Reg. No.												

Question Paper Code	12440

B.E./B.Tech - DEGREE EXAMINATIONS, NOV / DEC 2023

Fifth Semester

Mechanical Engineering

20MEPC504 - DESIGN OF MACHINE ELEMENTS

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Briefly explain what is adaptive design?	*2,K1,CO1*
2.	Compare hole-basis system over the shaft-basis system?	*2,K1,CO1*
3.	State some advantages of hollow shafts over solid shafts.	*2,K2,CO2*
4.	Differentiate between shaft and axle?	*2,K2,CO2*
5.	State the disadvantages of welded joints.	*2,K1,CO3*
6.	Why throat is considered while calculating stresses in fillet welds?	*2,K1,CO3*
7.	What are active and inactive coils?	*2,K1,CO4*
8.	State the functions of flywheel.	*2,K2,CO4*
9.	What is meant by square journal bearing?	*2,K2,CO5*
10.	Define the term reliability of a bearing.	*2,K2,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) A Shaft is loaded as shown in Figure 1. Determine the stresses at point A & B. *13,K2,CO1*

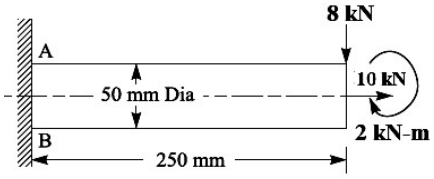

Figure 1

OR

b) A Wall bracket as shown in Figure 2 is subjected to a pull of 4 kN at 60° to the vertical. The cross-section of the bracket is rectangular having "b = 4t". Determine the dimensions if the maximum permissible stress induced in the bracket is limited to 30MPa. *13,K2,CO1*

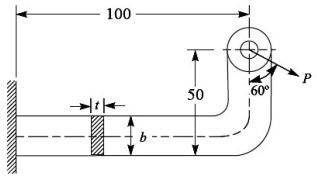

Figure 2

12. a) The shaft, as shown in Figure 3, is driven by pulley B from an electric motor. Another belt drive from pulley A is running a compressor. The belt tensions for pulley A is 1500 N and 600 N. The ratio of belt tensions for pulley B is 3.5. The diameter of pulley A is 150 mm and the diameter of pulley B is 480 mm. The allowable tensile stress for the shaft material is 170 MPa and the allowable shear stress is 85 MPa. Taking torsion and bending factors as 1.25 and 1.75 respectively, find the shaft diameter. Also find out the dimensions for a hollow shaft with outside diameter limited to 30 mm. *13,K3,CO2*

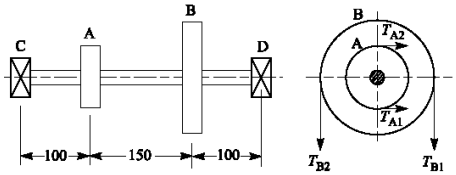

Figure 3

OR

b) Design a muff coupling to connect two steel shafts transmitting 25kW power at 360 rpm. The shafts and keys are made of plain carbon steel with a yield stress of 400 N/mm^2. The sleeve is made of grey cast iron FG 200. The factor of safety for the shafts and key is 4. For sleeve, the factor of safety is 6 based on ultimate strength. *13,K3,CO2*

13. a) Determine the size of the weld for the eccentrically loaded member as shown in Figure 4 for steady and alternating load if the permissible shear stress is 80 N/mm^2. *13,K3,CO3*

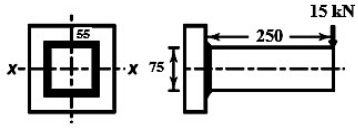

Figure 4

OR

b) Design a Knuckle joint to connect two circular rods subjected to an axial tensile force of 50kN.Select a suitable material with a factor of safety of 4. *13,K3,CO3*

14. a) Design a helical spring for a spring loaded safety valve for the following conditions: Operating pressure = 1 N/mm^2; Maximum pressure when the valve blows off freely = 1.075 N/mm^2; Maximum *13,K4,CO4*

lift of the valve when the pressure is 1.075 N/mm^2 = 6 mm; Diameter of valve seat = 100 mm; Maximum shear stress = 400 MPa; Modulus of rigidity = 86 kN/mm^2; Spring index = 5.5.

OR

b) Design a leaf spring for the following specifications: Total load = 160 kN; Number of springs supporting the load = 4; Maximum number of leaves = 10; Span of the spring = 1000 mm; Permissible deflection = 100 mm. Take Young's modulus, E = 200 kN/mm^2 and allowable stress in spring material as 550 MPa. Design for both conditions (i) With initial stress (ii) No initial stress. *13,K4,CO4*

15. a) A Journal Bearing is to be designed for a centrifugal pump for the following data: *13,K4,CO5*
Load on the Journal = 12 kN; Diameter of the Journal = 75mm; Speed = 1440 rpm; Atmospheric temperature of the oil = 16°C; Operating temperature of the oil = 60°C; Absolute viscosity of oil at 60°C = 0.023 kg/m-s.

OR

b) Select a suitable deep groove ball bearing for supporting a radial load of 10 kN and an axial load of 3 kN for a life of 4000 hours at 800 rpm. Select from 63 series. Calculate the expected life of the bearing. *13,K4,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Design a cast iron flywheel for a four stroke cycle engine to develop 110 kW at 150 rpm. The work done in the power stroke is 1.3 times the average work done during the whole cycle. Take the mean diameter of the flywheel as 3 meters. The total fluctuation of speed is limited to 5 per cent of the mean speed. The material density is 7250 kg/m^3. The permissible shear stress for the shaft material is 40 MPa and flexural stress for the arms of the flywheel is 20 MPa. *15,K3,CO6*

OR

b) Design a CI flange coupling for a MS shaft 90 kW at 250 rpm. The allowable shear in the shaft is 40 N/mm^2. The allowable shear stress in the coupling bolt is 30 N/mm^2. *15,K3,CO6*