

Module 1: *Thermodynamic vapour cycles:* Components of steam power system; Carnot cycle and Rankine cycle; their comparison; p-v, T-s & h-s diagrams; Reheat cycle; Regenerative cycle; use of steam table and chart. [5 Lectures]

Module 2: *Fuels and Combustions:* Classification of fuels; basic chemistry and combustion equations; theoretical and excess air; stoichiometric air-fuel ratio; conversion of volumetric to weight analysis and vice-versa. [5 Lectures]

Module 3: *Boiler performance:* Equivalent evaporation; Boiler efficiency; Heat balance; Boiler Draught; its classification; Chimney height; maximum discharge through chimney; Chimney efficiency. [5 Lectures]

Module 4: *Steam Nozzles:* Introduction; types of steam nozzles; nozzle efficiency; velocity of steam flow through the nozzle; discharge and condition of maximum discharge through a nozzle; physical significance of critical pressure ratio; Supersaturated flow through nozzle; General relationship between area, velocity and pressure in nozzle flow. [5 Lectures]

Module 5: *Steam Turbines:* Impulse and Reaction turbine; principle of working; velocity diagrams; compounding; Degree of reaction; efficiencies; condition of maximum efficiency [5 Lectures]

Module 6: Losses in steam turbines, state- point locus and reheat factor; governing of steam turbine; Back-pressure and pass-out Turbine [5 Lectures]

Module 7: *Steam condensers:* Classification of condensers; sources of air in condenser; effects of air leakage in condenser; vacuum efficiency; condenser efficiency; cooling water calculations; Air pumps. [5 Lectures]

Recommended Books:

1. Theory and Practice of Heat Engine – D.A. Rangham; Camb. Univ. Press.
2. Elements of Heat Engine – Pandey & Saha
3. Steam and Gas Turbine – R. Yadav
4. Thermal Engineering – R. K. Rajput.
5. Engineering Thermodynamics- P.K.Nag.

Module-1 Theories of elastic failure: Introduction, significance and comparison of various theories. Equivalent bending moment and equivalent torque.

Module-2 Unsymmetrical bending: Limitations of flexural formula. Bending stresses in beams with loads not acting in the plane of symmetry of the cross-section. Flexural formulas for stresses with reference to principal axes of inertia of the cross-section.

Module-3 Shear Centre: Theory of shear flow, shear flow diagrams and shear centre for thin-walled symmetrical sections.

Module-4 Bending of curved beams: Beams of small and large initial curvature, evaluation of circumferential stresses. Stresses and deformation of closed rings.

Module-5 Thin and thick cylinders: Radial and circumferential stresses, stresses produced due to shrink fit.

Module-6 Rotating Disc: Stresses in disc of uniform thickness and uniform strength.

Module-7 Springs: Open coiled helical spring, leaf spring and spiral spring.

Recommended Books:

1. Advanced Mechanics of Material by Seely & Smith
2. Strength of Materials by Ryder.
3. Strength of Materials by S.S. Rattan.

Module 1:

Introduction: Energy needs and energy supply, conventional & non-conventional energy sources. Principle of operation and need of the non conventional energy sources. Present energy scenario.

Wind Energy: Availability, site selection, different types of wind turbines, design criteria and material selection economics. (5 Lectures)

Module 2:

Solar energy: Solar geometry, Characteristics & estimation of solar radiation. Collector – flat plate & concentrating types. Heat loss calculation for flat plate type collector, Collector efficiency calculation, Selective paints & surfaces for them. (6 Lectures)

Module 3:

Thermal Storages and Solar ponds – principle & its uses.

Solar Application: Heating of air & water for building and other uses. Active & passive systems, solar pumps, solar power plant, solar cookers, solar refrigeration & air conditioning solar cookers, solar furnaces etc. (5 Lectures)

Module 4:

Bio-conversion: Photosynthesis & generation of bio-gas, digester and their design, selection of material, feed of digester, pyrolytic gasification, algae production & their uses. (5 Lectures)

Module 5:

Geo-thermal Energy: Sites, potentiality and limitation, study of different conversion system and other uses of geo-thermal sources. (5 Lectures)

Module 6:

Tidal Energy: Sites, potentiality and possibility of harnessing from site, limitation. Different method of using tidal power. (4 Lectures)

Module 7:

Ocean Thermal Energy: Principle of utilization and its limitation description of few system.

Other Non-Conventional Sources: Hydrogen energy, its production and applications. Fluidized bed combustions, waste product energy. (5 Lectures)

Books:

1. Non-conventional Energy Sources – G.D. Rai
2. Solar Energy –Garg and Prakash
3. Solar Energy Utilization – G.D. Rai
4. Solar Thermal energy – Peter J. Lunde

Theory of Metal Cutting

Geometry of single point cutting tool, Orthogonal and oblique cutting, Tool forces in orthogonal cutting, types of chips, Machinability, tool failure, tool life, cutting fluids and cutting tool materials

Machine Tools

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

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

Grinding and finishing operations

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

Gear cutting by forming and generating methods.

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

Reference Books

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

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.