

- 3 A 360° hydrodynamic journal bearing operates at 1200 rpm and carries a load of 5.5 k N. The journal diameter is 55 mm and length is 55 mm. The bearing is lubricated with SAE 20 oil and the operating temperature of oil is 79°C . Assume radial clearance as 0.025 mm and the attitude angle as 60° . Determine: (i) bearing pressure, (ii) Attitude, (iii) minimum film thickness, (iv) heat generated, (v) heat dissipated, if the ambient temperature is 25°C , and (vi) amount of artificial cooling if necessary. (15)

PART B

Answer any two full questions, each carries 15 marks.

- 4 A motor shaft rotating at 1440 rpm has to transmit 15 kW power to a low speed shaft running at 500 rpm. A 20° pressure angle full depth involute system of gear tooth is used. The pinion has 25 teeth. Both gear and pinion are made of cast iron having allowable static strength of 55 MPa. Design a suitable spur gear drive and check the design for dynamic load and wear. (15)
- 5 a) State and explain law of gearing with a neat sketch. (7)
b) Give an account on different modes of failure of gear tooth. (4)
c) Explain why dynamic factors need to be considered in the design of gears. (4)
- 6 A helical gear speed reducer is to be designed. The rated power of the speed reducer is 75 kW at a pinion speed of 1200 rpm. The speed ratio is 3:1. For medium shock conditions and 24 hr operation, design the gear pair. The teeth are 20° full depth involute in the normal plane and helix angle is 30° . (15)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Design a connecting rod of I cross section for an IC engine running at 1800 rpm and developing a maximum pressure of 3.15 N/mm^2 . The diameter of the piston is 100 mm, mass of the reciprocating parts per cylinder is 2.25 kg, length of the connecting rod is 380 mm, stroke of the piston is 190 mm and compression ratio is 6:1. Take a factor of safety of 6 for the design. The maximum allowable bearing pressure at big end and the small end are respectively 10 N/mm^2 and 15 N/mm^2 . The density of material of the rod may be taken as 8000 kg/m^3 and allowable stress in the bolts as 85 N/mm^2 and in the cap as 80 N/mm^2 . (16)
b) Explain why I section is usually preferred in the case of a connecting rod? (4)

- 8 a) Explain the main functions of the piston in an internal combustion engine? (4)
- b) Make out a systematic classification of pressure vessels and discuss the role of statutory regulations. (4)
- c) A seamless cylinder with a storage capacity of 0.025 m^3 is subjected to an internal pressure of 8 MPa. The length of the cylinder is twice its internal diameter. The cylinder is made of plain carbon steel 20C8. (Ultimate stress is 380 MPa and Factor of safety is 2.5) Determine the dimensions of the cylinder. (12)
- 9 a) Enumerate the various types of flat belt drives. (3)
- b) Explain galling of Roller chains. (3)
- c) Design a flat belt drive for a compressor running at 670 rpm, which is driven by a 25 kW, 1340 rpm motor. Space is available for a centre distance of 3 m. The belt is open type. (14)
