JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, November/December - 2020
DESIGN OF MACHINE MEMBERS - II
(Mechanical Engineering)

Time: 2 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks
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1.a) Explain different types of sliding contact bearings with neat sketches.
 b) Explain the factors which are essential for the formation of a thick film of oil in hydrodynamic lubricated bearings. [7+8]

2. Design a journal bearing for a centrifugal pump from the following data:
Load on the journal = 20 000 N; Speed of the journal = 900 r.p.m; Type of oil is SAE 10, for which the absolute viscosity at 55^0C = 0.017 kg / m-s; Ambient temperature of oil = 15.5^{0}C; Maximum bearing pressure for the pump = 1.5 N /mm^2. [15]

3. The rolling contact ball bearing is to be selected to support the overhung countershaft. The shaft speed is 720 r.p.m. The bearings are to have 99% reliability corresponding to a life of 24 000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability. [15]

4. A single-row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 1200 rpm. The expected life L_{10h} of the bearing is 20000 h. The minimum acceptable diameter of the shaft is 75 mm. Select a suitable ball bearing for this application. [15]

5. Design a cast iron piston for a single acting four stroke engine for the following data:
Cylinder bore = 100 mm; Stroke = 125 mm; Maximum gas pressure = 5 N/mm^2; Indicated mean effective pressure = 0.75 N/mm^2; Mechanical efficiency = 80%; Fuel consumption = 0.15 kg per brake power per hour; Higher calorific value of fuel = 42 × 10^3 kJ/kg; Speed = 2000 r.p.m. Any other data required for the design may be assumed. [15]

6.a) Discuss the design of connecting rod for an internal combustion engine.
 b) Explain the various stresses induced in the connecting rod. [9+6]

7. It is required to design a helical compression spring subjected to a force of 500 N. The deflection of the spring corresponding to this force is approximately 20 mm. The spring index should be 6. The spring is made of cold-drawn steel wire with ultimate tensile strength of 1000 N/mm^2. The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength (G = 81 370 N/mm^2). Design the spring and calculate: (a) wire diameter; (b) mean coil diameter; (c) number of active coils; (d) total number of coils; (e) free length of the spring; and (f) pitch of the coils. [3+3+3+2+2+2]

8. A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20^0, while the helix angle is 25^0. The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 4OC8 (S_{ut} = 600 N/mm^2) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. [15]

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