Regulation R18 Subject code: 2P6CA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech VI Semester Supplementary Examinations, February 2024

DESIGN OF MACHINE MEMBERS-II

(MECHANICAL ENGINEERING)

Maximum Marks: 70 Date:17.02.2024 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.
Design data book is allowed for examination

Part-A

All the following questions carry equal marks (10X2M=20 Marks)			CO	Bloom Tx
1.	What is meant by hydrodynamic lubrication?	2	1	Remembering
2.	State any four desirable properties of a good bearing material.	2	1	Remembering
3.	Where do you use self-aligning ball bearings and spherical roller bearings?	2	2	Understanding
4.	Why are taper roller bearings used in pairs?	2	2	Understanding
5.	Discuss the forces that act on the piston head of an internal combustion engine	2	3	Understanding
6.	What are the methods and materials used in the manufacture of crankshafts?	2	3	Remembering
7.	What are the advantages and disadvantages of V-belt drive over flat belt drive?	2	4	Analyze
8.	How do you classify springs and name them.	2	4	Understanding
9.	Write a shot note on Law of gearing?	2	5	Understanding
10.	Why is the pinion weaker than the gear made of same material?	2	5	Remembering

Part-B

Answer All the following questions. (5X10M=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 fi lm 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	1	Evaluate

	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	1	Create
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	2	Evaluate
	OR			
14	The rolling contact ball bearings are to be selected to support the overhung countershaft. The shaft speed is 720r.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 1kN. 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	2	Evaluate
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/mm2. The diameter of the piston is 100 mm; mass of the reciprocating parts per cylinder 2.25kg; 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 10N/mm2 and 15 N/mm2. The density of material of the rod may be taken as 8000kg/m3 and the allowable stress in the bolts as 60 N/mm2 and in cap as 80 N/mm2. 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/mm2 and the denominator 1/7500.	10	3	Create
	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/mm2 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	3	Evaluate
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	10	4	Evaluate

	stress in the material of the wire is limited to 4,500 kg/sq cm. G = 0·84 x 10 Kg/Sq cm.			
	OR			
18	Design a belt drive pulley for transmitting 15kW at 280 rpm. The velocity of the belt is not to exceed 10m/s, and the maximum tension is not to exceed 15N/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	4	Evaluate
19	The following particulars of a single reduction spur gear are given, Gear ratio=10:1; Distance between centers =660mm approximately; pinion transmits 500kw at 1800rpm; Involutes teeth of standard proportions (addendum=1m) with pressure angle of 22.50; Permissible normal pressure between teeth =175N 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	5	Evaluate
	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	5	Analysis