

NORTH MAHARASHTRA UNIVERSITY, JALGAON
Syllabus For Paper II Of Course Work Examination For PhD
In Mechanical Engineering

UNIT –I : Thermal Science

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, heat exchanger performance, LMTD and NTU methods.

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes;

UNIT –II : Fluid Mechanics and Applications of Thermal Science

Fluid Mechanics: Fluid properties; fluid statics, manometers, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; flow through pipes, head losses in pipes, bends etc.

Applications: Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. Turbomachinery: Pelton-wheel, Francis and Kaplan turbines - impulse and reaction principles, velocity diagrams

UNIT –III : Design and Vibration

Engineering Mechanics: Free body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts;

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

Vibrations: Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

UNIT –IV : Manufacturing

Engineering Materials: Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

Metal Casting: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

Forming: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy.

Metal Joining: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

Machining and Machine Tool Operations: Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, principles of design of jigs and fixtures

UNIT –V : Industrial Engineering

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Operations Research: Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Reference Books:

1. J.P.Holman “Heat Transfer”Mc Graw Hill VII Edition Publication.
2. V. Ganeshan, “Internal Combustion Engines”, 2/e, Tata McGraw Hill, New Delhi.
3. R K Rajput , “Thermal Engineering”, Laxmi Publication ltd. New Delhi.
4. Dr. R. K. Bansal, “Fluid Mechanics and Hydraulic M/c”, Laxmi publication Ltd,Delhi.
5. Arora C. P.,” Refrigeration and air conditioning”, TMH, New Delhi.
6. P. Radhkrishnan, S. Subramanyam, V. Raju ,”CAD/CAM/CIM” , New Age Publication
7. S.D. Sharma, “Operation Research”, Khanna Publication
8. R.K. Rajput “Applied mechanics” Laxmi Publications
9. M.F. Spotts,” Design of Machine Elements”, Pearson Education
10. Norton ,” Dynamics of Machinery”, Tata Mc-Graw Hill, New Delhi
11. Thomas and Bevan, “Theory of Machines” Tata Mc Graw Hill
12. R.K. Rajput “Mechanical Engineering” Firewall Media
13. G.K.Grover “Mechanical Vibrations”New Chand & Bros Roorkee
14. Sujatha “Vibration And Acoustics” Tata McGraw-Hill Education
15. O. P. Khanna , “Welding Technology”, Dhanpat Rai Publications
16. R. K. Jain , “Production Technology”
17. V.D.Kodgire, “Material Science and Metallurgy for Engineers”, Everest Publishing House. Pune
18. R.K.Jain, “Engineering Metrology”, Khanna Publications