

highly loaded bearing for an operating life of 5 years during which the bearing operates for 30 % of the time at 1800 rpm.

- b) Explain the step by step design procedure for piston in IC Engine. **07**
- Q-4** **Attempt all questions** **(14)**
- a) Explain Wedge film lubrication in detail with neat sketch. **06**
- b) A pair of helical gears consisting of 30 teeth on pinion and 120 teeth on gears, is used to transmit power from the pinion rotating at 750 rpm. The normal module is 5 mm and face width is 60 mm. The gears are made of carbon steel having a ultimate stress of 600 MPa, and heat treated to a surface hardness of 250 BHN. Assuming a service factor of 1.5 and wear factor $K = 0.156 [\text{BHN}/100]^2$, find the power transmitting capacity of gears. Assume the helix angle of 30° . Take $K_v = 4.5 / (4.5 + V)$ and FOS of 3. **08**
- Q-5** **Attempt all questions** **(14)**
- a) A Pair of bevel gears are used for 90° shaft, to transmit 12.5 kw at 1500 rpm. The module is 5 mm. the pinion and gear; both are made of steel, having allowable static stress of 210 MPa and have surface hardness of 240 BHN. It has surface endurance limit of 620 MPa. The pinion has 30 teeth and the gear has 90 teeth, with 20° full depth involute profile. The gears are cut carefully. The gear drive is used for 8 hours per day with a steady load condition. Assuming face width as 03 times the pitch cone distance, determine, **10**
- (i) Magnitude of induced bending stress.
(ii) Magnitude of dynamic tooth load.
(iii) Magnitude of wear load
- b) State the limitation of Lewis equation for gear design? **04**
- Q-6** **Attempt all questions** **(14)**
- a) Determine the thickness of cylinder, cylinder head, number of bolts, size of bolt and pitch of bolt for a 4-stroke diesel engine cylinder of 250 mm bore and allowable stress of 42 MPa. Take maximum explosion pressure of 3 N/mm^2 . Take $\sigma_t = 65 \text{ MPa}$ for Ni-steel bolts. Also find outer diameter of cylinder flange. **07**
- b) Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **07**
- Q-7** **Attempt all questions** **(14)**
- a) Explain important factors to be considered in the selection of bearing material in detail? **04**
- b) Write a short note on Thermal Considerations in worm gear? **04**
- c) Sketch a valve gear mechanism of an internal combustion engine and label its various parts. **06**
- Q-8** **Attempt all questions** **(14)**
- a) Sketch and explain the various stresses induced in the crankshaft. **07**
- b) Explain with neat sketch generation of Involute and Cycloidal tooth profile? **04**
- c) Why worm gear always governs the design in worm gear pair? **03**

