Uttarakhand Technical University
Program: B.Tech
Year: 3 Mechanical Engg. Session: 2011-2012

Scheme and Evaluation Pattern

Semester: V

<table>
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<th>S. No</th>
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<th>Subject</th>
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L- Lecture,  T- Tutorial,  P- Practical,  CT- Class Test comprising of two testes in a semester each of 15 Marks, TA- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks.
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Uttarakhand Technical University

Program: B.Tech

Year: 4  Mechanical Engg.  Session: 2012-2013

Scheme and Evaluation Pattern

Semester: VII

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Uttarakhand Technical University

Program: B.Tech

Year: 4 Mechanical Engg. Session: 2012-2013

Scheme and Evaluation Pattern

Semester: VIII

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Total 1000
UNIT- I

INTRODUCTION:

Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, fourier analysis.

Single Degree Freedom System: Free vibration, Natural frequency, Equivalent Systems, Energy method for determining natural frequency, Response to an initial disturbance,

Torsional vibrations, Damped vibrations. Damping models – Structural, Coulomb and Viscous damping, Vibrations of system with viscous damping, Logarithmic decrement, Viscous dampers.

UNIT- II

Single Degree Freedom: Forced vibration, Harmonic Excitation with viscous damping, Steady state vibrations,

Forced vibrations with rotating and reciprocating unbalance, Support excitation,

Vibration isolation, Transmissibility, Vibration measuring instruments- Displacement, Velocity, Acceleration and Frequency measuring instrument.

UNIT- III

Two Degree Freedom System: Introduction, Principal modes, Double pendulum, Torsional system with damping,

Coupled System, Undamped dynamic, vibration absorbers, Centrifugal pendulum absorber, Dry friction damper, Untuned viscous damper.

UNIT- IV

Multidegree Freedom System: Exact Analysis Undamped free and forced vibrations of multidegree system,

Influence numbers, Reciprocal Theorem, Torsional vibration of multi rotor system, Vibration of geared system,

Principal coordinates, Continuous systems- Longitudinal vibration of bars, Torsional vibrations of Circular shafts, Lateral vibration of beams.

UNIT- V

Multidegree Freedom System: Numerical Analysis Rayleigh’s, Dunkerley’s, Holzer’s and Stodola’s methods, Rayleigh – Ritz method.
Critical Speed of Shafts: Shafts with one disc with and without damping, Multi-disc shafts, Secondary critical speed.

Reference Books:

1. Mechanical Vibration – Magreb, Cengage India, New Delhi
4. Mechanical Vibration – Palm, Wiley India, New Delhi
TME-502 MACHINE DESIGN –I

UNIT-I

Introduction, Definition, Methods, standards in design & selection of preferred size.

Selection of materials for static & fatigue loads, Materials for components subjected to creep, BIS system of designation of steels, steels, plastics & rubbers. AISI (American Iron & Steel Institution), ASTM rubber testing methods.

UNIT-II

Design against static load.
Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure

Design against fluctuating load stress concentration, stress concentration factors, Fluctuating/altermting stresses, fatigue failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria.

UNIT-III

Design Of Joints
Welded joint, screwed joints, ecentric loading of above joints, Joint design for fatigue loading.

Shaft, keys & coupling.
Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys & splines, rigid & flexible couplings.

UNIT-IV

Mechanical springs
Design of Helical and leaf springs, against static & fatigue loading.

Design analysis of Power Screws
Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack.

UNIT-V

Introduction to Product Development & Design Process

References
1. Design of Machine Elements : Bhandari, TMH
3. Mechanical Design, Theory and Methodology, Waldraon, BSP, Hyderabad
4. M/C Design : Maleev & Hartman
UNIT-I

Force Analysis, Turning Moment & Fly wheel:

UNIT-II Balancing of machines:
Static and dynamic balancing, Balancing of rotating and reciprocating masses, Primary and secondary forces and couples.

UNIT-III Friction:
Pivot and collar friction, Friction circle, Single plate, Multiplate and Cone clutches, Michelle & Kingsbury thrust bearing and rolling contact bearing, Belts and pulleys, Flat and V-belts, Design and selection.

Brakes and Dynamometers (Mechanical Type):
External and internal shoe brakes, Band and Block brakes, Hydraulic brakes, Absorption and Transmission dynamometers.

UNIT-IV
Governors:
Dead weight and spring loaded governors, Sensitivity, Stability, Hunting, Isochronisms, Effort and Power, Friction and Insensitivity, Introduction to inertia governors.

UNIT - V
Gyroscopic Motion:
Principles, Gyroscopic acceleration, gyroscopic couple and Reaction. Effect of Gyroscopic couple upon the stability of aero planes, ship, two & four wheelers.

References
1. Theory of Machine: Thomas Bevan (Pearson)
2. Theory of Machine: S.S.Ratan (TMH)
UNIT 1
UTILIZATION: Developer fundamentals such as editor, integrated programming environment, UNIX shell, modules, libraries.
PROGRAMMING FEATURES: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic I/O.
APPLICATIONS: Sample problems in engineering, science, text processing, and numerical methods.

UNIT 2

UNIT 3

UNIT 4

REFERENCES:
1. Computer Concepts and C Programming by Vikas Gupta, Wiley India
2. Introduction to Computers by Peter Norton, TMH
3. G. Drome, How to Solve It by Computer, Pearson
4. Programming in ANSI C by Balaguruswamy, TMH
TME-504 MANUFACTURING SCIENCE-II

Unit-I

A Metal Cutting and Machine Tools

Metal Cutting-

8

Unit-II

Machine Tools
(i) Lathe: Principle, types, operations, Turret/capstan, semi/Automatic, Tool layout. 2
(ii) Shaper, slotter, planer: operations & drives. 1
(iii) Milling: Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required. 2
(iv) Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drills. 2

Limit, Fits & Tolerance and Surface-roughness:
Introduction to Limits, Fits, Tolerances and IS standards, and surface-roughness. 3

Unit-IV

B. Metal Joining (Welding)

Thermodynamic and Metallurgical aspects in welding and weld,. Shrinkage/residual stress in welds. Distortions & Defects in welds and remedies. Weld decay in HAZ. 3
Unit-V

C. Introduction to non conventional Manufacturing Process
Benefits, application and working principle of EDM, ECM, LBM, EBM, USM, AJM, WJM. Similarly, non-conventional welding application such as LBW, USW, EBW, Plasma arc welding, Explosive welding. HERE- Explosive Forming

Books

1. Modern Machining Processes by P.C. Pandey & H.S. Shan
2. Manufacturing science by Degarmo, Wiley India
3. Manufacturing Technology Metal Cutting & Machine Tools by PN Rao, TMH
4. Manufacturing Process by Sontosh Bhatnagar, BSP Hyderabad
UNIT-1

Introduction to Heat Transfer:
Concepts of heat flows: conduction, convection and radiation; effect of temperature on thermal conductivity of materials; introduction to combined heat transfer mechanism.

Conduction:
One-dimensional general differential heat conduction equation in the rectangular, initial and boundary conditions.

Steady State one-dimensional Heat conduction:
Composite Systems in rectangular, cylindrical and spherical coordinates with and without Energy generation; thermal resistance concept; Analogy between heat and electricity flow; thermal contact resistance; Overall Heat Transfer Coefficient, critical thickness of insulation.

UNIT-2
Types of fins, Fins of uniform cross-sectional area; errors of measurement of temperature in thermometer wells.

Transient Conduction:
Transient heat conduction Lumped capacitance method, unsteady state heat conduction in one dimension only, Heisler charts.

UNIT-3

Forced Convection:
Basic concepts; hydrodynamic boundary layer; thermal boundary layer, flow over a flat plate; flow across a single cylinder and a sphere; flow inside ducts; empirical heat transfer relations; relation between fluid friction and heat transfer; liquid metal heat transfer.

Natural Convection:
Physical mechanism of natural convection; buoyant force; empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and Cylinders, and sphere.

UNIT-4

Thermal Radiation:
Basic radiation concepts; radiation properties of surfaces; black body radiation laws; shape factor; black-body radiation exchange; Radiation exchange between non-blackbodies in an enclosure; Infinite parallel Planes, radiation shields;
UNIT-5

Heat Exchanger:
Types of heat exchangers; fouling factors; overall heat transfer coefficient; logarithmic Mean temperature difference (LMTD) method; effectiveness-NTU method; compact heat Exchangers, Steam distribution systems.

Condensation And Boiling:
Introduction to condensation phenomena; heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes pool boiling, curve, forced convective boiling.

Introduction To Mass Transfer:
Introduction; Flick's law of diffusion; steady state equimolar counter diffusion; steady state diffusion though a stagnant gas film.

Books
1. Elements of Heat transfer by Cengel, TMH
2. Heat and mass transfer, M.Thirumaleswar, Pearson
3. Fundamentals of Heat & Mass Transfer by Incropera Wiley India
(Min 3 out of these)
1. Design & drawing of a cotter joint.
2. Design & drawing of a knuckle joints.
3. Design & drawing of a simple screw jack.
4. Design of shaft for different loading conditions.
5. Design & drawing of rigid coupling (flanged type).
6. Design & drawing of a leaf spring for an automobile.
7. Design & drawing of a helical spring for a given application

Note -
1. Students may be advised to use design data book for design.
2. Drawing shall be made wherever necessary on small drawing sheets.

Min. 5 out of following (or such) experiments to be done:
1. Study of simple linkers/models/mechanisms.
2. Exp. on Velocity acceleration.
3. Exp. on cam.
4. Exp. on Governor.
5. Exp. on critical speed of shaft (whirling of shaft)
6. Exp. on Gyroscope
7. Exp. on Balancing (static & dynamic)
8. Exp. on 4-bar mechanism
9. Exp. on Gears (tooth profile, interference etc.)
10. Exp. on Gear trains.
11. Exp. on Mechanism
15. Exp. on Vibration (spring)
TME-555 HEAT & MASS TRANSFER – LAB

(min 8 experiment of the following or such experiment)

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
8. Any experiment - Such as on Stefan's Law,
on radiation determination of emissivity, etc.
9. Any experiment - Such as on solar collector, etc.
on radiation
10. Heat exchanger - Parallel flow experiment
11. Heat exchanger - Counter flow experiment
12. Any other suitable exp such as on critical insulation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
TME 601 OPERATIONS RESEARCH

Unit 1: Introduction:
Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods. 6

Linear Programming Problems:
The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases. 7

Unit 2: Transportation Problem:
Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, traveling problem. 7 6

Unit 3: Game Theory:
Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. 6

Unit 4: Queuing Theory:
Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model. 6

Unit 5: PERT-CPM Techniques:
Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. 8

Reference:
3. AM Natarajan, P.Balasubramani , ATamilaravari “Operation research” Pearson 2005
4. Introduction to operation research: Theory and Applications, Springer BSP, Hyderabad
5. S D Sharma-Operations Research, Kedarnath Ramnath
TME 602 I C ENGINES

Unit-1

Introduction to I.C Engines:
Engine classification, Air standard cycles, Otto, Diesel, Stirling, Ericsson cycles, Actual Cycle analysis, Two and four stroke engines, SI and CI engines, Valve timing diagram, Rotary engines, stratified charge engine.

Fuels:
Fuels for SI and CI engine, important qualities of SI engine fuels, Rating of SI engine fuels, Important qualities of CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.

Unit-2

SI Engines:
Carburetion, Mixture requirements, Carburetor types Theory of carburetor, MPFI. Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and its control, combustion chamber design for SI engines.

Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition, battery and its types, Charging and discharging of batteries

Unit-3 CI Engine:

Unit-4

Engine Cooling: Different cooling systems, Cooling Towers, Radiators and cooling fans.

Lubrication: Engine friction, Lubrication principal, Type of lubrication, Lubrication oils, Crankcase ventilation.

Supercharging: Effect of altitude on power output, Types of supercharging.

Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines.
Unit-5

**Compressors:**
Classification, Reciprocating compressors, Single and multi stage, Intercooling, Volumetric efficiency.

Rotary compressors, Classification, Centrifugal compressor, Elementary theory, Vector Diagram efficiencies, Elementary analysis of axial compressors.

**BOOKS:**
I.C. Engines by Ganeshan, TMH
I.C Engines by Ferguson, Wiley India
Reciprocating and Rotary Compressors, by Chlumsky, SNTI Publications Czechoslovakia.
I.C Engine Analysis & Practice by E.F Obert.
I.C Engine, by Ganeshan, TMH
I.C Engine, by R. Yadav, Central Publishing House, Allahabad
UNIT I

**Spur Gears**  Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

**Helical Gears**  Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design of helical gears.

**Worm Gears**  Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing

UNIT II


**Rolling Contact Bearing**  Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing.

**Recommended Books**

Mechanical Design  Theory and methodology by Waldron, Springer India

Machine Design by Juvinall, Wiley India , New Delhi

Handbook of Gear Design by Maitra ,TMH

Shigleys Mechanical Engineering Design ,TMH
UNIT III

IC ENGINE PARTS

Selection of type of IC engine, General design considerations, Design of Cylinder and cylinder head;
Design of piston, piston ring and gudgeon pin; Design of connecting rod; Design of centre crankshaft

References:

3. Machine design-M.F. Spott, Prentice Hall India
Introduction:
Classification of Fluid Mechanics, Application of momentum and momentum equation to flow through hydraulic machinery, Euler’s fundamental equation.

Impact of jet:
Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), effect of inclination of jet with the surface.

Hydraulic Turbines:
Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing of Pelton wheel.

UNIT-II

Reaction Turbines:
Fransis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, cavitation in turbines, principles of similarity, unit and specific speed, performance characteristics, selection of water turbines.

UNIT-III

Centrifugal Pumps:
Classifications of centrifugal pumps, vector diagram, work done by impellor, efficiencies of centrifugal pumps, specific speed, model testing, cavitation and separation, performance characteristics.

UNIT-IV

Positive Displacement Pumps:
Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration, work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps, performance characteristics.

UNIT-V

Other Machines:

Water Lifting Devices: Hydraulic ram, Jet pumps, Airlift pumps, water distribution systems.
References:
Fluid Mechanics and Hydraulic Machines by S C Gupta, Pearson
Fundamentals of Fluid Mechanics by Munson, Pearson
Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
Hydraulic Machines by R K Rajput, S. Chand & co Ltd.
Hydraulic Machines by D S Kumar
Unit-1

Refrigeration:
Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle,
Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle:
Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or
Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft
refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated
temperature (DART).

Unit-2

Vapour Compression System:
Single stage system, Analysis of vapour compression cycle, use of T-S and P-H charts,
Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of
condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour
compression refrigeration cycle, Different configuration of multistage system, Cascade system.

Unit-3

Vapour Absorption system:
Working Principal of vapour absorption refrigeration system, Comparison between
absorption & compression systems, Ammonia – Water vapour absorption system, Lithium-
Bromide water vapour absorption system, Comparison.

Refrigerants:
Classification, Nomenclature, Desirable properties of refrigerants, Common refrigerants,
Secondary refrigerants and CFC free refrigerants.

Unit-4

Air Conditioning:
Introduction to air conditioning, Psychometric properties and their definitions,
Psychometric chart, Different Psychometric processes, Thermal analysis of human body
Effective temperature and comfort chart, Cooling and heating load calculations, Infiltration &
ventilation, Internal heat gain, Sensible heat factor ( SHF ), By pass factor, Grand Sensible heat
factor ( GSHF), Apparatus dew point (ADP).
Unit-5

Refrigeration Equipment & Application:
Elementary knowledge of refrigeration & air conditioning equipments e.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, cold storage, Refrigerates Freezers, Icc plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

Books:
Refrigeration and Air conditioning by C.P Arora.TMH
Refrigeration and Air conditioning by Arora & Domkundwar.Dhanpat Rai
Refrigeration and Air conditioning by stoecker & Jones.
Refrigeration and Air conditioning by Roy J. Dossat.Pearson
Heating Ventilating and Air conditioning by Mcquiston
ASHRAE Handbooks
THU-608

PRINCIPLES OF MANAGEMENT

UNIT 1
INTRODUCTION TO MANAGEMENT: Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system.

UNIT 2
MANAGEMENT INFORMATION: Interaction with external environment. Managerial decision making and MIS.

UNIT 3
PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS: design of organization structure; job design and enrichment; job evaluation and merit rating.

UNIT 4

TEXT BOOK:
1. Schermerhorn.; Management and Organisational Behaviour essentials, Wiley India
4. A V Rau: Management Science, BSP, Hyderabad
6. Stephan R Robbins Fundamental of Management, Pearson
(Say min 8 experiments from following or such experiment)
1. Impact of Jet experiment.
2. Turbine exp. on Pelton wheel.
3. Turbine exp. on Francis turbine.
4. Turbine exp. on Kaplan turbine.
5. Exp. on Reciprocating pump.
6. Exp. on centrifugal pump.
7. Exp. on Hydraulic Jack/Press
8. Exp. on Hydraulic Brake
9. Exp. on Hydraulic Ram
10. Study through first visit of any pumping station/plant
11. Study through second visit of any pumping station/plant.
12. Any other suitable experiment/test rig such as comparision & performance of different types of pumps and turbines.
TME-655
REFRIGERATION & AIR CONDITIONING LAB

Say min 8 out of following

1. Experiment on refrigeration test ring and calculation of various performance parameters.
2. To study different types of expansion devices used in refrigeration system.
3. To study different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. To study air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
10. Visit of cold storage.
UNIT I:
**CAD TOOLS:** Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, Review of C, C++, statements such as if else for while & switch, functions, pointer notations, structure & class, concept of OOP.

**GEOMETRIC MODELLING:** Output primitives- Bresenham’s line drawing and Mid-point circle algorithms. Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves here cubic splines Bezier curves B-splines rational curves

UNIT II:
**SURFACE MODELING:** Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

**PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES** – Hermite Bicubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface, Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

**GEOMETRIC MODELLING-3D:** Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).

UNIT III:
**CAD/CAM Exchange:** Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF.


UNIT – IV

**NC Part Programming –** Manual (word address format) programming. Examples Drilling and Milling.

UNIT – V

**System Devices –** Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa.

**Interpolators –** Principle, Digital Differential Analysers. Linear interpolator, circulator
Interpolator and its software interpolator. Control of NC Systems- Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control

References
1. CAD/CAM Theory and Practice – Ibrahim Zeid ,TMH
2. CAD/CAM – Groover & Zimmers Pearson
4. CAD/CAM by
TME-702 MAINTENANCE & SAFETY ENGINEERING

Unit-I

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability

Unit-II

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency.

Unit-III

Replacement planning & maintain or replace decision, replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning

Unit-IV

SAFETY IN ENGINEERING INDUSTRY:

Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage, disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.

Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks, clamps. General safety consideration in material handling - manual and mechanical handling. Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents.

Unit-V

Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management.

References
1) Industrial Safety Handbook : William Handley
2) Introduction to Safety Engineering : David S Gloss & Miriam Gayle Wardle
3) Industrial Safety : Roland P Blake
4) Health and Safety in Welding and allied process : N C Balchin, Jaico publishers
Unit -I

**Energy Audit:** Definition, Need and Objectives.  

**Types of Energy Audit:** Internal Audit, External Audit, Walk through Energy Audit, Preliminary Energy Audit, Detailed Energy Audit, Industrial Energy Audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit.

**Basic Components of Energy Audit:** Preparing for Audit Visit, Instrumentation, Data Collection Techno-economics, Safety Considerations

Unit -II

**Fuel Analysis**

Proximate Analysis, Ultimate Analysis, Calorific Value. Combustion: Theoretical Air Requirement.

**Insulation and Refractories**

Insulation Type and Application, Economic Thickness of Insulation, Heat Savings and Application Criteria, Refractory-Types, Selection and Application of Refractories.

**Boilers:**


Unit -III

**Steam System:**

Properties of Steam, Assessment of Steam Distribution Losses, Steam Leakages, Steam Trapping, Condensate and Flash Steam Recovery System, Identifying Opportunities for Energy Saving.

**Cogeneration and Trigeneration**

Need, Applications, Advantages, Combined Cycles, Saving Potential,
Unit IV

Waste Heat Recovery:

Availability and Reversibility, First and Second Law Efficiencies, Classification, Advantages and Applications, Commericially Viable Heat Recovery Devices, HVAC and Refrigeration System, Factors Affecting Refrigeration and Air Conditioning System Performance and Savings Opportunities., Distribution systems for conditioned air

Compressed Air Systems

Types of air compressors, compressor efficiency, efficient compressor operation, compressed air systems components, capacity assessment, leakage test, factors affecting the performance and energy savings opportunities. Unit IV

Pumps and Pumping System

Performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. 2

Unit V

Electrical Systems: Active power, reactive power and apparent power, star, delta connection, electrical load management and electrical billing 3

Power Factor: Power factor, Power factor improvement and its benefit, selection and location of capacitors, and energy conservation opportunities. 2

Electric Motors: Types, losses in induction motors, motor efficiency, factor affecting motor performance, rewinding and motor replacement issues, energy saving opportunities in motors, energy efficient motors, soft starter with energy savers. 5

References


3. F. W. Pyne, P gm Energy Conservation Manual, Fairmont Proem, INC.P.O. Box 14227 Atlanta,GA 30224

5. W R Murphy & G McKay, Energy Management, Elsiver/BSP hyderabad
LIST OF ELECTIVES

Elective-I

TME-011 Non conventional energy resources

TME-012 Advanced Engineering Material

TME-013 Optimization Techniques in Engineering

TME-014 Advanced Welding Processes

TME-015 Non Destructive Testing
UNIT-1

Energy resources and their utilization: Indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation.

Solar radiations: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.

UNIT-2

Solar energy: Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, Solar pond, Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

UNIT-3


Wind energy: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills,
Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development.

UNIT 4

Electrochemical effects and fuel cells: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells.

Tidal power: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. Hydrogen Energy: Properties of hydrogen in respect of it's use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.

UNIT 5

Thermoelectric systems: Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators.

Geothermal energy: Structure of earth’s interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion.

Ocean energy: Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy.

Reference Books:

UNIT-I


UNIT-II


Surface hardening of steel:

Carbonising nitriding carbonitriding cyaniding, flues and induction hardening microscopic determination of case depth and depth of hardening.

UNIT-III

Nonferrous materials, their properties and application, brasses, bronzes, cupro-nickel alloys, aluminum, magnesium and titanium alloys, bearing materials, selection, specific form and availability. Heat treatment of nonferrous materials – solutionising and precipitations hardening

UNIT-IV

Composites


UNIT-V

ELASIONERS AND MASULLANEOUS Types, properties and identifications of different types of rubbers vulcanisation, fabrication and forming techniques of rubber. Introduction of plastics and ceramics – types, application and process. Smart materials-introduction and types. Selection of materials and factors effecting deflection, Selection process and systematic evaluation.
Unit-I

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Unit-II


Unit-III


Unit-IV


Unit-V


Books.

Unit-I

Introduction: Importance and application of welding, classification of welding process.


Unit-II Advanced welding Techniques - Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

Unit-III Advanced welding Techniques (continued): Principle and working and application of advanced welding techniques such as explosive welding/cladding, Underwater welding, Spraywelding/Metallising, Hard facing.


Books

Welding Hand Book
TME-015 Non Destructive testing

Unit-1

INTRODUCTION:
Scope and advantages of N.D.T. some common NDT methods used since ages – visual inspection, Ringing test, and chalk – test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects.

Unit-2

Common NDT methods Dye – penetrant tests – principle, scope, equipment and techniques. Zyglo testing. Magnetic Particle Tests- Scope of test, Principle equipment and technique. DC And AC magnetization, use of day and wet powders magnaglow testing. Interpretations of results.

Unit-3


Unit-4

ULTRASONIC TESTING METHODS Introduction Principle of Operation – piezoelectricity. Ultrasonic probes, cathode ray oscilloscope techniques and advantages limitation and typical applications.

Unit-5

Testing of castings, forgings & weldments Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples. Case studies. Sample-testing in the lab.
TME-751
CAD/CAM Lab
10 experiments (6 from CAD experiments, 4 from CAM experiment)

A. CAD Experiments-
1. Line drawing or Circle drawing algorithm experiment : writing the program and running it on computer.
2. Transformations algorithm experiment for translation/rotation/scaling : writing program and running it on computer.
3. Design problem experiment : writing the program for design of machine element or other system and running it on computer.
4. Optimisation problem experiment : writing a program for optimising a function and running it on computer.
5. Auto CAD experiment : understanding and use of Auto CAD commands.
6. Writing a small program for FEM for 2 spring system and running it. Or using a FEM package.
7. Use of Graphic software standards packages e.g. GKs/PHICS/GL etc.
8. Use of pro Engineer/Ideas etc.

B. CAM experiments-
1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine
3. Experiment on Robots and its programs
4. Experiment on Transfer line/Material handling.
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feedback devices.
7. Experiment on Mechatronics & controls
TME-801 POWER PLANT ENGINEERING

Unit-I

Introduction:
Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion, calculations. Variable Load problem Industrial production and power generation compared, ideal and realised load curves, terms and factors. Effect of variable load on power plant operation, methods of meeting the variable load problem. Power plant economics and selection Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor’s profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.

Unit-II

Steam power plant
Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories. General layout of steam power plant. Different systems such as fuel handling system, pulverizers and coal burners, combustion system, draft, ash handling system, feed water treatment and condenser and cooling system, turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency.

Unit-III

Diesel power plant

General layout, performance of diesel engine, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance. Gas turbine power plant Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants.

Unit-IV

Hydro electric station
Principles of working, applications, site selection, classification and arrangements, hydroelectric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems, micro and mini hydro power plant.

Unit-V

Nuclear power plant
Books:

1. Nuclear Reactor Engineering By S. Glastone and A. Sesonske.
2. Basic Nuclear Engineering, by K.S. Ram.
3. Introduction to Nuclear Engineering, by J.R lamash.
Unit-I

**INTRODUCTION:** Classification of automobile, Parts of an automobile, Description of an automobile, performance of automobile, engine cycle-energy balance, terms connected with I.C. Engines, Detonation, performance number, tractive efforts.

**FUEL-SUPPLY SYSTEM:**

**S.I. ENGINE:** Carburetion & carburetors, Induction system, factor influencing carburetion, Mixture requirement, Distribution, Complete carburetor, theory of simple carburetor.

**C.I. ENGINE:** Functional requirements of an injection system, Fuel pump and fuel injector (Atomizer), Types of nozzles and fuel spray patterns, troubleshooting of a fuel system & carburetor, Turbo Charger (Function and benefits).

Unit II

**ENGINE FRICTION, LUBRICATION & COOLING SYSTEM:**

Determination of engine friction, Lubrication, lubrication system, Crankcase ventilation, Necessity of engine cooling, Areas of heat flow in engines, gas temperature variation, heat transfer, temperature distribution & temp. profiles, cooling air and water requirements, cooling systems, troubleshooting of cooling system, gear box (Problems).

Unit III

**CHASSIS:** Introduction. Classification of chassis, Frame.

**SUSPENSION:** Introduction, requirements of suspension system, springs, damper.

**WHEELS:** Introduction, Requirement, types of wheels.

**TYRES:** Introduction, requirements, types of tyre, tyre construction-cross ply, radial ply, belted bias, tyre materials tyre shape, tread patterns, tyre markings, tyre inflation pressure, causes of wear, factors affecting tyre life, wheel balancing, wheel alignments.

Unit IV

FRONT AXLE: Introduction, construction, types of front axles, stub axles.

BRAKING SYSTEM: Necessity, functions, requirements, classification of brakes, Mechanical brakes, hydraulics brakes, power brakes, brake effectiveness, brake shoe holding down arrangements, brake tester, brake service, troubleshooting chart of hydraulic brakes system, air brakes & Brake shoes & drums.

UNIT V

AUTOMOTIVE ELECTRICAL SYSTEM: Introduction, main parts of vehicles.

STARTING SYSTEM: Introduction, battery, starting motor.

IGNITION SYSTEM: Introduction, purpose, requirements, coil ignition system, firing order, ignition timing, spark plugs, troubleshooting.

CHARGING SYSTEM: Introduction. Dynamo, alternators.

LIGHTING: introduction, main circuits, lighting system.

Maintenance system: Preventive maintenance, break down maintenance, and over hauling system.

References-

1. Automotive Engineering- Hietner


3. Automobile Engineering - Narang.

4. Automotive Mechanics- Crouse

5. Automobile Engg. – K.N.Gupta
LIST OF ELECTIVES

Elective-II

TME-020 Total Quality Management (TQM)
TME-021 Advanced Fluid Mechanics
TME-022 Mechatronics
TME-023 Finite Element Method
TME 024 Six Sigma and Applications

Elective-III

TME-030 Experimental stress analysis
TME-031 Thermal Turbo Machines
TME-032 Robotics and automation
TME-033 Machine Tool Design
TME-034 Unconventional Manufacturing Processes
Unit-I

**Quality Concepts** Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

Unit-II

**Quality Management** Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

Unit-III

**Control Charts** Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Charts Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

Unit-IV

Defects Diagnosis and Prevention Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.

Unit-V

**ISO-9000 and its concept of Quality Management:**

ISO 9000 series, Taguchi method, JIT in some details

References:

UNIT-I

Review of kinematics of fluid motion, method of describing fluid motion, translation, rate of deformation, the material derivatives, acceleration, vorticity in Cartesian & polar coordinates, Reynolds transport theorem, Stress at a point, velocity profile, wall shear stress.

UNIT-II

Non-viscous incompressible flow- Equation of continuity, Euler’s equation of motion, Bernoulli’s equation, circulation and its theorem, stress function, velocity potential, irrotational flow, two dimensional source, sink, source-sink pair, doublet vortex, superposition of sourcesink with rectilinear flow, Rankine body, Superposition of rectilinear flow and doublet, flow around a spinning circular cylinder, Magnus effect, lift & Drag, Skin friction. Lift of aerofoil.

UNIT-III

Boundary layer Concept-Introduction to boundary layer formation, Navier-stokes equation, Boundary layer thickness, momentum thickness, energy thickness, Boundary layer equations, Momentum-Integral equation - Von Korman, Blasius solution of boundary layer on a flat plate without pressure gradient, Flow with very small Reynolds number, Hogen poissieulle flow, Plane Couette flow, Hydrodynamic theory of lubrication.

UNIT-IV

Compressible flow- Propagation of pressure change, sound velocity, elastic waves, Mach number, Mach cone, isentropic flow relations in terms of sonic velocity and mach number, Stagnation properties, Regions of flow, Energy equation, Effect of Mach number on compressibility. Propagation of infinitesimal waves, Non-steep finite pressure wave and steep finite pressure waves, Expansion waves Isentropic flow with variable area, Mach number variation and its effect on Flow through nozzles and diffusers. Area ratio, impulse function, Use of Gas/Air tables.

UNIT-V

References:

1. Fluid Mechanics by White.
2. Fluid Mechanics by Streeter
3. Fluid Mechanics by Som & Biswas
4. Fluid Mechanics by K.L. Kumar
5. Gas Dynamics by E. Radhakrishnan
TME-022 MECHATRONICS

Section – I


2 Ladder Diagram Fundamentals: Basic Components and their symbols, Fundamentals of ladder diagrams, Machine Control Terminology. The Programmable Logic Controller: A Brief History, PLC configurations, System Block Diagrams, Update Solve the ladder – Update, Update, Solve the Ladder

3 Fundamentals of PLC Programming: Physical Components Vs Program, components, Lighting Control Example, Internal Relays, Disagreement Circuit, Majority Circuit, Oscillator, Holding contacts, Always ON and Always OFF Contacts, Ladder Diagram Having more than one rung. Programming On/Off Inputs, to produce on – off outputs: Introduction, PLC input instructions, outputs: Coils, Indicators and others, Operational procedures, Contact and Coil Input output programming Examples, Fail Safe Circuits, Industrial Process Examples.


5 Material Handling: Generations Considerations, Applications in material transfer and loading unloading Assembly and Inspections: Assembly and robot assembly automations, Parts presentations methods., Assembly ope4rations, Assembly syst4m configurations inspe4ction automation. Introduction to Nano-technology.
**Reference Books:**

1 "Programmable Logic Controller – Principles and Applications" 5/e, J. W. Webb, R. A. Reis; Prentice Hall of India Ltd. ISBN 81-203-2308-4


4 Introduction to 8085 – Gaonkar
TME-023 FINITE ELEMENT METHOD

UNIT I Introduction to Finite Difference Method and Finite Element Method, Advantages and disadvantages

UNIT II
Mathematical formulation of FEM, Variation and Weighted residual approaches, Shape functions, Natural co-ordinate system, Element and global stiffness matrix, Boundary conditions, Errors, Convergence and patch test, Higher order elements.

UNIT III
Application to plane stress and plane strain problems, Axi-symmetric and 3D bodies, Plate bending problems with isotropic and anisotropic materials, Structural stability, Other applications e.g., Heat conduction and fluid flow problems.

UNIT IV
Idealisation of stiffness of beam elements in beam-slab problems, Applications of the method to materially non-linear problems, Organisation of the Finite Element programmes, Data preparation and mesh generation through computer graphics, Numerical techniques, 3D problems.

UNIT V
FEM, an essential component of CAD, Use of commercial FEM packages, Finite element solution of existing complete designs, Comparison with conventional analysis.

Books:
Unit 1

**Quality Perception** : Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

**Descriptive statistics** : Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

**Probability Distribution** : Normal, Binomial, Poisson Distribution

Unit 2

**Basics of Six Sigma** : Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X’S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

Unit 3

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

Unit 4

**Six Sigma Tools** : Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

Unit 5

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

**References**:

1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower Publishing Co.

2. Six Sigma for managers, Greg Brue, TMH

3. What is Six Sigma, Pete Pande, TMH

4. The Six Sigma Way, Peter S. Pande, TMH Team Field book

5. The Six Sigma way, Peter S. Pande, TMH
UNIT I

Elementary Elasticity:


7

UNIT II


7

UNIT III


8

UNIT IV


7

UNIT V

References:


2. Experiment Stress Analysis by Dr. Sadhu Singh, Khanna Publishers.TME-043

TME 031 THERMAL TURBO MACHINES

UNIT-I

Brief history of turbo machinery, introduction to blowers, pumps, compressors, steam & gas turbines, turbojet, Review of laws of thermodynamics & SFEE in reference to turbo machinery, Energy transfer in turbo machines, Euler’s equation, Velocity diagrams for axial & radial turbo machinery and pumps. Definition of various efficiencies, Introduction to blowers, pumps, compressors, steam & gas turbines turbojet.

UNIT-II

Centrifugal compressors- Principle of operation, work done and pressure rise, Diffuser, state losses, ship factors, Performance, characteristics. Axial flow compressor- basic operation, Elementary theory, Factors affecting stage pressure ratio, Blockage in compressor annulus, Degree of reaction, 3-D flow, Design process, blade design, calculation of stage performance. Supersonic & transonic stages, Performance.

UNIT-III


UNIT-IV

Steam turbines- Constructional details, working of steam turbine.

Pumps : Pumps, main components, indicator diagram and modification due to piston acceleration, performance and characteristics, axial flow pumps.

UNIT-V

**Gas Turbine Starting & Control Systems:** Starting ignition system, combustion system types, safety limits & control. 3

**Turbine Blade coding:** Cooling techniques, types Mechanical Design consideration: Overall design choices, Material selection, Design with traditional materials. 3

**References:**

3. Turbomachinery: S.M. Yahya.
5. Gas Turbine- Ganeshan, Tata Mc Graw HillTME 044
TME 032 ROBOTICS AND AUTOMATION

Unit I

Introduction: Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrial robot. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, design consideration.

Robot Motion Analysis & Control: Introduction to manipulator kinematics, robot dynamics, manipulator dynamics, robot control, task planning.

Unit II

Sensors: Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torque sensors.

Machine Vision: Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system robotic applications.

Unit III

Programming: Basics of robot programming, languages, commands, communications and data processing.

Applications: Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Future applications. Introduction to design of robot in specific applications.

Unit IV


Automated Material Handling: components, operation, types, design of automated guided vehicles and applications.

Automated storage / retrieval systems - types, basic components and applications.
Unit V


**Automated Inspection And Testing:** Automated inspection principles and methods sensors techniques for automated inspection - techniques for automated inspection - contact and noncontact inspection methods - in process gauging, CMM’s, construction, types, inspection probes, types, and applications. Machine vision, LASER Micrometer and optical inspection methods.

**Reference Books:**

1. Industrial Robotics (Technology, Programming and applications) – Mc Graw Hill Editions
3. Robot technology fundamentals - Saures G. Keramas - Delmar publishers
Unit-I

Introduction: Developments in machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis.

UNIT-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, Selection of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools.

Unit-III

Regulation of Speed and Feed rates: Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.

Unit-IV

Design of Machine Tool Structure: Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design. Design of guide ways and power screws: Basic guide way profiles, Designing guide way for stiffness a wear resistance, hydrostatic and antifriction grand ways. Design of sliding friction power Screws. Design of spindlier & spindle supports. Layout of bearings, selection of bearings for machine tools

Unit-V

References:


Unit-I


Unit-II

Unconventional Machining Process: Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.

Unit-III

Principle and working and application of unconventional machining processes such as laser beam machining, Electron beam machining, Ultrasonic machining etc.

Unit-IV

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metallising, Plasma arc welding/cutting etc.

Unit-V

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.

Books:

1. Modern Machining Processes – P.C. Pandey
2. Unconventional Machining – V.K. Jain
3. Modern Machining – G.F. Benedict
Energy Efficient Building Design Strategies


Thermal Comfort

Criteria and various Parameters, Psychometric Chart, Thermal Indices. Indoor air quality; Requirements in residential, Commercial, Hospital Buildings.

Passive concepts and components

(a) passive heating concepts direct gain, indirect gain, isolated gains and suspenses;(b) passive cooling concepts - evaporative cooling, evaporative air and water coolers, radiative cooling, application of wind, water and earth for cooling ,use of isolation, shading, paints and cavity walls for cooling; (c) passive heating and cooling concepts - roof pond/sky therm, roof radiation trap, vary-therm wall, earth sheltered or earth based structures and earth airtunnels; selective ventilation, components- windows and thermal storage


Typical Designs of Selected Buildings in various Climatic Zones, Thumb Rules for Design of Building systems and Building Codes.
Reference Books

6. Energy storage technologies, a reading material prepared by Dr. D. Buddhi, School Of Energy And Environmental Studies, DAVV, Indore.
List of Open Electives to be Offered by the Mechanical Engineering

OME-001  Optimization Techniques in Engineering
OME-002  Robotics and automation
OME-003  Advanced Engineering Materials
OME-004  Computer Integrated Manufacturing
OME-005  Energy Efficient Buildings