COURSES & EXAMINATION SCHEME

For

B. Tech. (Common to B. Tech. Mechanical Engineering/Production Engg./Industrial & Production Engineering)

YEAR II, SEMESTER –III

(Effective from the session: 2010-2011)

Uttrakhand Technical University, Dehradun
# B. Tech.
## (Mechanical Engg./Production Engg./Industrial & Production Engg.)
### YEAR II, SEMESTER –III

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**Common to Civil Engineering**

**Common to Civil, Chemical & Bio-chemical Engineering**

w.e.f. 2010-11
# COURSES AND EVALUATION SCHEME

## B. Tech. Second Year

(Common to B. Tech. Mechanical Engineering/Production Engg./Industrial & Production Engineering)

**YEAR II, SEMESTER –III**

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### B) PRACTICAL / TRAINING / PROJECT

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**TOTAL** | 17 | 6 | 8 | - | - | - | - | 1000 | 28 |       |        |

**Notes:**
- **Common to Civil Engineering**
- **Common to Civil, Chemical & Bio-chemical Engineering**

w.e.f. 2010-11
TMA-301 MATHEMATICS –III

Unit – I: Function of Complex variable
Analytic function, C-R equations, Cauchy’s integral theorem, Cauchy’s integral formula for
derivatives of analytic function, Taylor’s and Laurent’s series, singularities, Residue theorem,
Evaluation of real integrals of the type \( \int_0^{2\pi} f(cos\theta, sin\theta) d\theta \) and \( \int_{-\pi}^{+\pi} f(x) dx \)

Unit – II: Statistical Techniques - I
Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least
squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non –
linear and multiple regression analysis, Probability theory.

Unit – III: Statistical Techniques - II
Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tests of
significations: Chi-square test, t-test, Analysis of variance (one way), Application to engineering,
medicine, agriculture etc.
Time series and forecasting (moving and semi-averages), Statistical quality control methods,
Control charts, X, R, p, np, and c charts.

Unit – IV: Numerical Techniques – I
Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method
and Newton-Raphson method. Rate of convergence of above methods. Interpolation: Finite
differences, difference tables, Newton’s forward and backward interpolation , Lagrange’s and
Newton’s divided difference formula for unequal intervals.

Unit – V: Numerical Techniques –II
Solution of system of linear equations, Gauss-Seidal method, Crout method. Numerical
differentiation, Numerical integration , Trapezoidal , Simpson’s one third and three-eight rules,
Solution of ordinary differential (first order, second order and simultaneous) equations by
Euler’s, Picard’s and forth-order Runge- Kutta methods.

Reference Books :-
1. T. Veerajan & T. Ramchandran, Theory & Problems in Numerical Methods, TMH, New
Delhi,2004.
2. Kreyszig, Advanced Engineering Mathematics, 8ed, Wiley India

3. Walpole, Myers, Myers & Ye, Probability and Statistics for Engineers & Scientists,

w.e.f. 2010-11
THU-301

ENGINEERING ECONOMICS

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Unit-I
Time value of money: Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Comparisons of assets with equal, unequal and infinite lives, comparison of deferred investments, Future worth comparison, payback period comparison.

Unit-II
Use and situations for equivalent annual worth comparison, Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions.

Unit-III
Analysis of public Projects: Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost –effectiveness analysis.

Unit-IV
Depreciation, computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Product and Process Costing, Standard Costing, cost estimation, Relevant Cost for decision making, Cost control and Cost reduction techniques.

Reference Books:
1. Horn gren, C.T., Cost Accounting, Prentice Hall of India
2. White, Engineering Economics, Wiley India
**TME- 301 MATERIAL SCIENCE**

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<tr>
<td><strong>Introduction</strong></td>
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<tr>
<td>Historical perspective, importance of materials. Brief review of modern &amp; atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bondings.</td>
<td></td>
<td></td>
<td>4</td>
</tr>
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|                      |   |   |   |
| **Crystallography and Imperfections** |   |   |   |
| Concept of unit cell space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques. Imperfections, Defects & Dislocations in solids. |   |   | 3 |

|                      |   |   |   |
| **Unit-II**          |   |   |   |
| **Mechanical properties and Testing** |   |   |   |
| Stress strain diagram, Ductile & brittle material, Stress vs. strength. Toughness, Hardness, Fracture, Fatigue and Creep. Tastings such as Strength tastings, Hardness testing, Impact tastings, Fatigue testing Creep testing, Non-destructive testing (NDT) |   |   | 4 |

|                      |   |   |   |
| **Micro structural Exam** |   |   |   |
| Microscope principle and methods. Preparation of samples and Microstructure exam and grain size determination. Comparative study of microstructure of various metals & alloys such as Mild steel, CI, Brass. |   |   | 2 |

|                      |   |   |   |
| **Phase Diagram and Equilibrium Diagram** |   |   |   |
| Unary and Binary diagrams, Phase rules. Types of equilibrium diagrams: Solid solution type, eutectic type and combination type. Iron-carbon equilibrium diagram. |   |   | 4 |

|                      |   |   |   |
| **Unit-III**         |   |   |   |
| **Ferrous materials** |   |   |   |
| Brief introduction of iron and steel making furnaces. Various types of carbon steels, alloy steels and cast irons, its properties and uses. |   |   | 3 |

|                      |   |   |   |
| **Heat Treatment**   |   |   |   |
| Various types of heat treatment such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams. |   |   | 2 |

|                      |   |   |   |
| **Non-Ferrous metals and alloys** |   |   |   |
| Non-ferrous metals such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various type Brass, Bronze, bearing materials, its properties and uses. Aluminum alloys such as Duralumin. Other advanced materials/alloys. |   |   | 3 |

|                      |   |   |   |
| **Unit-IV**          |   |   |   |
| **Magnetic properties** |   |   |   |
| Concept of magnetism - Dia, para, Ferro Hysteresis. Soft and hard magnetic materials, Magnetic storages. |   |   | 2 |

|                      |   |   |   |
| **Electric properties** |   |   |   |

|                      |   |   |   |
| Super conductivity and its applications. Messier effect. Type I & II superconductors. High Tc superconductors. |   |   | 2 |

**Unit-V**

w.e.f. 2010-11
Ceramics: Structure types and properties and applications of ceramics. Mechanical/Electrical behavior and processing of Ceramics.  


Other materials: Brief description of other material such as optical and thermal materials concrete, Composite Materials and its uses. Brief introduction to Smart materials & Nanomaterials and their potential applications

Performance of materials in service: Brief theoretical consideration of Fracture, Fatigue, and Corrosion and its control.

References:
1. Callister/Balasubramaniam – Callister’s Material Science & Engineering Wiley India
4. Chawla, Composite Materials, T & F
UNIT I: INTRODUCTION
Review of fundamental concepts and definitions. Review of first and second law of thermodynamics, entropy, properties of substances. (5)

UNIT II: AVAILABLE ENERGY, EXERGY AND IRREVERSIBILITY
Available energy, available energy referred to a cycle, quality of energy, maximum work in a reversible process, reversible work by an open system exchanging heat only with surroundings, useful work, dead state, availability, availability in a chemical reaction, irreversibility and Gouy-Stodala Theorem, availability or exergy balance, second law efficiency, comments on exergy, Helmholtz and Gibb's function. (7)

UNIT III: THERMODYNAMIC RELATIONS, EQUILIBRIUM AND THIRD LAW
Mathematical conditions for exact differential, Maxwell's equation, Tds equation, difference in heat capacities, ratio of heat capacities, energy equation, Joule-Kelvin effect, Clausius-Clapeyron equation, evaluation of thermodynamic properties from an equation of state, general thermodynamic considerations on an equation of state, mixtures of variable composition, conditions of equilibrium of a heterogeneous system, Gibbs phase rule, types of equilibrium, local equilibrium conditions, conditions of stability, Joule-Thompson coefficient and Inversion curve, coefficient of volume expansion, adiabatic and isothermal compressibility. (8)

UNIT IV: GAS POWER CYCLES AND GAS COMPRESSORS

Gas power cycles
Carnot cycle, Stirling cycle, Ericsson cycle, Air standard cycles, Otto cycle, Diesel cycle, Limited pressure cycle or Dual cycle, comparison of Otto, Diesel and Dual cycles, Brayton cycle, Aircraft propulsion, Brayton-Rankine combined cycle. (4)

Gas compressors
Compression processes, work of compression, single stage reciprocating air compressor, volumetric efficiency, multi stage compression, air motors, rotary compressors, blowers and fans. (3)

Reference Books:
1. Engineering thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
2. Fundamentals of thermodynamics by Sonntag. Wiley India
TCE-301 FLUID MECHANICS

Unit-I: Introduction:
Fluid and continuum, Physical properties of fluids, Rheology of fluids.

Kinematics of Fluid flow: Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, subcritical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential, source, sink, doublet and half-body.

Unit-II: Fluid Statics:
Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Dynamics of Fluid Flow: Euler’s Equation of motion along a streamline and its integration, Bernoulli’s equation and its applications- Pitot tube, orifice meter, venturi meter and bend meter, Hot-wire anemometer and LDA, notches and weirs, momentum equation and its application to pipe bends.

Unit-III: Dimensional Analysis and Hydraulic Similitude:
Dimensional analysis, Buckingham’s Pi theorem, important dimensionless numbers and their significance, geometric, kinematics and dynamic similarity, model studies.

Unit-IV: Laminar and Turbulent Flow:
Equation of motion for laminar flow through pipes, Stokes’ law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and networks.

w.e.f. 2010-11
Unit-V: Boundary Layer Analysis:
Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub layer, separation and its control, Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect.

Reference Books:
1. Fox, Introduction to Fluid Mechanics, 7ed, Wiley India
2. Zoeb Hussain, Basic Fluid Mechanics & Hydraulic Machines, B S Publications
5. M M Das: Fluid Mechanics & Turbomachines, Oxford University Press
TME- 303 SOLID MECHANICS

Unit-I
Introduction. Stress and strain: stress at point, Cauchy stress tensor, equilibrium equations, analysis of deformation and definition of strain components, compatibility relations, principal stresses and strains, stress and strain invariants, Mohr’s circle representation.

Unit-II
 Constitutive relations: true and engineering stress-strain curves, Material properties for isotropic materials and their relations. Theories of failures for isotropic materials.

Unit-III
Shear Force and Bending Moment diagrams. Axially loaded members. Torsion of circular shafts Stresses due to bending: pure bending theory, combined stresses.

Unit-IV
Deflections due to bending: moment-curvature relation, load-deflection differential equation, area moment method, and superposition theorem. Stresses and deflections due to transverse shears.

Unit-V
Torsion of circular shaft. Energy methods: Strain energy due to axial, torsion, bending and transverse shear. Castigliano's theorem, reciprocity theorem etc.

Reference Books:
2. Fundamentals of Strength of Materials, Nag, Wiley India
4. Mechanics of Materials by Bear Jhonson
5. Advanced Mechanics of Materials, 6ed, Boresi, Wiley

w.e.f. 2010-11
PME- 351  MATERIAL SCIENCE LAB

Material Science Lab Experiments:

1. Making a plastic mould for small metallic specimen.
2. Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
3. Grain size determination of a given specimen.
4. Comparative study of microstructures of different given specimens (mild steel, gray cast iron, brass, copper etc.)
5. Heat treatment experiments such as annealing, normalizing, quenching, case hardening and comparison of hardness before and after.
6. Material identification of, say, 50 common items kept in a box.
7. Faradys law of electrolysis experiment.
8. Study of corrosion and its effects.
9. Study of microstructure of welded component and HAZ. Macro and Micro Examination.
10. Suitable experiment on Magnetic/ Electrical/ Electronic materials.

PME – 352  MACHINE DRAWING LAB

Assembly and Part Drawings of simple assemblies and subassemblies of machine parts viz., couplings, clutches, bearings, gear assemblies, I.C. Engine components, valves, machine tools, etc.; IS/ISO codes;
Limits, tolerances and Fits, Surface finish; Symbols for weldments, process flow, electrical and instrumentation units.
Introduction to solid modellers. A drawing project on reverse engineering.

Reference Books:

w.e.f. 2010-11
PCE-351 FLUID MECHANICS LAB

1. To verify the momentum equation using the experimental set-up on diffusion of submerged air jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter, venturimeter, and bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
5. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
6. To study the variation of friction factor, ‘f’ for turbulent flow in commercial pipes.
7. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
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B. Tech. (Common to B. Tech. Mechanical Engineering/Production Engg./Industrial & Production Engineering)

YEAR II, SEMESTER –IV

(Effective from the session: 2010-2011)

Uttrakhand Technical University, Dehradun

w.e.f. 2010-11
B. Tech. (Mechanical Engineering/Production Engg./Industrial & Production Engineering)

YEAR II, SEMESTER –IV

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<td>GP-401</td>
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w.e.f. 2010-11
TME 401 KINEMATICS OF MACHINES

UNIT I:
**Introduction:** Links-types, Kinematics pairs-classification, Constraints-types, Degree of Freedom, Grubler’s equation, linkage mechanisms, inversions of four bar linkage, slider crank chain and double slider crank chain. (6)
**Velocity in Mechanisms:** Velocity of point in mechanism, relative velocity method instantaneous point in mechanism, Kennedy’s theorem, instantaneous center method (3)

UNIT II:
**Acceleration in Mechanisms:** Acceleration diagram, Coriolis component of acceleration, Klein’s construction for Slider Crank and Four Bar mechanism, Analytic method for slider crank mechanism. (4)
**Mechanisms with Lower Pairs:** Pantograph, Exact straight line motion mechanisms-Peaucellier’s, Hart and Scott Russell mechanisms, Approximate straight line motion mechanisms – Grass-Hopper, Watt and Tchebicheff mechanisms. (5)

UNIT III:
**Kinematics Synthesis of Planar Linkages:** Movability of four bar linkages, Grashoff’s law, Graphical methods of synthesis – Two and Three position synthesis of four bar and slider crank mechanisms, Analytical method-Freudenstein’s equation for function generation (three position) (7)

UNIT IV:
**CAMS:** Cams and Followers - Classification & terminology, Cam profile by graphical methods for uniform velocity, simple harmonic motion and parabolic motion of followers. (7)

UNIT V:
**Gears:** Classification & terminology, law of gearing, tooth forms, interference, under cutting, minimum number of teeth on gear and pinion to avoid interference, simple, compound and planetary gear trains. (8)

Books and References:
2. Kinematics, Dynamics and Design of Machinery, 2ed, w/CD, Waldron, Wiley India
4. Theory of machines and mechanisms- Rao & Dukkipati,
TME- 402 MANUFACTURING SCIENCE-I

Unit-I

Metal Forming Processes : Elastic & plastic deformation, yield criteria. Hot working vs cold working.
Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging.

Unit-II
Metal Forming Processes (continued): Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application.
Condition for Rolling force and power in rolling. Rolling mills & rolled-sections.
Design, lubrication and defects in metal forming processes.

Unit-III
Analysis of forming process like cup/deep drawing. Bending & spring-back.

Unit-IV
Unconventional Metal forming processes: Unconventional metal forming processes such as explosive forming, electromagnetic, electro-hydraulic forming.
Powder Metallurgy: Powder metallurgy manufacturing process. The need, process, advantage and applications.

Jigs & Fixtures :


Unit-V
Die Casting, Centrifugal casting. Investment casting, CO₂ casting and Stir casting etc.

Reference Books:
1. Manufacturing Science by Ghosh and Mallik
2. Fundamentals of Modern Manufacturing, Groover, Wiley India

w.e.f. 2010-11
TME -403 MECHANICAL MEASUREMENT

Unit-I: Mechanical Measurements:
Introduction: Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, units of measurement, static and dynamic performance characteristics of measurement devices, calibration, concept of error, sources of error, statistical analysis of errors. 4
Sensors and Transducers: Types of sensors, types of transducers and their characteristics. 2
Signal transmission and processing: Devices and systems. Signal Display & Recording Devices 3

Unit-II: Time related measurements: Counters, stroboscope, frequency measurement by direct comparison. Measurement of displacement 2
Measurement of pressure: Gravitational, direct acting, elastic and indirect type pressure transducers. Measurement of very low pressures. 1
Strain measurement: Types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration. 2
Measurements of force and torque: Different types of load cells, elastic transducers, pneumatic & hydraulic systems. 2
Temperature measurement: Thermometers, bimetallic thermocouples, thermistors and pyrometers. 2
Vibration: Seismic instruments, vibration pick-ups and decibel meters, vibrometers accelerometers. 2

Unit-III: Metrology and Inspection: Standards of linear measurement, line and end standards. Limit fits and tolerances. Interchangeability and standardization. 2
Linear and angular measurements devices and systems Comparators: Sigma, Johansson’s Mikrokator. 2
Limit gauges classification, Taylor’s Principle of Gauge Design. 1

Unit-IV:
Measurement of geometric forms like straightness, flatness, roundness. Tool makers microscope, profile project autocollimator. **Interferometry**: principle and use of interferometry, optical flat. Measurement of screw threads and gears. **Surface texture**: quantitative evaluation of surface roughness and its measurement. 6

w.e.f. 2010-11
Unit-V:
Concept of Automatic Controls- Open loop & closed loop systems. Servomechanism. Block diagrams
Brief introduction to Pneumatic, Hydraulic and Electric controllers.

Reference Books:
1. Theory and Design for Mechanical Measurements, 3ed, w/CD, Figliola, Wiley India
TME-404  APPLIED THERMODYNAMICS  

Unit-I  
Review of Properties of steam and thermodynamics cycles: Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of thermodynamic processes on P-T & P-V diagrams, T-S and H-S diagrams, Use of property diagram, Steam-Tables & Mollier charts, Dryness factor and it’s measurement, processes involving steam in closed and open systems. Simple Rankine cycle.  

Unit-II  

Condenser: Classification of condenser, Air leakage, Condenser performance parameters  

Unit-III  

Steam & Gas Nozzles: Flow through nozzle, Variation of velocity, Area and specific volume, Choked flow, Throat area, Nozzle efficiency, Off design operation of nozzle, Effect of friction on nozzle, Super saturated flow.  

Unit-IV  
Vapour Power cycles: Carnot vapour power cycle, Effect of pressure & temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.  

Steam Turbines: Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple & compound multistage impulse & reaction turbines & related calculations work done efficiencies of reaction, Impulse reaction Turbines, state point locus, Comparison with steam engines, Losses in steam turbines, Governing of turbines.  

Unit-V  


Books:  
1. Fundamentals of Thermodynamics, 7ed, w/CD, Sonntag, Wiley India  
2. Thermodynamics, P k Shah, B S Publications  
4. Thermal Engg. By P.L. Ballaney, Khanna Publisher  

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5. Theory of Stream Turbine by W.J. Kearton
7. Gas turbine Theory & Practice, by Cohen & Rogers, Addison Wesley Long man
TME - 405

INDUSTRIAL ENGINEERING

<table>
<thead>
<tr>
<th>Unit-I</th>
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<tbody>
<tr>
<td><strong>Productivity</strong> : Introduction, definition, measurement, productivity index, ways to improve productivity, Types of Production System.</td>
</tr>
<tr>
<td><strong>Work study</strong> : Meaning and benefits of work study, time &amp; motion study. Micromotion study P.M.T.S. man machine Diagram flow chart. Motion economy, Method study, work measurement, work sampling, standard time.</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Unit-II</th>
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<tbody>
<tr>
<td><strong>Plant layout and materials Handling</strong> : Plant location, type of layout, principles of facility layout principles of material handling, Material Handling eqpts.</td>
</tr>
<tr>
<td><strong>Replacement Analysis</strong> : Depreciation causes, obsolescence, service life of assets, Replacement of items.</td>
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<td><strong>Maintenance Management</strong> : Maintenance Planning &amp; Control, Maintenance Strategy</td>
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<tr>
<th>Unit-III</th>
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<tbody>
<tr>
<td><strong>Inventory Control</strong> : Inventory, function, cost, deterministic models, Introduction to MRP, supply chain Management</td>
</tr>
<tr>
<td><strong>Quality Control</strong> : Introduction, process control, SQC control Charts, Single double &amp; sequential sampling, Introduction to TQM &amp; bench marking.</td>
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<tr>
<th>Unit-IV</th>
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<tr>
<td><strong>Industrial Ownership</strong> : Proprietorship, partnership, Joint stock &amp; co-operative stores.</td>
</tr>
<tr>
<td><strong>Manpower Planning</strong> : Resources, Human relationship.</td>
</tr>
<tr>
<td><strong>Organization</strong> : Principles of organization, Development of Organizational charts like line, staff, line and staff &amp; Functional types.</td>
</tr>
<tr>
<td><strong>Job Evaluation &amp; Merit Rating</strong> : Job analysis, Job description job simplification and job evaluation methods &amp; description, merit rating, wage incentive plans.</td>
</tr>
</tbody>
</table>

**Reference Books:**
2. Motion and Time Study Design and Measurement of Work, 7ed, Barnes, Wiley India
7. Industrial Engineering by Mahajan.
TEE: 405  CONTROL SYSTEM  

<table>
<thead>
<tr>
<th>Unit-I</th>
<th>Introduction: Laplace Transform and its applications, Transfer function and its determination, Modeling of mechanical system: Linear mechanical elements, force-voltage and force current analogy, Electrical analog of simple mechanical system.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit-II</td>
<td>Time Response analysis: Standard test signals, time response of second order systems and their specifications, steady state errors and error constants, Controllers and its applications: P, PI, PD, PID.</td>
</tr>
<tr>
<td>Unit-IV</td>
<td>Frequency response Analysis I: Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots.</td>
</tr>
<tr>
<td>Unit-V</td>
<td>Frequency response Analysis II: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant.</td>
</tr>
</tbody>
</table>

Text Books:
2. B.C. Kuo , “Automatic Control System” Wiley India.
5. Norman S. Nise, Control System Engineering 4th edition, Wiley India

w.e.f. 2010-11
Experiment List:
Say minimum 8 experiments out of following (or similar experiment).

1. Design of pattern for a desired casting (containing hole)
2. Pattern making
3. Making a mould (with core) and casting.
4. Sand testing (at least one such as grain fineness number determination)
5. Injection moulding with plastics
6. Forging hand forging processes
7. Forging - power hammer study & operation
8. Tube bending with the use of sand and on tube bending m/c.
9. Press work experiment such as blanking/piercing, washer, making etc.
10. Wire drawing/extrusion on soft material.
11. Rolling-experiment.
13. Powder metallurgy experiment.
15. Any other suitable experiment on manufacturing science / process / technique.
PME 452  MEASUREMENT & METROLOGY LAB

Experiments: Minimum 8 out of following (or similar experiments)

1. Study & working of simple measuring instruments- Vernier calipers, Micrometer, Tachometer.
4. Study of limit gauges.
5. Study & angular measurement using level protector
6. Adjustment of spark plug gap using feeler gauges.
7. Study of dial indicator & its constructional details.
8. Use of dial indicator to check a shape run use.
9. Study and understanding of limits, fits & tolerances
10. Study of Pressure & Temperature measuring equipment.
11. Strain gauge measurement.
12. Speed measurement using stroboscope.
13. Flow measurement experiment
15. Experiment on Dynamometers.

PME-453  THERMODYNAMICS LAB

Experiments: Minimum 10 experiments out of following;

1. Study of Fire Tube boiler
2. Study of Water Tube boiler
3. Study and working of Two stroke petrol Engine
4. Study and working of Four stroke petrol Engine
5. Determination of Indicated H.P. of I.C. Engine by Morse Test
6. Prepare the heat balance for Diesel Engine test rig
7. Prepare the heat balance sheet for Petrol Engine test rig
8. Study and working of two stroke Diesel Engine
9. Study and working of four stroke Diesel Engine.
10. Study of Ignition system of an I. C. engine
11. Study of Velocity compounded steam turbine
12. Study of Pressure compounded steam turbine
13. Study of Impulse & Reaction turbine
15. Study of Gas Turbine Model
16. Any other suitable experiment on thermodynamics
PEE 454: CONTROL SYSTEM LAB

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Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.

1. To determine response of second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To study DC position control system
5. To study synchro-transmitter and receiver and obtain output V/S input characteristics
6. To determine speed-torque characteristics of an ac servomotor.
7. To study performance of servo voltage stabilizer at various loads using load bank.
8. To study behavior of separately excited dc motor in open loop at various loads.

Software based experiments (Use MATLAB, LABVIEW software etc.)

9. To determine time domain response of a second order system for step input and obtain performance parameters.
10. To plot root locus diagram of an open loop transfer function and determine range of gain ‘k’ for stability.
11. To plot a Bode diagram of an open loop transfer function.
12. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.

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