

DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR QUALIFYING EXAMINATION FOR PHD SUBMISSION
MACHINE DESIGN & HEAT TRANSFER

SECTION - A

Composite Materials: Elastic behavior of unidirectional and multi directional composites, Analysis of Laminated composite Beams and plates, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory, Application of Nano Composite Materials in plate theory, Linear Elastic Fracture Mechanics in Composites, Elastic Plastic Fracture Mechanics in Composites. Mechanical, Thermal and Physical properties of Composite materials.

Multi-Objective Optimization Problems: Convergence criterion, Applications of multi objective problems and Local and Global optimization problems, Pareto's analysis, Non-dominated front, Genetic Algorithms, Hybrid Genetic Algorithms, Multi – objective GA, Non-dominated sorted GA, Particle Swarm Optimization, Parallel Computing, Parallel Genetic Algorithms and Parallel Particle Swarm Optimization Problems.

Tribological, Fatigue and Creep Properties in Metals and Composites: Studies on Wear rate, Wear Regimes and friction behaviour of Metals and composites. Fatigue, Low and High cycle fatigue test, Crack Initiation and Propagation mechanism, Coffin – Manson Law, Basquin's law, Paris Law and Miner's law. Effect of surface and metallurgical parameters on Fatigue, Fracture of non metallic materials, fatigue analysis, Sources of failure, procedure of failure analysis. Creep curves, Creep properties, Multi – axial creep, Creep – Fatigue Interaction, Creep Integrals.

SECTION - B

Steady state heat conduction with and without heat generation in different geometries, transient heat conduction in solids: lumped system analysis, semi infinite solid, use of Grober and Heisler charts, one term approximate solutions for unsteady heat conduction in solids, numerical methods in heat conduction: application to steady one dimensional and two-dimensional heat conduction. Radiation fundamentals, radiation exchange between gray bodies.

Boundary layer theory, equations of motion, forced convection over external surfaces: laminar and turbulent flows, Forced convection inside tubes, natural convection, pool boiling in liquids, forced convective boiling, condensation on external surfaces, forced convective condensation inside tubes, pressure drop in two-phase flows.

Books:

1. Isaac and Daniel M., "Engineering Mechanics of Composite Materials", Oxford University Press, 1994.
2. Jones R.M., "Mechanics of Composite Materials", McGraw Hill, New York, 1975
3. Anderson T L, "Fracture Mechanics- Fundamentals and Applications", CRC Publishers, 2nd edition, 1995
4. Thomas H. "Courtney Mechanical Behaviour of Materials", McGraw Hill.
5. Stachowiak., "Wear: Materials, Mechanisms and Practices", Tribology series, 2005
6. Rolfe S.T. and Barsom J.M., "Fracture and Fatigue control in structures, Prentice Hall, Eglewood Cliffs.

7. Kalyanmoy Deb, "Multi – Objective Optimization Using Evolutionary Algorithms", John Wiley & Sons, 2001.
8. Fundamentals of Heat & Mass Transfer, M. Thirumaleshwar, Pearson Education
9. Heat Transfer, Yunus Cengel
10. Fundamentals of Heat Transfer, F. Incropera, Jhon Wiely & Sons
11. Liquid Vapor Phase Change Phenomena, V.P Carey and Collier

Note: Set Four Questions from each Section