

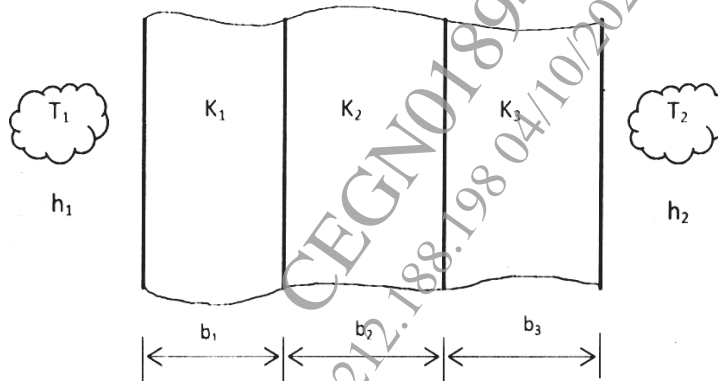
Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4
- 2) Draw neat diagram wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data if necessary.
- 5) Figures to the right indicate full marks.

- Q1) a)** Formulate following composite slab conduction system and equivalent electricla circuit. Let A be cross section area and surface area of composite area. [5]



- b) Compare Heat by Conduction and Heat by Convection. [4]
- c) A steel tube fo 5cm inner diameter and 8cm outer diameter ( $k=16\text{W/mK}$ ), is covered with an insulation of 3cm thickness ( $k=0.3\text{ W/mK}$ ). A hot gas at  $350^\circ\text{C}$  with  $h=400\text{ W/m}^2\text{K}$  flows inside the tube. outer surface of the insulation is exposed to air at  $30^\circ\text{C}$  with  $h=60\text{ W/m}^2\text{K}$ . Calculate the heat loss from the tube for 20 meter lenght.[6]

OR

P.T.O.

- Q2)** a) Write differential equation of heat conduction in Cartesian co-ordinates and reduce it to Fourier's Equation and Unidirectional Poission's Equation. [4]
- b) A plate having a thickness of 0.4cm has an internal heat generation of  $200 \text{ MW/m}^3$  and a thermal conductivity of  $25 \text{ W/mK}$ . One side of the plate is insulated and the other side is maintained of  $100^\circ\text{C}$ . Calculate maximum temperature in the plate. What is the temperature at the centre of plate? [7]
- c) Explain the Temperature boundary condition and heat flux boundary condition with example. [4]
- Q3)** a) Write the equation for finding critical radius of cylindrical and spherical object. Why critical thickness is not significance in case of slab. [5]
- b) Derive an expression for Heat flow rate and efficiency of an infinitely long fin. [8]
- c) Enlist the applications of extended surfaces. [2]

OR

- Q4)** a) A cylindrical rod of 2cm diameter & 25cm long extended from a insulated steam vessel at  $100^\circ\text{C}$  into air at  $30^\circ\text{C}$ . The free end of the rod is insulated. Determine the temperature at free end if rod is made of. [7]
- i) Copper,  $K=330 \text{ W/mK}$
- ii) Steel,  $K=49 \text{ W/mK}$
- calculate heat transfer in each cases. Take  $h = 7 \text{ W/m}^2\text{K}$ . Also comment on result.
- b) The purchase department of power plant is planning to purchase insulation for covering steam carrying pipe. The total insulation cost \$25,000 and would have life of 10 years with zero salvage value. The expected annual cash inflow of the insulation is \$10,000. Compute payback period of insulation and conclude whether or not the insulation would be purchased if the maximum desired payback period is 3 years. [6]
- c) Explain the significance of Biot Number. [2]

