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Question Paper Code : 51092

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fourth Semester

Automobile Engineering

AT 2251/AT 41/AT 1251/10122 AU 402/080190007 – APPLIED THERMODYNAMICS AND HEAT TRANSFER

(Regulation 2008/2010)

Time : Three hours   Maximum : 100 marks

Heat transfer, Data books are may be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the assumptions made in air standard cycles.
2. What is the significance of mean effective pressure?
3. What are the uses of compressed air?
4. Define COP.
5. State Fourier law of heat conduction.
6. Discuss the use of Heislers Chart.
7. What is meant by thermal boundary layer?
8. State the significance of Grashoff number.
9. What is meant by irradiation?
10. Differentiate between surface resistance and shape resistance.

PART B — (5 × 16 = 80 marks)

11. (a) Find the air standard efficiencies for the Otto and diesel cycles on the basis of equal compression ratio of 10 and equal heat rejection of 840 kJ/kg. The suction conditions are 1 bar and 328 K.

Or

(b) A gas turbine plant consists of two stage compressor with perfect intercooling and single stage turbine. If the plant works between the temperature limits of 300 K and 1000 K and 1 bar and 16 bar. Find net power of the plant per kg of air.

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12\. (a) A two stage air compressor compresses air from 1 bar and 20°C to 42 bar. If the law of compression is $pv^{1.35} = c$ and the intercooling is complete. find per kg of air

(i) the work done in compressing

(ii) the mass of water necessary for abstracting the heat in the intercooler if the temperature rise of the cooling water is 25°C.

Or

(b) Explain with a neat sketch the working principle of practical vapour absorption refrigeration system.

13\. (a) An aluminium pipe carries steam at 110°C. The pipe (k=185 W/mK) has an inner diameter of 100 mm and outer diameter of 120 mm. The pipe is located in a room where the ambient air temperature is 30°C and the convective heat transfer coefficient between the pipe and air is 15 W/m^2 °C. Determine the heat transfer rate per unit length of pipe. To reduce the heat loss from the pipe, it is covered with a 50 mm thick layer of insulation (k=0.2 W/mK) Determine the heat transfer rate per unit length from the insulated pipe. Assume the convective resistance of the steam is negligible.

Or

(b) A 15 mm diameter mild steel sphere (k=42 W/mK) is exposed to cooling air flow at 20°C resulting in convective coefficient h = 120 W/mK. Determine the time required to cool the sphere from 550°C to 90°C. Also find the total energy transferred from the sphere during the first two minutes.

14\. (a) In a straight tube of 60 mm diameter water is flowing at a velocity of 2 m/s. The tube surface temperature is maintained at 70°C and the flowing water is heated from the inlet temperature 15°C to an outlet temperature of 45°C. Taking the physical properties of water at its mean temperature, calculate

(i) the heat transfer coefficient

(ii) the heat transferred

(iii) the length of the tube.

Or

(b) A vertical cylinder 1.5 m high and 180 mm in diameter is maintained at 100°C in an atmosphere of 20° C. Calculate the heat loss by free convection from the surface of the cylinder.

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15. (a) Determine heat lost by radiation per meter length of 80 mm diameter pipe at 300°C, if

(i) located in a large room with red brick walls at a temperature of 27°C

(ii) enclosed in a 160 mm diameter red brick conduit at a temperature of 21 °C. Take the emissivity of the pipe and brick as 0.79 and 0.93 respectively.

Or

(b) Calculate the net radiant heat exchange per m^2 area for two large parallel plates at temperatures of 427° C and 27° C respectively, The emissivities of the hot and cold plate are 0.9 and 0.6 respectively If a polished aluminium shield of emissivity 0.4 is placed between them, find the percentage reduction in the heat transfer.

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