28/11/2018

Paper / Subject Code: 50102 / THERMODYNAMICS & HT

SE/Sem III/MTRX/CBGS/SH 2018

Q. P. Code : 27126

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 the First Law of Thermodynamics and give mathematical Expression of it for a process and for cycle

(b) Give the Comparison between Fire tube and water tube boilers.

(c) Differentiate between two and four Stroke Engine.

(d) State and explain Fourier law of heat conduction.

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

2. (a) Explain the Terms: (i) Heat pump,(ii) Heat engine (iii) Refrigerators 06

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

(c) Differentiate between Impulse and reaction steam turbines. 06

3. (a) In air standard Otto cycles the pressure ratio during the compression is 15.Temperature of air at beginning of compression is 37 ^{0}C and maximum temperature in cycles is 1950 ^{0}C.Determine (a) Compression Ratio (b) Thermal efficiency and (c) Work done. 07

(b) A wall of furnace is made up of inside layer of silica brick 120mm thick covered with a layer of magnesite brick 240 mm thick. The temp of inside surface of silica brick wall and outside surface of magnesite brick wall are 725 ^{0}C and 110^{0}C respectively. The contact thermal resistance between the two walls at the interface is 0.0035^{0}C/W per unit wall area. If thermal conductivities of silica and magnesite bricks are 1.7 W/m^{0}C and 5.8 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

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

(b) Write the steady flow energy equation and apply it to: 10

(i) Compressor

(ii) Turbine

(iii) Boiler

(iv) Nozzle

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

(i) Economizer

(ii) Super heater

(iii) Steam separator

(iv) Steam trap

(b) Air entering at 2 bar pressure and bulk temp of 200° C is heated as it flow through a tube with a diameter of 25.4 mm and velocity of 10 m/s. Calculate heat transfer per unit length of the tube if the constant heat flux condition is maintained at the wall and the wall temp is 20° C above the air temp all along the length of the tube. How much would the bulk temp increases over 3 m length of the tube.
Take the properties if the air as : $\varrho = 1.493$ kg/m^3 ; $\mu = 2.57 \times 10^{-5}$ N-s/m^2 ; k = 0.0386 W/m°C.
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 Mode of heat transfer 05

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

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