



Regulation R18

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

Subject code: 2P6CA

B.Tech VI Semester Supplementary Examinations, January 2023
DESIGN OF MACHINE MEMBERS-II
MECHANICAL ENGINEERING

Maximum Marks: 70

10-01-2023

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.

Note: DESIGN DATA BOOK ALLOWED

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 What is equivalent static load and equivalent dynamic load?
- 2 Explain wedge film and squeeze film journal bearings
- 3 What is a piston slap?
- 4 Why ball and roller bearings are called 'antifriction' bearings?
- 5 What are the methods and materials used in the manufacture of piston.
- 6 Write a short note on piston rings.
- 7 What are the important applications of springs
- 8 Write about velocity ratio of belt drive.
- 9 What is the minimum number of teeth on spur gear? Why?
- 10 Why the radial component of gear tooth force is called 'separating' component?

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 a) Derive the expression for finding the life of the bearing subjected to variable loading. 5
b) A 3 kN load is supported by a journal bearing of 75 mm diameter and 75 mm length. Diametric clearance 0.05 mm and bearing is lubricated by the oil of 0.0207 paS viscosity at operating temperature. Determine the maximum speed of rotation of bearing when it is capable of dissipating 80 watts by heat transfer. 5

OR

- 12 A 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0.05 mm and the viscosity of the oil is 0.021 kg/ms at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the maximum safe speed 10
- 13 A 306 radial ball bearing with inner ring rotation as 8s work cycle as follows Radial force 3KN, Axial load 2KN Speed 1200rp Under steady load conditions the basic dynamic load capacity of the bearing is 24.25KN. Determine the expected average life of this bearing. Take $X=0.56$ and $Y=1.43$. 10

OR

- 14 Design a self-aligning ball bearings for a radial load of 7000 N and a thrust load of 2100 N. the desired of the bearing is 160 millions of revolutions at 300r.p.m. Assume uniform and steady load. 10
- 15 The following data is given for the piston of a four-stroke diesel engine: Cylinder bore = 250 mm Maximum gas pressure = 4 MPa Allowable bearing pressure for skirt = 0.4 MPa Ratio of side thrust on liner to maximum gas load on piston = 0.1 Width of top land = 45 mm Width of ring grooves = 6 mm Total number of piston rings = 4 Axial thickness of piston rings = 7 mm Calculate: (i) length of the skirt; and (ii) length of the piston. 10

OR

- 16 The following data is given for the piston of a four-stroke diesel engine: Cylinder bore = 250 mm Maximum gas pressure = 4 MPa Bearing pressure at small end of connecting rod = 15 MPa Length of piston pin in bush of small end = $0.45D$ Ratio of inner to outer diameter of piston pin = 0.6 Mean diameter of piston boss = $1.4 Y$ outer diameter of piston pin Allowable bending stress for piston pin = 84 N/mm^2 Calculate: (i) outer diameter of the piston pin; (ii) inner diameter of the piston pin; (iii) mean diameter of the piston boss; and (iv) check the design for bending stresses. 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 A V-belt drive system transmits 100 kW at 475r.p.m. the belt has a mass of 0.6kg/m. The maximum permissible tension in the belt is 900N. The groove angle is 38° and the angle of contact is 160° . Find minimum number of belts and pulley diameter. The coefficient of friction between belt and pulley is 0.2 10
- 19 A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength 10

OR

- 20 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° , while the helix angle is 25° . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 ($S_{ut} = 600 \text{ N/mm}^2$) 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. 10