Roll No. .....

2309

B.E./B.Tech 6th Sem.(ME)

Examination – May, 2014

HEAT TRANSFER

Paper : ME-306-E

Time : Three hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

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1. (a) Define reversible and in irreversible process. 10

(b) Explain various modes of Heat transfer. 10

2. Derive the one dimensionaly, steady state heat conduction equation with internal heat generation in Cartesian coordinate system. 20

3. A furnace wall is made of three layers, the first layer of insulation brick (K = 0.6 W/m-k) has a thickness of 120 mm. The face is exposed to gas at 870°C with a convection coefficient of 110 W/m^2 –K. The layer is

backed by a 100 mm layer of fibrebrick of conductivity K = 0.8W/M–K. The third layer is the backing plate of conductivity 49 W/m-k has a thickness of 10mm. The plate is exposed to air at 30°C with a convection coefficient of 15W/m²–k. Determine the heat flow perunit area temperatures at the interfces and overall heat transfer coefficient. 20

4. (a) What are the physical significance of Biot number ? 10

(b) What is the condition for the validity of lumped capacitance method for transient heat conduction analysis. 10

5. A mild steel sphere of 15 mm in diameter initially at 625°C is exposed to a current of air at 25°C with convection coefficient of 120 W/m²K. Calculate :

(i) Time required to cool the sphere at 100°C.

(ii) Initial rate of cooling.

(iii) Instantaneous heat transfer at the end of one minute after the start of cooling.

(iv) Total energy transferred during first one minute. 20

6. (a) Explain stephen-Boltzmann law. 10

(b) Differentiate forced convection and free convection. 10

7. Derive the expression of heat transfer rate between the cold and hot fluids in terms of overall heat transfer co-efficient heat exchanger area and LMTD for a parallel flow heat exchanger. 20

8. A hot fluid at 200°C enters a heat exchanger at a mass flow rate of 10^4 Kg/hr. Its specific heat is 2000 J/kg – K. It is cooled by another fluid entering at 25°C with a mass flow rate 2500 Kg/hr. and specific heat 400J/Kg K. The overall heat transfer coefficient based on outside area of 20 m^4 is 2590 W/m^2-K. Find the exist temperature of the hot fluid when the fluids are is parallel flow. 20
