Course Content & Grade

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<td>Metrology and Quality Control</td>
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Unit 1

**General concept of measurement:** Definition-standards of measurement, Errors in measurement, Limit-gauging, various systems of limits, Fits and tolerance, Interchangeability, Tolerance analysis in manufacturing and assembly, ISI and ISO system. Basic principles and design of standards of measuring gauges, Types of gauges and their design, Taylors Principal, Accuracy and precision, Calibration of instruments, Principals of light interference, Interferometer, Measurement and calibration, Tolerance analysis in manufacturing and assembly.

Unit 2

**Linear and angular measurements:** Slip gauges, Micrometers, Dial gauges, Surface plates, Comparators Mechanical, Electrical, Pneumatic and optical comparators, Angular measuring instruments-Sine bar, Angle gauges, Sprit level, Autocollimators, Clinometers, Measurement of straightness, flatness, squareness, roundness, and symmetry Inspection of screw threads and gears.

Unit 3

**Measurement of surface finish and measuring machines:** Surface finish-Definitions, types of surface texture, Surface roughness measurement methods, Visual inspection, Surface roughness blocks, Averaging Instruments, Profile-meters, Pneumatics and replica, Measurement of run out and concentricity, Length bar measuring machine, Optical projection, Comparators, Tool makers microscope, Inspection of Screw threads and gears, Measurement of straightness, flatness, roundness, squareness and symmetry.

Unit 4

**Statistical Process Control:** Basic Discrete and Continuous distributions, Measures of central tendency, Variability and shapes, Sampling, Size and Central value theorem, Control chart structure, Process plotting and stability, Study of out-of-control evidences, Defect detection and prevention, Use of control charts in evaluating past, present and future trends; Variables and Attributes, Concept of Control Charts, Types of Control Charts, Control Charts for Attributes, p Chart, np Chart, c Chart u Chart, Control Charts for Variables x Chart, R Chart.

Unit 5


References:
1. ASTE.Handbook of Industrial Metrology PHI Publications.
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### Unit 1
Basics of turbo machines, Principles of impulse and reaction machines.

**Steam turbines:** Impulse staging, Velocity and Pressure Compounding, Utilization factor, Analysis for optimum U.F Curtis stage, and Rateau stage, includes qualitative analysis, Effect of Blade and Nozzle losses on Vane Efficiency, Stage efficiency, Analysis for Optimum Efficiency, Mass Flow and Blade Height.

### Unit 2
Reactions staging: Parson’s stages, Degree of reaction, Nozzle Efficiency, Velocity Coefficient, Stage Efficiency, Carry over efficiency, Vane Efficiency, Conditions for Optimum Efficiency, Speed Ratio, Axial thrust, Reheat Factor in Turbines, Governing and Performance Characteristics of Steam Turbines.

### Unit 3
**Water turbines:** Classification, Pelton, Francis and Kaplan turbines, Vector diagrams and Work-done, Draft tubes, Governing of Water Turbines.

**Centrifugal Pumps:** Classification, Advantage over Reciprocating Type, Definition of Mano-metric head, Gross head, Static head, Vector diagram and work done.

### Unit 4
**Rotary Compressors:** (a) **Centrifugal Compressors** – Vector diagrams, Work done, Temp. and Pressure ratio, Slip factor, Work input factor, Pressure Coefficient, Dimensions of Inlet eye, Impeller and Diffuser.

**Axial flow Compressors**- Vector Diagrams, Work done factor, Temperature Dimensional Analysis, Characteristics, Surging, Polytrophic and Isentropic Efficiencies.

### Unit 5
**Gas Turbines:** Introduction, Classification, Application. Gas turbine & its components. Closed and open cycle Gas turbines, Optimum Pressure ratio for maximum specific & thermal efficiency in actual Gas Turbine Cycle. Effect of operating variables on thermal efficiency.

### References:
1. Venkanna B. K.; Turbomachinery; PHI
2. Hill G Philip and Peterson RC; Mechanics and thermodynamics of propulsion; Pearson.
3. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Newage Delhi
4. Ganeshan V; Gas Turbines; TMH
5. Yahya SM; Turbines, Compressors and Fans; TMH
6. Shepherd DG; Principles of Turbo machinery; McMillan
7. Bansal R. K; Fluid Mechanics & Fluid Machines; Laxmi Pub
8. Sarvanmulto HIH, Rogers GFC &; Cohen Henry Gas Turbine Theory; Pearson
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<td>Metal Cutting Science</td>
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Unit 1

**Principles of metal cutting:** Geometry of single pointed cutting tools, types of cutting tool, tool signature & nomenclature, Orthogonal and Oblique cutting, Measurement of cutting force, Merchant circle and force analysis of single point orthogonal cutting, Cutting tool material, Mechanism of cutting and chip formation, Types of chips, Tool Failure,..

Unit 2

**Tool Life and Thermal aspect of cutting:** Heat distribution, Shear plane temperature in orthogonal cutting, Determination of tool temperature, Tool life equation, Effect of process parameters on tool life, Tool life tests, Mechanism of tool wear, Types of tool wear, Economics of Machining Process, Machinability.

Unit 3

**Cutting Fluids:** Types of Cutting Fluid, Composition of Cutting Fluid, Selection of Cutting Fluids, Method of applying cutting fluid, Benefits,

**Lathe:** Lathe- specification, Components & accessories, various operations on lathes, Lathe parameters, Cutting speed, Depth of cut, Capstan & Turret lathes, tool layout, Machining time calculation, Methods of Screw production.

Unit 4

**Milling:** Working principle, classification, Specification, Accessories & Attachment, Milling Cutters, Elements of plain milling cutter, up milling and down milling, Thread milling, Universal dividing head, Indexing Methods: Direct Indexing, Plain or Simple Indexing, Compound Indexing, Differential Indexing, Angular Indexing, Machining time calculation.

Unit 5

**Shapers:** Classification and Specifications, Principle parts, Quick return mechanism, Shaper operations, Cutting speed, Feed, Depth of cut, Machining time calculation.

**Drilling:** Classification & specification of Drilling Machines, Work holding and Tool holding devices, Drilling Machine Operations, Machining time.

References:

1. Groover MP; Fundamentals of modern manufacturing; Wiley India
2. Kaushish JP; Manufacturing processes; PHI
3. Boothroyd G, Knight WA; Fundamentals of machining and machine tools; CRC-Taylor and francis
4. Munoz J and Oswald PF; Manufacturing processes and systems; Wiley India;
5. Boston; Metal Processing.
6. Hazra Chowdhary; Workshop Technology.II
8. Work shop technology by Raghuvanshi-Vol-II
9. Production Processes by HMT
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<tr>
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Unit 1

**Basic Features and Kinematics of Machine Tools**: Features of basic machine tools, Construction and operation, types of machine tools, Machine tools motion, and transmission-rotation in to rotation, Rotation in to translation, Kinematical-structures of machine tools, Elementary, Complex and compound structure.

Unit 2


Unit 3

**Design of jigs and fixtures**: Principles of Jigs and Fixture Design, Locating and Clamping, Principles of location, Locating devices, Mean Locators or centralisers, Types of clamping devices, Strap clamps, Hinged clamps, C clamps, Quick acting clamps, Elements of Jigs, Types of Jigs, Drilling jigs, Types of drilling jigs, Milling Fixture, Elements of Milling Fixtures, Classification of Milling Fixtures, Turning Fixtures, Grinding and Broaching Fixture, Materials for Jigs and Fixtures, Usefulness of Jigs and Fixtures.

Unit 4

**Gear Cutting**: Gear generation process: Gear Shaping, Gear Hobbing, Gear finishing process: Gear Shaving, Gear Burnishing, Gear Grinding, Gear Lapping, Gear Honing.
**Broaching**: Broaching machines, Broach terminology, Types of Broaches, Method of Broaching.
**Thread production methods**: Thread chasing, Thread Rolling, Die Threading, Thread Tapping, Thread Milling, Thread Grinding.

Unit 5

**Polymer and Composites**: Introduction, Plastic processing, Injection, Compression and Blow moulding, Extrusion, calendaring and thermoforming, moulding of composites, Dies and mould design for plastics and rubber parts.
**Powder Metallurgy**: Production of metal powders, Compacting and Sintering.
**Mould Design and Acceptance Tests**: Common Instruments used in alignment tests, Test procedures, Installation and Leveling, Testing the quality of Grinding and Bearing surfaces, Testing the main Spindle for running, Axial slip, Alignment between two axes, Parallism between an axis and a surface.

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Operations Management

Unit 1

**Operations Management**

**Plant Location:**

Unit 2

**Product Design and Development:**

Unit 3

**Forecasting:**
Need of forecasting, Costs of Forecasting, Methods of Forecasting, Delphi technique, Nominal Group Technique, Simple moving average, Weighted moving average, Exponential Smoothing, Linear Regression method, Forecasting error its sources and measurement.

**Operation Scheduling and Control:**
Functions of Scheduling and Control, Production Scheduling, Machine Loading, Sequencing, Dispatching, Expediting.

Unit 4

**Production Planning:**
Introduction to Aggregate Production Planning and Master Scheduling, Materials Requirement Planning (MRP), MRP Structure and Output, Applications. Manufacturing Resource Planning (MRP II), Just-In-Time production System, Waste and waste elimination, Kanban System and Conwip shop floor control, Kaizan.

Unit 5

**Economic Analysis:**
Capital budgeting, meaning and significance, types of capital expenditure, analysis, interest and present value concept, depreciation, Capital investment evaluation techniques - pay back period, Rate of return on investment, Net Present value method, Internal rate of return method.

Reference Books:
1. Elements of Production Planning & Control by Eilon McMillan
5. Operations Management, Schaum’s Outlines, TMH
7. Production and Operations Management by Adam & Ebert, PHI.
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List of Experiments

1. To study various measuring gages and their design and conduct experiments.
2. To study Introferometer.
4. To study straightness, flatness, squareness, roundness, of the given symmetry.
5. To construct Control Charts for Attributes and for Control Charts for Variables.
6. To construct Operating Characteristic curve.
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### List of Experiments

1. To study various parameters of steam turbine.
2. To study various Performance parameters of Pelton wheel.
3. To study various Performance parameters of Francis Turbines.
4. To study various Performance parameters of Kaplan turbines.
5. To study various Performance parameters of Centrifugal Pumps.
6. To study various Performance parameters of Rotary Compressors.
7. To study various Performance parameters of Gas Turbines.
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#### List of Experiments

1. Draw Kinematical-structures of machine tools.
2. To study Complex and compound structure of machine tools.
3. To study Principle of metal shearing in press working operations.
4. Design of Shearing, Piercing and Blanking dies.
5. Jigs and Fixture Design.
6. To study Gear generation process.
7. To study various Performance parameters of Thread generation methods.
8. To study various methods of Powder Metallurgy.