

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2171911

Date:10/05/2019

Subject Name:Advance Heat Transfer

Time:02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Tables for properties of air and water are permitted.

- Q.1**
- (a) What is heat generation? What do you mean by uniform heat generation? Also write examples of uniform heat generation. **03**
- (b) Explain the heat transfer in high velocity flow with a neat sketch? **04**
- (c) Consider steady two-dimensional heat transfer in a long solid bar whose cross section is given in the figure 1. The measured temperatures at selected points of the outer surfaces are shown. The thermal conductivity of the body is $K = 20 \text{ W/m}^\circ\text{C}$, and there is no heat generation. Using the finite difference method with a mesh size of $\Delta x = \Delta y = 1 \text{ cm}$, determine the temperatures at the indicated points in the medium. **07**
- Q.2**
- (a) What is transient heat conduction? How it is differ from steady state heat conduction? **03**
- (b) Discuss the use of Heisler and Grober charts. **04**
- (c) Explain radial fins of rectangular and hyperbolic profiles- longitudinal fin of rectangular profile radiating to free space. **07**

OR

- (c) Derive an expression for temperature distribution during steady state heat conduction with internal heat generation and exposed to convection environment in hollow cylinder. **07**
- Q.3**
- (a) Differentiate between free and forced convection? **03**
- (b) Prove that fully developed flow in a tube subjected to constant surface heat flux, the temperature gradient is independent of x and thus the shape of the temperature profile does not change along the tube. **04**
- (c) In a particular solar collector, energy collected by placing a tube at the focal line of parabolic collector and passing fluid through the tube. The arrangement resulting in a uniform heat flux of 2000 W/m^2 along the axis of the tube of diameter 60 mm. **07**
- Determine :
1. Length of the tube required to heat the water from 20°C to 80°C which flows at the rate of 0.01 kg/s .
 2. Surface temperature at the outlet of tube.

For constant heat flux condition , Use , Nusselt number(Nu) = 4.36

The thermo-physical properties of water are as follows:

$$\mu = 352 \times 10^{-6} \text{ Ns/m}^2, k = 0.67 \text{ W/mK}, C_p = 4187 \text{ J/kgK},$$

$$\text{Pr} = 2.2$$

OR

Q.3 (a) Define fin? Classify the fins? **03**

(b) Why is the flow separation in flow over cylinders delayed in turbulent flow? Explain with neat sketch? **04**

(c) A horizontal 40 W fluorescent tube which is 0.038 m in diameter and 1.2 m long stands in still air at 1 atm and 20°C. If the surface temperature is 40°C and radiation is neglected, what percentage of power is being dissipated by convection? **07**

Use the following correlation:

$$\text{Nu}_u = 0.53(\text{Gr}_r \times \text{Pr})^{0.25}$$

The thermo-physical properties of working fluid are as follows:

$$k = 0.02652 \text{ W/m.K}, \nu = 16.19 \times 10^{-6} \text{ m}^2/\text{s}, \text{Pr} = 0.706,$$

$$\beta = 3.3 \times 10^{-3} \text{ K}^{-1}$$

Q.4 (a) Explain with the neat sketch Minimum Heat Flux? **03**

(b) What are the effects of non-condensable gases in condensing equipments? **04**

(c) Explain with neat sketch, the heat transfer in high velocity flow in detail? **07**

OR

Q.4 (a) Write a short note on liquid-metal heat transfer? **03**

(b) Discuss modes of condensation. Why dropwise condensation is preferred? **04**

(c) Explain the different regimes of pool boiling? **07**

Q.5 (a) Write a note on Radiation shape factor. **03**

(b) Explain all the different mechanisms of heat transfer from the human body (a) through the skin and (b) through the lungs. **04**

(c) Explain Emissivity and absorptivity of gases and gas mixtures. **07**

OR

Q.5 (a) Explain in brief: radiation effects that affect human comfort. **03**

(b) How does the wavelength distribution of radiation emitted by a gas differ from that of a surface at the same temperature? **04**

(c) Derive an expression for a rate of radiation exchange, when a radiation shield is inserted between two parallel plates? **07**

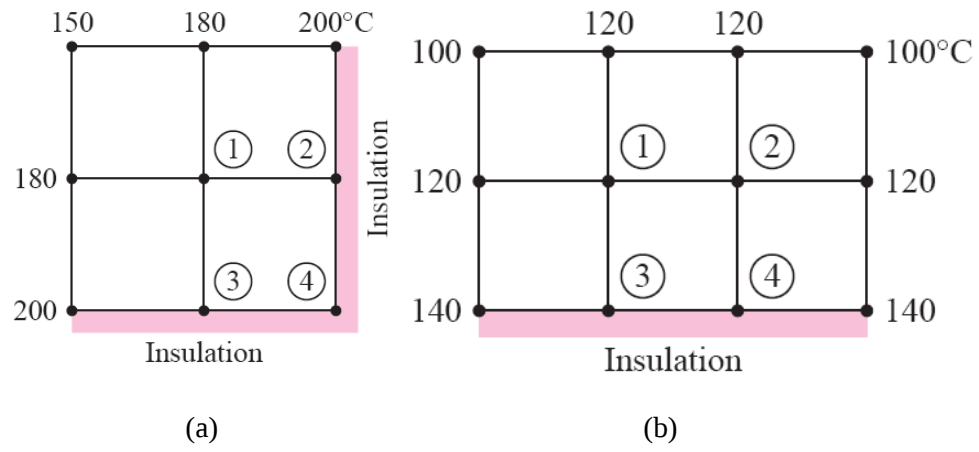


Figure 1
