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END TERM EXAMINATION

FOURTH SEMESTER [B.TECH.] MAY-2010

Paper Code: ETME204 **Subject: Heat Transfer**

Paper Id: 36204 **Maximum Marks :75**

Time : 3 Hours

Note: Q.1 is compulsory. Internal choice is indicated. Use of steam table, Mollier chart and calculator is allowed.

(5x5=25)

Q1 Explain the following:-
(a) Critical thickness of insulation (b) Dimensionless numbers
(c) Wein's displacement law (d) Rocket engines (e) Reheat factor

UNIT-I

Q2 (a) What is Fourier's law of heat conduction? **(5)**

(b) Prove that the heat flow through the hollow cylinder is given by $Q = \frac{2\pi LK(T_1 - T_2)}{\log_e\left(\frac{R_2}{R_1}\right)}$ where $T_1 > T_2$. Where R_1=Inside radius, R_2=Outside radius, T_1=Inside temperature, T_2=Outside temperature, K=Thermal conductivity, L=Length. **(7.5)**

OR

Q3 (a) Differentiate between convective heat transfer coefficient and overall heat transfer coefficient. **(5)**

(b) A brickwork of a furnace is built up of layers laid of fire clay (K_1=0.93W/m-^{0}C) and red brick (K_3=0.7W/m-^{0}C) and the space between the two is filled with crushed diatomite brick (K_2=0.13W/m-^{0}C). The thickness of fireclay, diatomite and red brick are 12cm, 5cm and 25cm respectively. What should be the thickness of the red brick layer, if the brick work is to be laid without diatomite filling between the two layers, so that the heat flow through the brick work remains constant? **(7.5)**

UNIT-II

Q4 (a) Differentiate between film condensation and dropwise condensation. **(5)**

(b) Find the expression for log-mean temperature difference (LMTD) for parallel flow heat exchanger. **(7.5)**

OR

Q5 (a) Explain Planck's distribution law. **(4)**

(b) A small polished sphere of 20cm in diameter and at 700K is located in a room, whose temperature is 27^{0}C. Find the heat loss rate from the sphere to room by radiation only, if the emissivity of the polished sphere is 0.1. If the surface of the sphere is oxidized having 0.8 emissivity, find the change in the heat loss. **(8.5)**

UNIT-III

Q6 (a) Explain the following as referred to air compressors: **(4)**
(i) Isothermal efficiency (ii) Volumetric efficiency

(b) State the influence of intake temperature, intake pressure, clearance and compression and expansion on the performance of reciprocating air compressor. **(4.5)**

(c) What are benefits of multistage compression over the single stage compression? **(4)**

OR

Q7 (a) What are the advantages of a closed cycle gas turbine over open cycle gas turbine? **(4)**

(b) Explain the working difference between propeller-jet, turbo-jet and turbo-prop. **(4)**

(c) An open cycle gas turbine plant works between the pressure range of 1 bar and 6 bar and temperature range of 300K and 1023K. The calorific value of the fuel used in 43000KJ/Kg. Find the air-fuel (A/F) ratio and the thermal efficiency of the plant. Assume the compression and expansion are isentropic and pressure losses are neglected. **(4.5)**

UNIT-IV

Q8 (a) Explain supersaturated flow in steam nozzles. **(4)**

(b) Find the expression for maximum mass flow per unit area of flow through a convergent-divergent nozzle when steam expands isentropically from rest. **(4)**

(c) Steam expands from 3 bar to 1 bar in a nozzle. The initial velocity is 90m/s and the initial temperature is 150^{0}C. The nozzle efficiency is 0.95. Determine the exit velocity. **(4.5)**

OR

Q9 (a) What are the advantages of steam turbines over steam engines? **(4)**

(b) Explain compounding of steam turbines. **(4.5)**

(c) List the important losses in steam turbines. **(4)**

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