E 109

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2003.

Third Semester

Chemical Engineering

(Common to Textile Technology and Leather Technology)

CH 234 — MECHANICAL ENGINEERING

Time : Three hours Maximum : 100 marks

Use of steam tables and Mollier charts are permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the limitations of the first law of thermodynamics?

2. Define Entropy.

3. State the expression for work done in the adiabatic process.

4. How will you classify Internal Combustion Engines?

5. Draw the p–v and T–s diagram for diesel cycle.

6. What do you understand by latent heat of evaporation?

7. Differentiate impulse and reaction turbine.

8. What is meant by kinematic chain?

9. What is the function of a flywheel?

10. State the expression for length of belt in (a) open and (b) crossed belt drives.

PART B — (5 × 16 = 80 marks)

11. A gas mixture obeying perfect gas law has a molecular mass of 26.7. The gas mixture is compressed to a compression ratio of 12 according to the law $PV^{1.25}$ = Const, from initial conditions of 0.9 bar and 333 K. Assuming a mean molar specific heat at const Volume of 21.1 kJ/kg–K, find, per kg of mass, the work done and heat flow across the cylinder walls. For the above gas, determine the value of characteristic gas constant, molar specific heat at a constant pressure and ratio of specific heats.

12. (a) Derive the expression for change in entropy during constant volume and constant pressure processes.

Or

(b) A perfect gas is compressed according to the law $PV^{1.25}$ = constant from an initial pressure of 1 bar and volume of 0.9 m^3 to a final volume of 0.6 m^3. Determine the final pressure and change of entropy per kg of gas during the process. Take γ = 1.4 and R = 287 J/kg–K.

13. (a) Explain the isothermal process with suitable sketches.

Or

(b) A certain quantity of air at a pressure of 1 bar and temperature 70°C is compressed reversibly and adiabatically until the pressure is 7 bar in an Otto cycle engine. 460 kJ of heat per kg of air is now added at constant volume. Determine (i) compression ratio of the engine (ii) temperature at the end of compression and (iii) temperature at the end of heat addition. Take for air, c_p = 1 kJ/kg–K and c_v = 0.707 kJ/kg–K.

14. (a) Explain with a neat sketch the working of two stroke cycle diesel engine.

Or

(b) Derive the expression for Rankine efficiency.

15. (a) Derive the expression for power developed by a simple steam engine.

Or

(b) The turning moment diagram for a petrol engine is drawn to the following scales : turning moment 1 mm = 5 N–m; crank angle 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order, are 295 mm^2, 685 mm^2, 40 mm^2, 340 mm^2, 960 mm^2, 270 mm^2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the co–efficient of fluctuation of speed when the engine runs at 1800 rpm.

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