

D 054

B.E./B.TECH. DEGREE EXAMINATION, APRIL/MAY 2008

Third Semester

Chemical Engineering

CE 234 - MECHANICAL ENGINEERING

(Common to Textile Technology and Leather Technology)

Time : Three hours

Maximum : 100 marks

(Use of Steam tables and Mollier charts are permitted)

Answer ALL questions.

PART A --- (10 × 2 = 20 marks)

1. State Kelvin Planck's and Clausius statement of second law of thermodynamics.
2. Draw the $p-v$ diagram of an ideal otto cycle clearly indicating the various processes.
3. Define displacement volume and compression ratio.
4. What do you understand by latent heat and dryness fraction?
5. Find the saturation temperature, the changes in specific volume and entropy during evaporation and latent heat of vapourisation of steam at 1 MPa.
6. What are impulse and reaction turbines?
7. What is a kinematic link and a kinematic pair?
8. Draw the turning moment diagram of a single cylinder double acting steam engine.
9. Explain the terms slip and creep as applied to belt drives.
10. What do you understand by static and dynamic balance?

PART B --- (5 × 16 = 80 marks)

11. A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle the sum of all heat transfers is -170 kJ. The system completes 100 cycles per min. Complete the following table showing the method for each item and compute the net rate of work output in kW.

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
$a - b$	0	2170	---
$b - c$	21000	0	---
$c - d$	-2100	---	-36600
$d - a$	---	---	---

12. (a) Write down the steady flow energy equation clearly indicating the various terms. In a steam power station steam flows steadily through a 0.2 m diameter pipeline from the boiler to the turbine. At the boiler end the steam conditions are $p = 4$ MPa, $T = 673$ K, $h = 3213.6$ kJ/kg and $v = 0.073$ m³/kg. At the turbine end the conditions are $p = 3.5$ MPa, $T = 665$ K, $h = 3202.6$ kJ/kg and $v = 0.084$ m³/kg. There is a heat loss of 8.5 kJ/kg from the pipeline. Calculate the steam flow rate.

Or

- (b) In a S.I. engine working on the ideal otto cycle the compression ratio is 5.5. The pressure and temperature at the beginning of the compression are 1 bar and 300 K respectively. The peak pressure is 30 bar. Determine the pressure and temperatures at salient points, the air standard efficiency and mean effective pressure. Assume ratio of specific heats to be 1.4 for air.
13. (a) Explain the principle of operation of a four stroke compression ignition engine with a neat sketch.

Or

- (b) Discuss the working principle of a steam engine with a neat sketch.

14. (a) Sketch and describe the four bar chain mechanism. Why it is considered to be the basic chain? Mention three practical applications of a four bar chain.

Or

- (b) A riveting machine is driven by a constant torque 3 kW motor. The moving parts including the flywheel are equivalent to 150 kg at 0.6 m radius. One riveting operation takes 1 second and absorbs 10000 joules of energy. The speed of the flywheel is 300 rpm before riveting. Find the number of rivets that can be closed per hour and the reduction in speed after the riveting operation is over.
15. (a) Obtain an expression for the length of a belt in an open belt drive.

Or

- (b) Explain the method of balancing of different masses rotating in different planes.