



Regulation R18

Subject code: 2P6CA

**TKR COLLEGE OF ENGINEERING AND TECHNOLOGY**  
(Autonomous, Accredited by NAAC with 'A' Grade)

**B. Tech VI Semester Supplementary Examinations, June/July 2023**

**DESIGN OF MACHINE MEMBERS-II**  
(MECHANICAL ENGINEERING)

Maximum Marks: 70

Date:24.06.2023 Duration: 3 hours

- Note: 1.This question paper contains two parts A and B.  
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.  
3. Part B consists of 5 Units. Answer any one full question from each unit.  
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

**DATA BOOKS ARE ALLOWED**

**Part-A**

All the following questions carry equal marks

(10x2M=20 Marks)

1. What is meant by hydrodynamic lubrication?
2. State any four desirable properties of a good bearing material.
3. Where do you use self-aligning ball bearings and spherical roller bearings?
4. Why are taper roller bearings used in pairs?
5. Discuss the forces that act on the piston head of an internal combustion engine
6. What are the methods and materials used in the manufacture of crankshafts?
7. What are the advantages and disadvantages of V-belt drive over flat belt drive?
8. How do you classify springs and name them.
9. Write a shot note on pitting?
10. Why is the pinion weaker than the gear made of same material?

**Part-B**

Answer All the following questions.

(10M X 5=50Marks)

- 11 The following data is given for a full hydrodynamic bearing used for electric motor: radial load = 1200 N journal speed = 1440 rpm journal diameter = 50 mm static load on the bearing = 350 N. The values of surface roughness (cla) of the journal and the bearing are 2 and 1 micron respectively. The minimum oil film thickness should be five times the sum of surface roughness of the journal and the bearings. Determine (i) length of the bearing; (ii) radial clearance; (iii) minimum oil film thickness; (iv) viscosity of lubricant; and (v) flow of lubricant. Select a suitable oil for this application assuming the operating temperature as 65°C. 10
- OR
- 12 Design a journal bearing for a centrifugal pump with the following data: Diameter of the journal = 150mm Load on bearing = 40KN Speed of journal = 900rpm. 10
- 13 A ball bearing subjected to a radial load of 8000N is expected to have a satisfactory life of 8000 hours at 2450r.p.m with a reliability of 97%.Calculate the dynamic load capacity of the bearing 10

OR

- 14 The rolling contact ball bearings are 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 24000 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 manufacture's catalogue, specified at 90% reliability. 10
- 15 Design a connecting rod for an I.C. engine running at 1800 r.p.m and developing a maximum pressure of 3.15 N/mm<sup>2</sup>. The diameter of the piston is 100 mm; mass of the reciprocating parts per cylinder 2.25 kg; length of connecting rod 380 mm; stroke of piston 190 mm and compression ratio 6:1. Take a factor of safety of 6 for the design. Take length to diameter ratio for big end bearing as 1.3 and small end bearing as 2 and the corresponding bearing pressures as 10 N/mm<sup>2</sup> and 15 N/mm<sup>2</sup>. The density of material of the rod may be taken as 8000 kg/m<sup>3</sup> and the allowable stress in the bolts as 60 N/mm<sup>2</sup> and in cap as 80 N/mm<sup>2</sup>. The rod is to be of I-section for which you can choose your own proportions.. Use Rankine formula for which the numerator constant may be taken as 320 N/mm<sup>2</sup> and the denominator 1/7500. 10
- OR
- 16 Write the design procedure of Piston and connecting rod. 10
- 17 The spring loaded safety valve for a boiler is required to blow off at a pressure of 10 kg/sq cm. The diameter of the valve is 6 cm, and the maximum lift of the valve is 1.5 cm. Design the suitable compression spring for the safety valve assuming the spring index to be 6 and providing initial compression of 3 cm. The maximum shear stress in the material of the wire is limited to 4,500 kg/sq cm.  $G = 0.84 \times 10 \text{ Kg/Sq cm}$ . 10
- OR
- 18 Design a belt drive pulley for transmitting 15 kW at 280 rpm. The velocity of the belt is not to exceed 10 m/s, and the maximum tension is not to exceed 15 N/mm width. The tension on the slack is one half of that on the tight side. Determine: a. Width of the pulley b. Diameter of the pulley. 10
- 19 The following particulars of a single reduction spur gear are given, Gear ratio=10:1; Distance between centers = 660 mm approximately; pinion transmits 500 kW at 1800 rpm; Involute teeth of standard proportions (addendum=1 m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find: i. The nearest standard module if no interference is to occur. ii. The number of teeth on wheel; iii. The necessary width of pinion iv. The load on the bearings of the wheels due to power transmitted 10
- OR
- 20 A helical cast steel gear with 30° helix angle has to transmit 35 kW at 1500 r.p.m. If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as  $0.154 - 0.912/T_E$  where  $T_E$  represents the equivalent number of teeth. 10