACTICE

**Subject Code:** 12ME514  
**Credits:** 03  
**Hrs /Week:** 3  
**Total Hours:** 39

#### UNIT - I

6 Hrs

**EFFECTS OF PARAMETERS:** Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, Residual stresses in wrought products.  
6 Hrs

#### UNIT - II

8 Hrs

#### UNIT - III

8 Hrs

#### UNIT - IV

Sheet metal forming - methods - shearing and blanking bending - stretch forming - deep drawing - forming limit criteria - defects. Stretch forming - press brake forming - explosive forming - electro hydraulic forming magnetic pulse forming - super plastic forming -
Syllabus of V & VI Semester B.E. /Mechanical Engg.

UNIT - V

POWDER METALLURGY: Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction and sintering application of powder metallurgy components, advantages and limitations. 7 Hrs

TEXT BOOKS:
2. Manufacturing Engineering and Technology by Serope Kalpakjian and Stevan R.

REFERENCE BOOKS:
2. Principles of Industrial metal working process - G.W. Rowe, CBSpub. 2002
4. Theory of plasticity by Dr. Sadhu Sing

OPERATIONS RESEARCH

Subject Code : 12ME 601
Credits : 04
Hrs /Week : 4
Total Hours : 52

UNIT – I

INTRODUCTION: Definition, scope of Operations Research (O. R) approach and limitations of OR Models, Characteristics and phases of OR. Linear programming problems: Mathematical formulation of LP P. Graphical solution methods. The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases. 12 Hrs
UNIT - II
TRANSPORTATION PROBLEM: Formulation of transportation Model, Basic feasible solution using different methods, Optimality Method, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems.
ASSIGNMENT PROBLEM: Formulation, unbalanced assignment problem, Traveling salesman problem. 10 Hrs

UNIT - III
SEQUENCING: Johnson’s algorithm, n - jobs to 2 machines, n jobs 3 machines, n jobs m machines without passing sequence. 2 jobs n machines with passing. Graphical solutions, priority rules.

REPLACEMENT THEORY: Replacement policy for equipment which deteriorates gradually. Replacement of items that fail suddenly.

SIMULATION: Introduction, process of simulation, Monte Carlo Simulation, Simulation of an inventory system, Simulation of queuing system, Advantages and disadvantages of Simulation, Applications of Simulation, Problems on Simulation. 10 Hrs

UNIT – IV
QUEUING THEORY: Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analysing of M/M/1 and M/M/C queuing model.

GAME THEORY: Formulation of games, Two person-Zero sum game, games with and without saddle point, dominance property, Graphical solution (2x n, m x 2 game) 10 Hrs

UNIT – V
PROJECT MANAGEMENT USING NETWORK ANALYSIS: Network construction, determining critical path, floats, scheduling by network, project duration, PERT- Estimation of project duration, variance under probabilistic models, prediction of date of completion. Crashing of networks, least cost project scheduling. 10 Hrs

TEXT BOOKS:
REFERENCE BOOKS:

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

DESIGN OF MACHINE ELEMENTS - II

Subject Code : 12ME 602
Credits : 04
Hrs /Week : 4
Total Hours : 52

UNIT - I
Curved Beams: Crane hook, punching press frames & C-clamps, closed rings and links.

DESIGN OF simple Machine components: Screw Jack, C-clamps, Machine vice, Levers, 12 Hrs

UNIT - II
DESIGN OF SPRINGS: Types of springs - Tension and compression springs, stresses in Coil springs of circular and non circular cross sections. Springs subjected to Fluctuating load, Leaf Springs: Stresses in Leaf springs. Equalized stresses – Energy stored in springs. Torsion, Belleville springs. 10 Hrs

UNIT - III
CLUCHTES & BRAKES: Design & selection: Design of single and multi plate, Design of cone clutch, Design of block, band, and expansion brakes, Principle and condition for self locking of brakes. 10 Hrs
UNIT - IV
DESIGN OF GEARS: Review of gear fundamentals, interference, gear forces, Design of a spur gear pair. Helical gears: parallel axis helical gear, normal and transverse planes, helix angles, equivalent number of teeth, Design of helical gear pair.

Bevel gears: Types & Nomenclature only (No Design problems on bevel gears)
WORM GEARS: Nomenclature, thermal capacity, efficiency, design of a pair of worm gears. 14 Hrs

UNIT - V
DESIGN OF BEARINGS:

Rolling Contact Bearing: Types, static and dynamic load capacities, equivalent bearing load, load-life relationship, bearing life, load factor, selection of bearing from manufactures catalogue. Ball and Roller bearing, Design for variable load and speed, Bearings with probability of survival other than 90 %. Bearing material and their properties: 14 Hrs

DESIGN DATA HAND BOOK:

TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

AUTOMOTIVE ENGINEERING (3-0-1)

Subject Code : 12ME 603 Credits : 0 4
Hrs/ week : 4 SEE Marks : 50
CIE Marks : 50 Examination Hrs : 03
Total Marks : 100

UNIT - 1
ENGINE COMPONENTS AND COOLING & LUBRICATION SYSTEMS:
SI & CI engines, Cylinder-arrangements and their relative merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Types of combustion chambers for S. I. Engine and C. I. Engines, Choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements. 10 Hrs.
UNIT - 2

FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Fuel mixture requirements for SI engines, types of carburetors, C.D. & C. C. carburetors, multi point and single point fuel injection systems, fuel transfer pumps, fuel injection pumps and injectors.  

IGNITION SYSTEMS:  
Battery Ignition systems, magneto Ignition system, Transistor assisted contacts. Electronic Ignition, Automatic Ignition advance systems, Lighting systems, starting device (Bendix drive)

UNIT - 3

POWER TRAINS:  
Clutches- Single plate, multiplate and centrifugal clutches. Gear box: Necessity for gear ratios in transmission, Constant mesh gear box, Synchromesh gear box, over drive, fluid coupling and torque converter , Epicyclic gear box, principle of automatic transmission, calculation of gear ratios, Numerical calculations for torque transmission by clutches.

UNIT - 4

DRIVE TO WHEELS:  
Propeller shaft, universal joints, Hotchkiss. and torque tube drives, differential, rear axle, different arrangements of fixing the wheels to rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe-in & toe-out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer & neutral steer, numerical problems.

UNIT - 5

SUSPENSION AND SPRINGS:  
Requirements, , leaf spring, coil spring, Torsion bar suspension systems, independent suspension for front wheel, Air suspension system.

BRakes:  
Types of brakes, mechanical, compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Drum brakes, numerical problems related to brake torque, minimum stopping distance with brakes on front, rear and all wheels, weight transfer and heat dissipation during braking.

TYRES  
Desirable tyre properties, Types of tyres.
AUTOMOTIVE EMISSION:
Automotive exhaust emissions, sources and emission control method.  3 Hrs.

List of proposed Experiments:  4 Hrs
1. Study of Automotive - Chassis & superstructure/body and its functions. Also involves study of seat, cut section of wheel rims(Drop-center and Flat-base) & tyres(bias and radial types).
2. Study of more commonly used tools and equipment in Automotive shop
3. Study of carburettors and petrol & diesel fuel injection systems (If part is not available, Charts/video to be used at present).
4. Demonstration and study of Front axle and steering system
5. Demonstration and study of various suspension systems
6. Power train - Dismantling and assembly of single/multi cylinder Engine as available
7. Power train - Study of clutch mechanism. Demonstration and study of dry friction clutches and wet clutches - Single plate & multi-plate types
8. Power train - Demonstration and study of transmission system - Gear box
9. Power train - Demonstration and study of Universal joints, propeller shaft, final drives, differential, and rear axles
10. Demonstration and study of brake mechanism (hydraulic type) and study of disc and drum brakes
11. Field visit to Automotive Servicing Station - Study of electrical system, wheel alignment (measuring and adjustment of castor, camber, king-pin inclination, toe-in and toe-out), automotive emission control systems.

(The details of each experiment to be given out as handout to each student or may be uploaded in Intranet)

Assessment Scheme:
At present 10 marks are allotted for class tasks.
10 Marks of tasks to be split as follows:
- 5 marks: For Lab assignment (Question -answer /layout drawing/report preparation as the case may be)
- 5 marks: For viva at the end of all the experiments
TEXT BOOKS:
2. Automobile Engineering, Kirpal Singh, Vol I and II

REFERENCE BOOKS:
4. Automotive Mechanics, Joseph Heithner 2000
5. Automobile Mechanics by N. K. Giri, Khanna publishers 2002

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

CAD/CAM

Subject Code : 12ME 604
Credits : 04
Hrs /Week : 4
Total Hours : 52

UNIT - I

Introduction to CAD:
Conventional design process, computer aided design, benefits of CAD.

Hardware for CAD: Graphic displays – Image generation techniques, Direct beam refresh, Direct view storage, Raster scan. Display controller & display memory,

Graphics software:
Algorithm for generation and display of simple graphical elements like lines, circles, ellipse. Transformations – Translation, Rotation and Scaling, Reflection. 10 Hrs

UNIT - II

Geometric Modeling:
Types and representation of curves: Analytical curves – line, ellipse, parabola. Synthetic curves – Cubic, Bezier & B-spline curves.
Types and representation of solids – Solid representation, half spaces, Boundary Representation (B-Rep), Constructive Solid Geometry (CSG)  

UNIT - III
**Finite Element Modeling and Analysis:**
General procedure of FEM. Formulation and solution of typical problems using Spring, Truss & Beam elements - Element equations, Assembly of elements, Boundary conditions and External loads, Solution of global equations.  

UNIT – IV
**Numerical Control:**
Definition of N.C. Machine, Classification, Advantages and disadvantages of N.C. machine,

CNC programming:  
Problem with conventional NC, Computer Numerical Control, Coordinate systems, point to point and contour programming. Direct Numerical Control, Adaptive Control Machining System.  

UNIT – V
**Industrial Robotics:**
Introduction to Robotics, Robot anatomy, physical configurations, Manipulator Kinematics, Technical features, programming the robot, robot programming language, end effecters, work cell design, work cell control and interlock, robotic sensor, robotic applications. [12 hours]

TEXT BOOKS:
REFERENCE BOOKS:

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

COMPUTER AIDED MODELING & ANALYSIS LAB
Subject Code : 12ME 605 Credits : 02
Hrs /Week : 3

PART A – STRUCTURAL ANALYSIS
Study of Finite Element Analysis (ANSYS)
Static Finite Element Analysis of Bars, Trusses, Beams, Plates. (8 exercises) 21 Hrs

PART B – PART MODELING & ASSEMBLY
Study of solid modeling packages (PRO-E & CATIA), Modeling and assembly of Flanged coupling (protected & unprotected type), Oldham’s coupling, Knuckle joint, Socket and Spigot joint, using above two software packages. 21 Hrs

Scheme for Examination:
One Question from Part A - 20 marks
One Question from Part B - 20 marks
Viva - Voce - 10 marks
Total - 50 marks
CNC & ROBOTICS LABORATORY

Subject Code : 12 ME 606  
Credits : 02  
Hrs /Week : 3

PART A – Programming & operation on CNC Lathe
Writing manual part programming using ISO codes, for machining simple machine parts in CNC turning machine and machining the model. (4 Exercises)

Writing manual part programming using ISO codes, for machining simple machine parts in CNC milling machine. (6 exercises).

21 Hrs

PART B - Programming & operation of 6 axis articulated Robot
Different methods of Programming of Robot for pick and place application (10 exercises)

21 Hrs

Scheme for Examination:
One Question from Part A - 20 marks
One Question from Part B - 20 marks
Viva - Voce - 10 marks

NON TRADITIONAL MACHINING

Subject Code : 12ME 611  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

UNIT – I
INTRODUCTION: Classification, comparison between conventional and Non-conventional machining process selection.

PLASMA ARC MACHINING (PAM): Introduction, equipment, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics, applications, Advantages and limitations.

LASER BEAM MACHINING (LBM): Introduction - Equipment of
LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages and limitations.

**ELECTRON BEAM MACHINING (EBM):** Principles, equipment, operations, applications, advantages and limitation of EBM. **10 Hrs**

**UNIT - II**

**ULTRASONIC MACHINING (USM):** Introduction, equipment, tool materials & tool size, abrasive slurry, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & disadvantages of USM.

**ABRASIVE JET MACHINING (AJM):** Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. Abrasive particles per unit volume" of the carrier gas, work material, stand off distance (SOD), nozzle design, and shape of cut. Process characteristics, Material removal rate, Nozzle wear, Accuracy & surface finish. Applications - advantages and disadvantages of AJM. **9 Hrs**

**UNIT - III**

**ELECTRICAL DISCHARGE MACHINING (EDM):** Introduction, mechanism of metal removal, dielectric fluid; spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design, choice of machining operation, electrode material selection, uncle; sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish. Heat Affected Zone. Application, EDM applications, electrical discharge grinding, wire EDM. **9 Hrs**

**UNIT – IV**

**ELECTROCHEMICAL MACHINING (ECM):** Introduction, study of ECM machine, elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the
process, ECM Process characteristics - Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement; Electrochemical Grinding, Advantages, Limitations.

**UNIT – V**

**CHEMICAL MACHINING (CHM):** Introduction, elements of process, chemical, blanking process: Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps - masking, Etching, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
2. Modern Machining Process, Aditya 2002
4. Metals Handbook: Machining - Volume 16
   Joseph R. Davis (Editor), American Society of Metals (ASM)

**Scheme Examination:**
TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.
MANAGEMENT INFORMATION SYSTEM

Subject Code : 12ME 612  
Credits : 03
Hrs /Week : 3  
Total Hours : 39

UNIT - I
7 Hrs

UNIT - II
REVIEW OF INFORMATION TECHNOLOGIES: Computer Hardware – computer systems, end user and enterprise computing, computer peripherals, input, output, and storage technologies, Computer Software- application software, end user application, system software, computer system management.  
7 Hrs

UNIT - III
5 Hrs
5 Hrs

UNIT - IV
BUSINESS DECISION: E –Business Decision Supports Systems for decision support, executive support systems, group decision support system, Artificial Intelligence Technologies in Business
5 Hrs

UNIT - V

5 Hrs


3 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

DESIGN FOR MANUFACTURING

Subject Code : 12ME 613  Credit : 03
Hrs /Week : 3  Total Hours : 39

UNIT - I
Selection of materials and processes: Phases of design - General Requirements: material and process selection, effect of material properties and manufacturing process on design-- The material selection process. DFM approach, DFM guidelines. 8 Hrs

UNIT - II
Product design for manual assembly, automatic assembly and robotic assembly Computer aided DFMA. Process capability, mean, variance, skewness, kurtosis,Process capability metrics, $C_p$, $C_{pk}$ Cost aspects, feature tolerances. 5 Hrs
Geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law. Selective assembly.

5 Hrs

UNIT - III
Datum systems-Feature location, Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.

8 Hrs

UNIT - IV
Redesign of castings based on parting line considerations, minimizing core requirements, redesigning cast members using weldments, use of welding symbols. Operation sequence for typical shaft type of components, preparation of process drawings of different operations. Tolerance worksheets and centrality analysis, examples.

8 Hrs

UNIT - V
Design features to facilitate machining, datum features - functional and manufacturing, component design machining considerations, redesign for manufacture, examples.

8 Hrs

REFERENCE BOOKS:
RAPID PROTOTYPING TECHNOLOGY

Subject Code : 12ME 614  Credits : 03
Hrs /Week : 3  Total Hours : 39

UNIT - I
INTRODUCTION: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems. STEREO LITHOGRAPHY SYSTEMS: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application. 10 Hrs

UNIT - II
SELECTIVE LASER SINTERING: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. FUSION DEPOSITION MODELLING: Principle, Process parameter, Path generation, Applications. 8 Hrs

UNIT - III

CONCEPTS MODELERS: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems. 8 Hrs

UNIT - IV
RAPID TOOLING: Indirect Rapid tooling, Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM. RAPID TOOLING: Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling. 8 Hrs

UNIT - V
SOFTWARE FOR RP: STL files, Overview of Solid view, magics, mimics, magic communicator, etc. Internet based software, Collaboration tools.
RAPID MANUFACTURING PROCESS OPTIMIZATION:
factors influencing accuracy. Data preparation errors, Part building
errors, Error in finishing, influence of build orientation.  8 Hrs

TEXT BOOKS:
1. Stereo Lithography and other RP & M Technologies, Paul
2. Rapid Manufacturing, Flham D.T & Dinjoy S.S Verlog

REFERENCE BOOKS:
1. Rapid Prototyping, Terry Wohlers Wohler's Report 2000"
   Wohler's Association 2000.

DESIGN PRACTICES OF JIGS & FIXTURE

Subject Code: 12ME 615    Credits: 03
Hrs /Week: 3          Total Hours: 39

UNIT - I
Locating and clamping devices-Design Principles of Jigs and Fixtures-
Locating principles- Locating elements- Standard parts- Clamping
devices- Mechanical actuation, Pneumatic & hydraulic actuation,
Analysis of clamping forces.

UNIT - II
Jigs- Drill bushes, Different types of Jigs- Plate latch, channel, box,
post, angle plate, angular post, turnover, pot jigs. Automatic drill jigs,
Rack & Pinion Operated jigs, Air operated Jigs and Components.
Design and development of Jigs for given components.

UNIT - III
Fixtures: General principles of boring, lathe, milling, broaching,
Grinding, and shaping fixtures. Assembly, Inspection and welding
fixtures. Modular fixtures. Design and development of Fixtures for
given components, Press tools: Press working terminology Presses
and Press accessories, Computation of capacities and tonnage
requirements.
UNIT - IV
Design concepts of the following elements of progressive and combination dies, Selection of standard die sets. Strip layout and development. Design and development of Compound, Progressive and Combination dies.

UNIT - V
Term project
(Not for end-semester examination; to be considered for internal assessment only).

TEXTBOOKS:

REFERENCE BOOKS:
3. 'Design Data Book', PSG College of Technology.
DESIGN OF THERMAL SYSTEMS

Subject Code : 12ME 616  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

UNIT - I
8 Hrs

UNIT - II
System Simulation  
8 Hrs

UNIT - III
Optimization, Lagrange Multipliers, Search Methods  
8 Hrs

UNIT - IV
Dynamic Programming, Geometric Programming  
8 Hrs

UNIT - V
Linear Programming, Mathematical Modeling- Thermodynamic Properties, Steady state Simulation of Large Systems  
10 Hrs

TEXT BOOK:

RENEWABLE SOURCES OF ENERGY

Subject Code : 12ME 617  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

UNIT - I
Man and Energy, Worlds and India’s production and reserves of energy, present and future power position, energy alternatives. Solar Energy: Solar Energy Option:
  • Solar radiation and its measurement – Solar radiation data, solar radiation geometry Prediction of availability of solar radiation
  • Liquid flat plate collector, general performance analysis with numerical problems, design considerations effect of various parameters on performance, testing procedure.
• Concentrating collectors – Introduction, cylindrical, parabolic collector, Compound parabolic collector, Central receiver collector.  

UNIT - II

UNIT - III


UNIT - IV
Geothermal Energy – Introduction, types of geothermal resources, methods of harnessing, geothermal energy applications, environmental problems and prospects in India. 

Tidal Power- Introduction, causes for tide formation, power of tide, tidal power plants, advantages and limitations. 

Ocean Thermal Energy – Introduction to O.T.E.C., open and closed cycle OTEC systems, prospects in India.  

UNIT - V

TEXT BOOKS:
1. Renewable Energy Sources by Twidal & Weirs.
REFERENCE BOOKS:

INTRODUCTION TO AIRCRAFT DESIGN

Subject Code : 12ME 618
Credits : 03
Hrs /Week : 3
Total Hours : 39

UNIT - 1
Chapter 1 - Aircraft industry overview

Chapter 2 - Aircrafts Classification and Structure
Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Forces on the airplane, Control surfaces, Types of Aircrafts - Lighter than Air/Heavier than Air Aircrafts.
Aircraft materials: Introduction, Requirements, Material Properties and Selection criteria of Aluminium, steel, titanium, Introduction to composite, need and use of composites, challenges and key enablers of composites.

UNIT - 2
Chapter 3 - Basic Principles of Flight
Properties of Atmosphere, Air speed and Ground Speed, Bernoulli’s Equation, Measurement of air speed, Types of air speeds, Airflow over wing section, Pressure Distribution over a wing section, Center of Pressure and its effects, Definitions of lift, drag and angle of attack,

UNIT – 3
Chapter 4 - Basics of Flight Mechanics
Maneuvers: Aerobatics – Loop, spin, roll, inverted loop.

UNIT - 4

UNIT - 5
Chapter 7- Aircraft Design Configuration: Conventional Design Configurations: Based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements. Unconventional Design 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.

Resources
TEXT BOOKS

**REFERENCE BOOKS**
2. Introduction to Flight by Dave Anderson
3. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge

**Web resources**
3. [http://ameslib.arc.nasa.gov/randt/1999/aero/aero.html](http://ameslib.arc.nasa.gov/randt/1999/aero/aero.html)
4. [http://www.ctas.arc.nasa.gov/project_description/pas.html](http://www.ctas.arc.nasa.gov/project_description/pas.html)
6. [http://www.dcmt.cranfield.ac.uk/aeroxtra/e339.htm](http://www.dcmt.cranfield.ac.uk/aeroxtra/e339.htm)

**GAS DYNAMICS & JET PROPULSION**

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<th>Subject Code</th>
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<tr>
<td>12 ME 621</td>
<td>03</td>
<td>3</td>
<td>39</td>
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**UNIT - I**

**BASIC CONCEPTS AND ISENTROPIC FLOWS**: Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves and Mach cone –Effect of Mach number on compressibility - Isentropic flow through variable area ducts - Nozzle and Diffusers –Use of Gas tables.  

9 Hrs

**UNIT - II**

**FLOW THROUGH DUCTS**: Flow through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) - Variation of flow properties - Use of tables and charts - Generalised gas dynamics.  

9 Hrs

**UNIT - III**

**NORMAL AND OBLIQUE SHOCKS**: Governing equations - Variation of flow parameters across the normal and oblique shocks - Prandtl – Meyer relations - Use of table and charts - Applications.  

9 Hrs
UNIT - IV

JET PROPULSION: Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines – Aircraft combustors. 9 Hrs

SPACE PROPULSION: Types of rocket engines - Propellants - Ignition and combustion - Theory of rocket propulsion – Performance study - Staging - Terminal and characteristic velocity - Applications - Space flights. 6 Hrs

TEXT BOOK:

REFERENCES:
11. Hans Vanohain and Jack D Mattingly, ”Elements of Gas Turbine Propulsion”, TMH.
PROJECT MANAGEMENT

Subject Code : 12ME 622
Credits : 03
Hrs /Week : 3
Total Hours : 39

UNIT - I

UNIT - II

UNIT - III
Linear Programming and Network Flow Formulations-PERT/COST Accounting. Scheduling with limited resources:

UNIT - IV
Resource Planning-Resource Allocation-Project Schedule Compression-Project Scheduling Software.

UNIT - V

REFERENCE BOOKS:
MACHINE TOOL DESIGN

Subject Code : 12ME 623  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

UNIT - I
8 Hrs

UNIT - II
8 Hrs

UNIT - III
7 Hrs

UNIT – IV
DESIGN OF GUIDE WAYS AND POWER SCREWS: Functions and Classification of guide ways (V-guide, Flat guide ways), Design of slideways, Antifriction guide ways, Combination guide ways, Protecting devices for slideways, Selection of Power Screws and Recirculating Ball Screws.  
8 Hrs

UNIT - V
7 Hrs
TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.

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**FINITE ELEMENT METHODS**

Subject Code : 12ME 624  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

UNIT - I
Introduction: Definition of FEM, General Description of FEM, Engineering applications of FEM, Discretization process, Types of Elements – 1D, 2D, 3D and Axisymmetric elements, location of nodes, node numbering scheme, boundary conditions, half band width, stiffness matrix of bar elements by direct method, properties of stiffness matrix, preprocessing, post processing. Displacement of 3D Elastic body, Differential equations of equilibrium of stresses at a
point, strain displacement relations, stress – strain relations for plane stress and plane strain.  8 Hrs

UNIT - II
Principle of minimum potential energy: Rayleigh – Ritz method, Galerkins Method, Numerical Integration.  8 Hrs

UNIT - III
Displacement models, Pascal Triangle - displacement functions for higher order quadrilateral & triangular elements, Shape functions, Derivation of Shape function for 1D linear element, quadratic element, CST element, Convergence & its types.  8 Hrs

UNIT - IV
Finite element formulation of 1D linear element, Numerical problems on bars, stepped bars - solution of displacements, reactions and stresses by using elimination approach, penalty approach. Stress and strain in plane truss by direct stiffness method, Numerical problems.  8 Hrs

UNIT - V

TEXT BOOKS:

REFERENCE BOOKS:
1. Introduction to the Finite Element Method, C. S. Desai and J.F. Abel
2. Finite Element Analysis – Theory & Programming, Krishnamoorthy C.S
5. An Introduction to the Finite Element Method J. N. Reddy
Scheme Examination:
TWO questions to be set from each UNIT and Students shall answer
FIVE full questions choosing at least ONE question from each UNIT.

COMPUTATIONAL FLUID DYNAMICS

Subject Code : 12ME 625     Credits : 03
Hrs /Week : 3               Total Hours : 39

UNIT - I
INTRODUCTION: Computational Fluid Dynamics, Advantages, Applications, Future of CFD.
CFD SOLUTION PROCEDURE: Problem set up-pre-process, Numerical solution – CFD solver, Result report and visualization-post-process. 10 Hrs

UNIT - II
GOVERNING EQUATIONS FOR CFD: Introduction, the continuity equation, the momentum equation, the energy equation, the additional equations for turbulent flows, generic form of the governing equations for CFD, boundary conditions.
CFD TECHNIQUES: Introduction, Discretisation of governing equations, Finite difference method, Finite volume method, converting governing equations to algebraic equation system, Numerical solutions 9 Hrs

UNIT - III
PRACTICAL GUIDELINES FOR CFD: Introduction, grid generation, boundary conditions, turbulent modeling. 9 Hrs

UNIT - IV
APPLICATIONS OF CFD: Introduction, CFD as a design tool, indoor air flow distribution, CFD as a research tool, CFD applied to heat transfer coupled with fluid flow, buoyant free standing fire, flow over vehicle platoon, air/particle flow in human nasal cavity, high speed flows. 8 Hrs

UNIT - V
ADVANCED TOPICS IN CFD: Introduction, advances in numerical methods and techniques – incompressible flows, compressible flows, moving grids, multigrid methods, parallel computing, immersed boundary methods. Advances in computational methods – DNS, LES,
RANS-LES coupling for turbulent flows, multiphase flows, combustion, fluid-structure interaction, physiological fluid dynamics and other numerical approaches.  

**TEXT BOOKS:**


**REFERENCE BOOKS:**


**Scheme Examination:**

TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.

**ORGANIZATIONAL BEHAVIOR & PROFESSIONAL ETHICS**

Subject Code : 12ME 626  
Credits : 03  
Hrs /Week : 3  
Total Hours : 39

**UNIT - I**


8 Hrs
UNIT - II
LEARNING: Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement. PERCEPTION: Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect. 8 Hrs

UNIT - III
MOTIVATION: Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X and Y, Hertzberg's motivation Hygiene theory, David Mc-Clelland’s three needs theory, Victor Vroom's expectancy theory of motivation. THE GROUPS: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making. 9 Hrs

UNIT - IV
CONFLICT & STRESS MANAGEMENT: Definition of conflict, functional and dysfunctional conflict, stages of conflict process. Sources of stress, fatigue and its impact on productivity. Job satisfaction, job rotation, enrichment, job enlargement and reengineering work process. 8 Hrs

UNIT - V
PRINCIPLES OF COMMUNICATION: Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication. 9 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
ADVANCED STRENGTH OF MATERIALS

Subject Code : 12ME 627  
Credits : 03
Hrs/Week : 3  
Total Hours : 39

BEAMS ON ELASTIC SUPPORTS: Beam with a concentrated load. Use of principle of superposition. Beam supported on equally spaced separate elastic supports-UDL over part of the beam.  8 Hrs

FLAT PLATES IN BENDING: Plates in which bending action is dominant-small deflections. Stress in a circular plate with UDL, simply supported and fixed edges-concentrated load. Stresses in square and rectangular plates with UDL, concentrated load at center.  8 Hrs

ROTATING DISKS: Solid disk, disk with a central hole with external and internal pressures, disks of uniform strength, plastic collapse of rotating disks. Rotating cylinders (circular). Disk of varying thickness.  8 Hrs

TORSION OF NON CIRCULAR SECTIONS: Torsion of bar having a rectangular sections, elastic membrane (soap film) analogy hollow thin walled tubes.  8 Hrs

THICK WALLED CYLINDERS: Lame solution for principal stresses. Maximum stresses, radial deflection, failure theories, applications. Methods of increasing the elastic strength by pre-stressing, analysis of effects of stresses of shrinking a hollow cylinder made of thin walled laminations, auto frottage.  10 Hrs

TEXT BOOK:

REFERENCES:

Scheme Examination:
TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.