Model Question Paper
QUALIFYING EXAMINATION FOR SUBMISSION OF PH.D
MECHANICAL ENGINEERING
MACHINE DESIGN & HEAT TRANSFER
(Effective from the Admitted Batch of 2013-2014)

Time: 3 hours Max. Marks: 100

Answer any **FIVE** questions
All Questions carry equal marks
---

1 a) Explain about Elastic behavior of unidirectional and multi directional composites

b) Derive the necessary equations for orthotropic, cross and angle ply laminated plates and mention few applications.

2 a) Write in detail about Mechanical, Thermal and Physical properties of Composite materials.

b) Discuss in detail about Hybrid, Multi – objective and Non-dominated sorted Genetic Algorithms with an example.

3 a) Describe about Parallel Computing, Parallel Genetic Algorithms and Parallel Particle Swarm Optinmization Problems with suitable example.

b) Differentiate in detail about tribological properties of Metals and Composites.

4 a) Write in detail about Low and High cycle fatigue and discuss in detail about Coffin –Manson Law, Basquin's law and Paris Law and their importance.

b) Write short notes on Multi – axial creep, Creep – Fatigue Interaction and Creep Integrals

5 The hot combustion gases at 150°C flow through a hollow cylindrical pipe of 10cm inner diameter and 12 cm outer diameter. The pipe is located in a space at 30°C and the thermal conductivity of the pipe material is 200 W/mK. Neglecting surface heat transfer coefficients, calculate the heat loss through the pipe per unit length and the temperature at a point halfway between the inner and outer surface.

6 A carbon steel shaft of 0.2m diameter is heat treated in a gas fired furnace whose gases are at 1200K and provide a convection coefficient of 80 W/m^2K. If the shaft enters the furnace at 300K, how long must it remain in the furnace to achieve a centre line temperature of 900K. (ρ = 7854kg/m^3, K = 48.8W/mK, Cp= 559J/kgK)

7 Liquid sodium flows with a mean velocity of 3m/s inside a smooth tube of 25mm diameter and is heated by the tube wall maintained at a uniform temperature of 120°C. Determine the heat transfer coefficient at a location where bulk mean fluid temperature is 93°C and the flow is fully developed.

8 The bottom of a copper pan 300mm in diameter is maintained at 120°C by an electric heater. Calculate the power required to boil water in this pan. What is the evaporation rate, estimate critical flux.
