

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VII (NEW) EXAMINATION – SUMMER 2021****Subject Code:2171911****Date:03/08/2021****Subject Name:Advance Heat Transfer****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define: Nusselt Number, Reynolds Number, Prandtl Number. **03**
 (b) With suitable examples, explain in brief about periodic variation and non-periodic variation transient heat transfer. **04**
 (c) Discuss the various regimes of pool boiling with neat sketch. **07**

- Q.2** (a) Why is the burnout point avoided in the design of boilers? **03**
 (b) Discuss modes of condensation. Why dropwise condensation is preferred? **04**
 (c) An infinite long, circular aluminum rod ($k=220$ W/mk) is attached at one end to a heated wall and transfers heat by convection to a cold fluid. **07**
 (i) If the diameter of the rod is tripled, by how much would the rate of heat removal change?
 (ii) If a copper rod ($k=385$ W/mk) of the same diameter is used in place of the aluminum, by how much would the rate of heat removal change?

OR

- (c) Water in a tank is to be boiled at sea level by a 1cm diameter nickel plated steel heating element equipped with electrical resistance wires inside. Determine the maximum heat flux that can be attained in the nucleate boiling regime and the surface temperature of the heater surface in that case. Take following properties of water at saturation temperature of 100°C ; $\rho_l = 957.9$ kg/m³, $\sigma = 0.0589$, $\rho_v = 0.6$ kg/m³, $Pr_l = 1.75$, $h_{fg} = 2257 \times 10^3$ J/kg, $\mu_l = 0.282 \times 10^{-3}$ kg m/s, $C_{p_l} = 4217$ J/Kg $^{\circ}\text{C}$, $C_{s_f} = 0.013$, $n=1$, and $C_{cr} = 0.12$. **07**
- Q.3** (a) Explain in brief about radiation effects that affect human comfort. **03**
 (b) Explain radial fins of parabolic profile. **04**
 (c) What is Beer's law? Why do surfaces absorb differently for solar or earthbound radiation? **07**

OR

- Q.3** (a) Differentiate clearly between boiling and condensation. **03**
 (b) What is a practical way of handling irregular boundary surfaces with the finite difference method? **04**
 (c) Explain the mechanism of laminar film condensation on a vertical plate. **07**
- Q.4** (a) What is transient heat conduction? How it is differ from steady state heat conduction? **03**
 (b) Define mean bulk temperature and mean film temperature with their significances. **04**
 (c) Define fin efficiency and fin effectiveness. Why is the insulated-tip solution important for the fin problems? **07**

OR

- Q.4** (a) What do you mean by extended surfaces? Under what circumstances, one should opt for extended surfaces? **03**
 (b) Explain in brief about free convection and force convection with suitable examples. **04**

- (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.5** (a) Define Biot number and Fourier number? State their significances? **03**
- (b) Write a short note on Emissivity of gases and gas mixtures. **04**
- (c) What is an irregular boundary? What is a practical way of handling irregular boundary surfaces with the finite difference method? **07**
- OR**
- Q.5** (a) What are Heisler charts? How these charts are used to obtain temperature distribution? **03**
- (b) Explain in brief, the different mechanisms of heat transfer from the human body through the lungs. **04**
- (c) Define these terms used in the finite difference formulation: node, nodal network, volume element, nodal spacing, and difference equation. **07**
