

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

SECOND SEMESTER 2015-2016

CHE F241: Heat Transfer

Mid Term Test

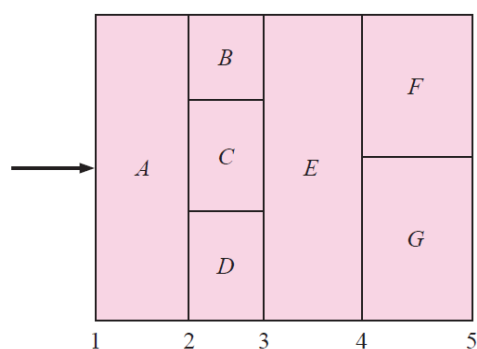
Date: 08.10.2015

Duration: 2 PM - 4:30 PM

Maximum Marks: 90

PART- A (Close book- 30 min)

1. Briefly explain the modes of heat transfer 5M
2. Derive the heat conduction expression in cylindrical system. 5M
3. Explain the lumped heat capacity analysis 5M
4. Develop the equivalent electrical circuit for the composite slab system 5M



5. Define critical insulation thickness and explain the importance for the cylindrical system. 5M
6. Explain the following a) Thermal conductivity, b) Nusselt Number c) Prandtl number 10M
d) Grashoffs Number d) Stanton number, e) Biot number
7. Explain the importance of extended surfaces(FINS) on the process systems 5M

PART- B (Open book- 60 min)

1. A steel pipe with 5-cm OD is covered with a 6.4-mm asbestos insulation [$k=0.096 \text{ Btu/h} \cdot \text{ft} \cdot ^\circ\text{F}$] followed by a 2.5-cm layer of fiberglass insulation [$k=0.028 \text{ Btu/h} \cdot \text{ft} \cdot ^\circ\text{F}$]. The pipe-wall temperature is 315°C , and the outside insulation temperature is 38°C . Calculate the interface temperature between the asbestos and fiberglass. 10M
2. The temperature distribution "T" across the large concrete slab 30 m thick is given by $T= 20 + 15 X- 2X^2$, where X is the thickness of the slab. compute the following.
a) Heat entering and leaving each face
b) Heat gained or lost in unit time
c) Temperature change per unit time at the centre of the slab 10M
3. A 10-cm-square plate has an electric heater installed that produces a constant heat flux. Water at 10°C flows across the plate at a velocity of 3 m/s. What is the total heat which can be dissipated if the plate temperature is not to exceed 80°C ? 10M

4. Water at the rate of 3 kg/s is heated from 5 to 15°C by passing it through a 5-cm-ID copper tube. The tube wall temperature is maintained at 90°C. What is the length of the tube? 10M
5. A 1-m-square vertical plate is heated to 300°C and placed in room air at 25°C. Calculate the heat loss from one side of the plate. 10M