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SUBJECT CODE NO:E-29
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(MECH) Examination Nov/Dec 2017
Heat Transfer
(REVISED)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
i) Solve any three questions from each section.
ii) Figure to the right indicates full marks.
iii) Assume suitable data, if necessary.
iv) Use of non programmable calculator is allowed.

Section A

Q.1 a) Explain different modes of heat transfer. State the basic laws for these modes. 06

b) A pipe (k = 180 W/m^{0}C) having inner and outer diameters 80mm and 100mm respectively is located in a space at 25^{0}C. Hot gases at temperature 160^{0}C flow through the pipe. Neglecting surface heat transfer coefficients, calculate: 07
i) The heat loss through the pipe per unit length
ii) The temperature at a point halfway between the inner and outer surfaces

Q.2 a) The interior of a refrigerator having inside dimensions of 0.5m X 0.5m base area and 1m height is to be maintained at 6^{0}C. The walls of the refrigerator are constructed of two mild steel sheets 3mm thick (k= 46.5 W/m ^{0}C) with 50 mm of glass wool insulation (k = 0.046 W/m ^{0}C) between them. If the average heat transfer coefficients at the inner and outer surfaces are 11.6 W/m^2 ^{0}C and 14.5W/m^2 ^{0}C Respectively, calculate: 08
i) The rate at which heat must be removed from the interior to maintain the specified temperature in the kitchen at 25 ^{0}C, and
ii) The temperature on the outer surface of the metal sheet.

b) Explain: Biot number and Fourier number. 05

Q.3 a) Starting with boundary conditions, derive the expressions for temperature distribution along the length and heat flow rate for a very long fin using standard notations. 08

b) Fins are more effective, when provided on the surface for which film heat transfer coefficient is smaller, explain. 05

Q.4 a) Find the convective heat loss from a radiator 0.6 m wide and 1.2 m high maintained at a temperature of 90 ^{0}C in a room at 14 ^{0}C. Consider the radiator as a vertical plate. 06

b) Differentiate between Hydrodynamic boundary layer and thermal boundary layer 07

Q.5 a) Write short notes on (Any two) 14

i) Reynolds Number & it's significance

ii) Nussult Number & it's significance

iii) Fourier Number & it's significance

Section B

Q.6 a) Explain film and drop wise condensation 06

b) Draw the pool boiling curve and explain six regimes of pool boiling curve. 07

Q.7 a) State and prove Kirchhoff's law. 05

b) The large parallel planes with emissivity's 0.3 and 0.8 exchange heat. Find the percentage reduction when a polished aluminum shield of emissivity 0.04 is placed between them. 08

Q.8 a) A chemical (Specific heat = 3.2 kJ/kg K) enters a parallel flow heat exchanger at 150^0C at a flow rate of 30,000 kg/hr. Cooling water (specific heat = 4187 J/kg K) enters the heat exchanger at 20^0C at a flow rate 1000 kg/min. Heat transfer area of the heat exchanger is 12 m^2. Over all heat transfer coefficient can be taken as 1000 W/m^2K. Find the effectiveness of the heat exchanger and outlet temperatures of both chemical and water. 08

b) Classify the heat exchanger. 05

Q.9 a) Derive LMTD for parallel flow. 06

b) An oil cooler for a lubrication system has to cool 1000kg/h of oil (Cp = 2.09 kJ / kg^{0}C) from 80^0C to 40^0C by using a cooling water flow of 1000 kg/h at 30^0C. Give you choice for a parallel or counter flow heat exchanger, with reasons. Calculate the surface area of the heat exchanger, if the overall heat transfer coefficient is 24 W/m^2 ^{0}C. 07

Q.10 Write explanatory notes on : (Any two) 14

i) Wien's displacement law

ii) Radiation shield

iii) Shape factor