A 200

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Chemical Engineering

CH 234 — MECHANICAL ENGINEERING

(Common to Textile and Leather Technology)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. With examples define Intensive and Extensive Properties.

2. Define available energy and un-available energy.

3. A mixture of gas expands at constant pressure of 1 Mpa from 0.03 m^3 to 0.06^3 with 84 KJ positive heat transfer. There is not work other than that on the piston, find ΔE for the gaseous mixture.

4. Express Otto cycle on P-V and T-S diagrams.

5. Distinguish between B-P and I-P.

6. What is meant by total heat of super heated steam?

7. How reciprocatory motion in an engine is converted into rotary motion?

8. What is the function of flywheel in an engine?

9. Calculate the length of the belt of a cross belt transmission system of pulley diameter 0.5 mtr and 0.2 mtr and the distance between shafts being 1 mtr.

10. Two masses of 5 Kg each rotate in a plane at 120° apart their rotating arms being equal in length. Balance the system suitably.

PART B — (5 × 16 = 80 marks)

11. (i) State Kelvin Plank statement and clausius statement of second law of thermodynamics. (4)

(ii) A gas initially at 5 bar pressure and 2 m^3 in volume undergoes an isentropic process to final condition of 2 bar pressure and 4 m^3 in volume. The decrease in enthalpy during the process is 520 KJ. Find C_p, R and ΔU for the given gas. Take C_v = 3.15 kJ/Kg K. (12)

12. (a) One Kg of air is compressed in a reversible steady flow process from 1.03 bar to 10.3 bar polytropically which follows the law $pv^{1.25} = C$. The initial temp of air is 40° C. Find work done, heat transfer change in enthalpy during the process. Assume $\Delta KE = 0$ and $\Delta PE = 0$. (16)

Or

(b) (i) An engine 20 cm bore and 30 cm stroke works on Otto cycle. The clearance volume is 1600 CC. The initial pressure and temperature are 1 bar and 60° C. If the maximum pressure is limited to 24 bar, find the Air std. efficiency of the cycle. (8)

(ii) Why air standard analysis has been adjudged for IC engines? State the assumptions made in the Air standard cycles. (8)

13. (a) One kg of steam at 10 bar exist at the following conditions

(i) Wet and 0.8 dry

(ii) Dry and saturated

(iii) At a temperature of 199.9° C.

Determine the enthalpy, specific volume, density internal energy and entropy in each case. Take Cps = 2.25 KJ/Kg. (16)

Or

(b) The enthalpy of steam supplied to a turbine of a power plant is 3200 KJ/Kg and enthalpy of steam entering the turbine is 2500 KJ/kg. If the temperature of the saturated condensate is 50° C, find

(i) Rankine efficiency and specific steam consumption

(ii) If the highest temperature of the system supplied in the above power plant is 400° C, what would be the maximum possible efficiency of the plant?

(iii) If the mass flow rate of steam in the above power plant is 1 Kg/sec, find, power developed by the turbine, heat transfer in the condenser and heat supplied to the boiler. (16)

14. (a) (i) What is known as 'slip of belt' and 'creep of belt'? (4)

(ii) A machine weighing 9 kN hangs freely from a rope which makes 2.5 turns round a drum of 300 mm diameter revolving at 20 rpm. The other end of the belt is pulled by a man. The coefficient of friction is 0.25 . Determine,

(1) force required by the man and

(2) the power required to raise the machine. (12)

Or

(b) Write short note on :

(i) Kinematic chain

(ii) Mechanism

(iii) Centrifugal tension

(iv) Flywheel. (4 × 4 = 16)

15. (a) A steam engine developed 300 K at 90 rpm. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and speed is to be kept within 0.5% of the mean speed. Find the mass of the flywheel required if the radius of gyration in 2 mtrs. (16)

Or

(b) Write short note on :

(i) Turning moment diagram

(ii) Condition for maximum power transmitted in the belt

(iii) Types of gear train

(iv) Balancing of rotating masses. (4 × 4 = 16)
