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Question Paper Code : 21530

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Electronics and Instrumentation Engineering

EI 2254/EI 46/ME 1260/080300011/10133 EI 406 — APPLIED THERMODYNAMICS

(Common to Instrumentation and Control Engineering)

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

(Use of steam tables, refrigeration tables, psychrometric charts and heat and mass transfer tables are permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you understand by path function and point function?

2. State carnot theorem.

3. Sketch the P-V and T-S diagram of otto cycle.

4. What is mean effective pressure?

5. List any four boiler mountings.

6. Distinguish an impulse and reaction turbine.

7. What are the advantages of multi-stage compression?

8. What do you mean by C.O.P of refrigerator? What is the relation between COP of pump and refrigerator?

9. State the Fourier's law of heat conduction?

10. Define shape factor.

PART B — (5 × 16 = 80 marks)

11. (a) A gas undergoes a thermodynamic cycle consisting of the following processes :

(i) Process 1 – 2 : constant pressure with p = 1.4 bar to V_1 = 0.028 m^3, W_{12} = 690 kJ.

(ii) Process 2 – 3 : compression with pV = constant, $W_{23} = 0$, $U_3 = U_2$.

(iii) Process 3 – 1 : constant volume $U_1 - U_3 = -26.4$ kJ. There are no significant changes in KE and PE.

(1) Sketch the cycle on a p-v diagram

(2) Calculate the net work for the cycle in kJ.

(3) Calculate the heat transfer for process 1-2.

(4) Show that $\Sigma Q_{cycle} = \Sigma W_{cycle}$.

Or

(b) What is a steady flow process? Derive the steady flow Energy Equation.

12. (a) In a dual cycle compression cycle the maximum pressure is 56 bar. At the beginning of compression the pressure and temperature is 198 bar and 28.6°C respectively. The compression ratio is 14 and heat supplied to the cycle is 1265 KJ/Kg. Find the cut off ratio, the expansion ratio and the efficiency.

Or

(b) With the neat sketches, explain the working principle of four stroke petrol engine.

13. (a) The steam at 15 bar and 300°C is supplied to an engine working on Rankine cycle. The exhaust takes place at 0.8 bar. Calculate

(i) the condition of steam after isentropic expansion,

(ii) Rankine cycle efficiency,

(iii) mean effective pressure,

(iv) the ideal steam consumption per kw hour.

Or

(b) Describe the working principle of a steam power plant with a neat layout.

14. (a) Explain the construction and working of centrifugal compressor.

Or

(b) What is air conditioning? Discuss in detail the types of Air conditioning systems.

15. (a) A steel pipe Line (k = 50 W/m/k) of inner diameter 100mm and outer diameter 110 mm is to be covered with two layers of insulation each having a thickness of 50 mm. the thermal conductivity of the first insulation material is 0.12 W/m/k. Calculate the heat loss per meter length of pipe and the interface temperature between the two layers of insulation when the temperature of the inside surface is 250°C and that of the outside surface of insulation is 50°C.

Or

(b) Calculate the convective heat loss from a radiator 0.5 m wide and 1 m high maintained at a temperature of 84 °C in a room at 20 °C. Treat the radiator as vertical plate.
