

# PRODUCTION ENGINEERING

## UNIT 1: ENGINEERING MATHEMATICS

**Linear Algebra:** Matrix algebra, Systems of linear equations, Eigen values and Eigenvectors.

**Calculus:** Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and Minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and non-linear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation. Fourier integral theorem.

**Complex variables:** Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions. Statistical basis for control charts — Control limits — Control charts for variables, R Charts — Control chart for defective: p, np Chart - Control chart for defects: c charts. Correlation X

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

## UNIT 2: ENGINEERING MATERIALS AND ENGINEERING MECHANICS

**Engineering Materials:** Structure and properties of engineering materials and their applications: effect of strain, strain rate and temperature on mechanical properties of metals and alloys; heat treatment of metals and alloys, its influence on mechanical properties.

**Engineering Mechanics and strength of materials:** Engineering Mechanics — equivalent force systems- laws of forces - free body Concepts, equations of equilibrium; friction — types of friction — mechanical advantage — geometrical properties of sections — kinematics and kinetics — types of motion - DAlembert's principle momentum equations of momentum — laws of conservation of momentum — coefficient of restitution. strength

of materials — stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns, Theory of torsion.

### **UNIT 3: THEORY OF MACHINES AND DESIGN**

Analysis of planar mechanisms, cams and followers; governors and fly wheels; design of elements — failure theories; design of bolted, riveted and welded joints; design of shafts, keys, spur gears, belt drives, brakes and clutches.

### **UNIT 4: FLUID MECHANICS AND THERMAL ENGINEERING**

Fluid Mechanics — fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum; thermodynamics — zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; basics of internal combustion engines and steam turbines; heat transfer — fundamentals of conduction, convection and radiation, heat exchangers.

### **UNIT 5: METAL CASTING AND FORMING**

**CASTING PROCESSES** — types and applications; patterns — types and materials; allowances; moulds and cores — materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

**METAL FORMING** — Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working — forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, blending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire/rod drawing; metal working defects.

### **UNIT 6: METAL JOINING PROCESSES**

Welding Processes — manual metal arc, MIG, TIG, plasma arc, submerged arc, electroslag, thermit, resistance, forge, friction, and explosive Welding; other joining processes — soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes — ultrasonic, electron beam, laser beam; thermal cutting.

## **UNIT 7: MACHINING AND MACHINE TOOL OPERATIONS**

**Basic Machine tools;** machining processes—turning, drilling, boring, milling, shaping, planning, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining — geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes — USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

**Tool Engineering:** Jigs and fixtures — principles, applications, and design; press tools — configuration, design of die and punch; principles of forging die design.

## **UNIT 8: METROLOGY AND INSPECTION**

Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

## **UNIT 9: POWDER METALLURGY AND NEWER PRODUCTION PROCESSES**

Production of metal powders, compaction and sintering. Unconventional Machining Processes - electrodischarge machining — Laser beam machining — Ion beam machining — Plasma beam machining — Ultrasonic machining — Abrasive jet machining — Electrochemical and chemical machining — abrasive flow finishing

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## **UNIT 10: QUALITY CONTROL, PROCESS ANALYSIS AND MODERN MANUFACTURING SYSTEMS**

Quality objectives - Quality control - Quality Assurance - Quality system - Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process planning; parameter selection and comparison of production alternatives; time and cost analysis; manufacturing technologies — strategies and selection. Computer Integrated Manufacturing: Basic concepts of CAD, CAM, CAPP, cellular manufacturing, NC, CNC, DNC, Robotics, FMS and CIM