

**Module 1****Theory of Metal Cutting**

Geometry of single point cutting tool, Orthogonal and oblique cutting, Tool forces in orthogonal cutting, types of chips,

**Module 2**

Machinability, tool failure, tool life, cutting fluids and cutting tool materials

**Module 3****Machine Tools**

Constructional features, specification, operations and drives of lathe, working principles of capstan and Turret lathes, Shaper, Planer, & Slotter.

**Module 4**

Constructional features, specification, operations and drives of milling & drilling machine, indexing in milling operations

**Module 5****Grinding and finishing operations**

Cylindrical, surface and centreless grinding; Broaching, lapping, honing and buffing

**Module 6**

Gear cutting by forming and generating methods.

**Module 7****Introduction to Modern Manufacturing Processes**

Fundamental principles, application possibilities, process parameters, and operational characteristics of Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Ultrasonic Machining (USM), Chemical Machining (CHM).

**Text Books**

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| 1. <b>Workshop Technology –Vol. II</b>             | B S Raghuwanshi                 |
| 2. <b>Production Technology -Vol. II</b>           | OP Khanna& M Lal                |
| 3. <b>Elements of workshop technology- Vol. II</b> | HajraChoudhry                   |
| 4. <b>Modern Machining Processes</b>               | P. C. Pandey, H. S. Shan, TMH   |
| 5. <b>Non-conventional Machining</b>               | P. K. Mishra ,Narosa Publishing |
| House  |                                 |
| 6. <b>New Technology</b>                           | A. Bhattacharyya, IE(I)         |

**Reference Books**

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|---|--------------------|
| 1. <b>Production Technology hand book</b>                     | HMT                |
| 2. <b>Principles of manufacturing materials and processes</b> | J S Campbell       |
| 3. <b>Principles of Manufacturing technology</b>              | P N Rao ( Part I ) |

**Module -1.** Principles of Machine Design, standardization, designation and selection of materials, aesthetic and ergonomic considerations in design, Preferred numbers, Tolerances.

**Module -2.** Design against static and fluctuating loads.

**Module -3.** Threaded Joints, Cotter and Knuckle joints.

**Module –4** Riveted and Welded Joints.

**Module –5** Shafts, keys, couplings, Belt, Rope and chain drives

**Module – 6** Power screws, Screw Jack, Helical and leaf springs.

**Module – 7** Clutches and Brakes

**Text Books:**

1. Machine Design by Maleev and Hatman, CBS Publisher & Distributor, New Delhi, 1983.
2. Mechanical Engineering Design by J.F. Shegley, McGraw Hill Book and Company, U.S.A., 1986.

**Reference Books:**

1. Machine Design, Sharma and Agarwal, S.K. Kataria and Sons, New Delhi, 2001.
2. Design of Machine Elements, VB Bhandari, Tata McGraw Hill, New Delhi 1999.
3. Hand book of Properties of Engineering Materials and Design Data for Machine Elements, Abdulla Shariff, DhanpatRai& Sons, New Delhi – 2001.

**Module 1****Standards of Measurement**

Historical development, system of measurement, line, end & wavelength standards, type and source of measurement errors

**Module 2****Comparators**

Principle and uses of mechanical, optical, Electrical, electronic and pneumatic Comparators

**Module 3****Limits, Fits & Limit Gauge Design**

Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Indian standard system , type of plain limit gauges, design of plain limit gauges, Taylor's principle of gauging

**Module 4****Optics in Metrology**

Principle of interferometry, concept of optical flat, projector, microscope, autocollimator and interferometer

**Module 5****Screw thread And Gear Measurement**

Measurement of minor, major, effective diameter, pitch and thread angle of screw threads, gear tooth thickness & pitch measurement, involute profile peasting of gear

**Module 6****Geometrical Form and surface Finish**

Straightness, flatness and squareness and circularity tests, numerical evaluation measurement of surface finish, construction detail and working of Taylor – Hobson instrument

**Module 7****Machine Tool Metrology**

Types of machine tool tests, alignment tests for lathe, milling and drilling machine tools

**Text Books**

1. **A Text book of Engineering Metrology** I. C. Gupta , DhanpatRai , New Delhi
2. **Engineering Metrology** R.K. Jain ,Khanna Pub., New Delhi

**References**

1. **Engineering Metrology** K. J. Hume
2. **Engineering Metrology** M. Mahajan ,DhanpatRai& Co. New Delhi

**Module-1:** Definitions; Link or element of a machine, Kinematic pair, Kinematic chain, Mechanism, Inversion, Machine. Degree of freedom, Inversions of four bar chain, single slider crank chain and Double slider crank chain. Straight line motion mechanism and copying mechanism.

**Module 2:** Velocity and acceleration diagram of planar mechanism including coriolis component. Relative velocity method, Instantaneous centre method. Klein's construction and Analytical treatment of single slider crank mechanism.

**Module 3:** Static force analysis, Dynamic force analysis, Equivalent two-mass system.

**Module 4:** Flywheel: Turning moment on crankshaft, Turning moment diagram, Fluctuation of speed and energy and determination of moment of inertia of flywheel.

**Module 5:** Fundamental law of gearing, classification and basic terminology, Involute tooth profiles, spur gears. Gear trains; simple, compound and epicyclic gear trains.

**Module 6:** Cams: various types of cams, various types of followers, Displacement –time, velocity-time and acceleration-time diagrams. Graphical determination of cam profiles, specified cam profiles.

**Module 7:** Vibrations: Linear single degree of freedom systems, Free undamped and free damped longitudinal vibration, Transverse vibrations in shaft, torsional vibration, Two-rotor system and three-rotor system.

**Text Book:**

1. Theory of Machine by Thomas Beven

**Reference Books:**

1. Theory of Machines and Mechanism by Ghosh and Malik
2. Mechanism and Machine Theory by J.S. Rao and R.V. Dukkibati
3. Theory of Machine by S.S. Rattan, Tata McGraw Hill.

**Module-1**

Nature of living things: Definition of life, Miller's experiment, theories and evidences about origin of life, levels of biological organization, classification of living world.

**Module-2**

Biomolecules: composition of living matter, water, carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals.

**Module-3**

Biochemistry: Bioenergetics and thermodynamics, biological oxidation-reduction reactions, glycolysis, citric acid cycle, fatty acid metabolism, electron transport chain, aerobic and anaerobic respiration

**Module-4**

Molecular organization of cell: Viruses, cellular structure of microorganism, animal and plant, salient features of intracellular organelles, cell division and cell cycle, structure of chromosomes, difference between prokaryotes and eukaryotes.

**Module-5**

Molecular biology: Structure of DNA and RNA, DNA as genetic material, central dogma of molecular biology, DNA replication, transcription and translation, Introduction to bioinformatics and drug designing.

**Module-6**

Enzymology:, Mechanism of enzyme action, Lock and key model and induced fit model, active site, Michaelis Menten equation, reversible and irreversible inhibitors, competitive, non-competitive and uncompetitive inhibition.

**Module-7**

Techniques in biological sciences: Centrifugation, chromatography, gel electrophoresis, spectroscopy, thermal analysis,.

**Books Recommended**

1. Purves et al, Life: The Science of Biology
2. R. Dulbecco, The Design of Life.
3. Lehninger A, Principals of Biochemistry
4. Stryer L, Biochemistry
5. K. Wilson & K.H. Goulding, A biologist's guide to Principles and Techniques of Practical Biochemistry.