



R20 Regulation

Subject code:3P6CA

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech VI Semester Supplementary Examinations, December 2024

DESIGN OF MACHINE MEMBERS -II

(ME)

Maximum Marks: 70

Date:10.01.2025

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 which carries 10M.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

DESIGN DATA BOOK IS ALLOWED

Part-A

All the following questions carry equal marks (10X2M=20) Marks)		CO	Bloom Tx
1	Write short note on classifications and different types of antifriction bearings	1	L1
2	Define Basic static load rating in rolling contact bearings	1	L1
3	At what angle of the crank the twisting moment is maximum in the crank shaft?	2	L1
4	State the function of the rings for an IC engine piston.	2	L1
5	What are the uses and construction of wire ropes. How is wire rope ends fastened?	3	L1
6	Write the relation for the ratio of driving tensions of a V-belt.	3	L1
7	What are the advantages and disadvantages of V-belt drive over flat belt drive?	4	L1
8	Write design procedure for spur gears?	4	L1
9	Write equation for formative number of teeth in helical gears?	5	L1
10	Why is the pinion weaker than the gear made of same material?	5	L1

Part-B

Answer All the following questions. (5X10M=50Marks)		CO	Bloom Tx
11	A 150mm diameter shaft supporting a load of 10KN has a speed of 1500rpm. The shaft run in whose bearing length is 1.5 times the shaft diameter. If the diametric clearance of bearing is 0.15mm and the absolute viscosity of the oil at the operating temperature is 0.011 Kg/m-s. Find the power wasted in friction. [10M]	1	L2
OR			
12	A full journal bearing of 50mm diameter and 100mm long has a bearing pressure of 1.4N/mm ² . The speed of the journal is 900rpm and the ratio of journal diameter to the diametric clearance is 1000. The bearing is lubricated with oil, whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 350C. Find, (1)The amount of artificial cooling required. (2)The mass of lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of oil as 1850J/Kg/0C. [10M]	1	L2

13	Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 r.p.m. for an average life of 5 years at 10 hours per day. Assume uniform and steady load. [10M]	2	L2
	OR		
14	The rolling contact ball bearing 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 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. [10M]	2	L2
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^2 . 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 10 N/mm^2 and 15 N/mm^2 . The density of material of the rod may be taken as 8000 kg/m^3 and the allowable stress in the bolts as 60 N/mm^2 and in cap as 80 N/mm^2 . 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^2 and the denominator $1/7500$. [10M]	3	L2
	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. [10M]	3	L2
17	A pump is driven by an electric motor through a open type flat belt drive. Determine the belt specifications for the following 10 4 L3 Page 10 of 12 data. Motor pulley diameter(d_s) = 300 mm, Pump pulley diameter(d_L) = 600 mm Coefficient of friction (μ_s) for motor pulley = 0.25 Coefficient of friction (μ_L) for pump pulley = 0.20 Center distance between the pulleys=1000 mm; Rotational speed of the motor=1440 rpm; Power transmission = 20kW; density of belt material (ρ)= 1000 kg/m^3 ; allowable stress for the belt material (σ) = 2 MPa; thickness of the belt = 5mm. [10M]	4	L2
	OR		

18	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. $G = 0.84 \times 10 \text{ Kg/Sq cm}$. [10M]	4	L2
19	A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth has 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4. [10M]	5	L2
OR			
20	A pair of 20° full depth involute teeth bevel gears connect two shafts at right angles having velocity ratio 3 : 1. The gear is made of cast steel having allowable static stress as 70 MPa and the pinion is of steel with allowable static stress as 100 MPa. The pinion transmits 37.5 kW at 750 r.p.m. Determine : 1. Module and face width; 2. Pitch diameters; and 3. Pinion shaft diameter. Assume tooth form factor, $y = 0.154 - 0.912$, where T is the formative number of teeth, width = 1/3 rd the length [10M]	5	L2

