Code No: 56020 **R09**

JAWAHARLAL NEHRU TECHNOLOGY UNIVERSITY HYDERABAD
B.Tech III Year II Semester Examinations, May - 2016
HEAT TRANSFER
(Common to ME, AME, MSNT)

Time: 3 hours **Max. Marks: 75**

Answer any five questions.
All questions carry equal marks.

1.a) Discuss applications of heat transfer.
b) Derive General Heat Conduction equation in Cartesian Coordinates. [7+8]

2.a) What is the critical radius of insulation.
b) Derive the equation for the one dimensional study state conduction heat transfer spheres. [5+10]

3.a) Explain the concept of functional body.
b) Air at 36^0C flows over a plate of length 2m with a velocity of 3m/s. if the width of the plate is 0.3m find the drag force exerted on it. [8+7]

4. Air at a temperature of 20^0C flows across a flat plate maintained at a temperature of 600^0C. Calculate the amount of heat transferred per metre width from both sides of the plate over a distance of 300 mm from the leading edge. The following relation holds good in the case of large temperature difference between the plate and fluid:

$$Nu_x = 0.332(pr)^{1/3}(Re)^{1/2}\left(\frac{T_s}{T_\infty}\right)^{0.117}$$

Where T_S and T_∞ are the absolute temperatures of the plate surface and free steam respectively and all fluid properties are evaluated at the mean film temperature. [15]

5. Derive momentum equation for hydrodynamic boundary layer over a flat plate. [15]

6.a) Explain Nusselt's Theory of Condensation on a plate.
b) Distinguish difference between film cooling and pool cooling. [7+8]

7. The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on the hot and cold sides are 75^0C and 20^0C respectively. The exit temperature of hot water is 45^0C. If the individual heat transfer coefficients on both sides are 650W/m^2 ^{0}C, calculate the area of the heat exchanger. [15]

8. Calculate the following for an industrial furnace in the form of a black body and emitting radiation at 2500^0 C:
a) Monochromatic emissive power at 1.2μm
b) Wavelength at which the emission is maximum,
c) Maximum emissive power. [5+5+5]

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