MTRX /III /THT /R-12
29/11/12

Q. P. Code : 27128

Time : 3 hours **Marks : 80**

N.B: (1) Question No.1 is compulsory.

(2) Attempt any three from question No.2 to 6

(3) Use illustrative diagram whenever required.

1. Attempt Any FOUR 20

(a) State 1st law of thermodynamics and write its significance

(b) Explain the principle of operation of impulse turbine.

(c) Differentiate between CI and SI Engine.

(d) Discuss the effect of various parameters on thermal conductivity of solid

(e) State and explain the Wien's displacement law of thermal radiation.

2. (a) State and explain Kelvin-plank and Clausius Statement of second law of thermodynamics 06

(b) Derive an expression of efficiency of the Otto cycle. 08

(c) Derive the expression for maximum Blade efficiency in Parson reaction turbine 06

3. (a) A diesel engine has a compression ratio of 15 and heat addition at constant pressure takes place at 6% of stroke. Find air standard efficiency of the engine.

(Take $\gamma = 1.4$). 07

(b)A wall of furnace is made up of inside layer of silica brick 130mm thick covered with a layer of magnesite brick 250 mm thick. The temp of inside surface of silica brick wall and outside surface of magnesite brick wall are 720 ^{0}C and 100^{0}C respectively. The contact thermal resistance between the two walls at the interface is 0.0045^{0}C/W per unit wall area. If thermal conductivities of silica and magnesite bricks are 1.7 W/m^{0}C and 6.0 W/m^{0}C, calculate.

(i) The rate of heat loss per unit area of walls, and

(ii) The temperature drop at interface. 07

(c) Draw a neat boiling curve for water and marks the different regions.

Explain in brief. 06

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4. (a) Derive general heat conduction equation in Cartesian Co-ordinate and reduce it to all three forms. 10

(b) A working fluid in a steady flow process flow at a rate of 220 kg/min. The fuel rejects 100 kJ/sec passing through the system. The condition of the fluid at the inlet and the outlet are given as V_1 = 320 m/sec, P_1 = 6 bar, U_1 = 2000 kJ/kg, υ_1 = 0.36 m^3/kg and V_2 = 140 m/sec, P_2 = 1.2 bar, U_2 = 1400 kJ/kg and υ_2 = 1.3 m^3/kg. Determine the power capacity of the system in MW

5. (a) Explain with neat sketches any three of the following: 10

i) Lever safety valve

ii) High steam lower safety valve

iii) Blow-off cock

iv) Fusible plug

(b) In a Straight tube of 60 mm diameter, water is flowing at a velocity of 12 m/s. the tube surface temp is maintained at 70° C and the flowing water is heated from the inlet temp 15° C and outlet temp of 45° C. taking physical properties of the water at means bulb temp. calculate:

i) Heat transfer coefficient from the tube surface of the water.

ii) Heat transferred

iii) The length of the tube

The thermo-physical properties of water at 30° C are: ϱ = 995.7 kg/m^3, C_p = 4.174 kJ/kgK. k = 61.718x10^{-2} W/m°C and ν = 0.805x10^{-6} m^2/s, P_r = 5.42

Use relation $N_u = 0.023^* (R_e)^{0.8} (P_r)^{0.4}$ 10

6. (a) Explain the radiation shields in brief. 05

(b) Explain the critical thickness of insulation in case of cylinder 05

(c) Derive an expression for LMTD in case of parallel flow heat exchanger. 10

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