Reg. No. : | | | | | | | | | | | | |

Question Paper Code:R5704

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Fifth Semester

R21UME504- DESIGN OF MACHINE ELEMENTS

Mechanical Engineering

(Regulations R2021)

(Use of Design Data Book can be allowed)

Duration: Three hours Maximum: 100 Marks

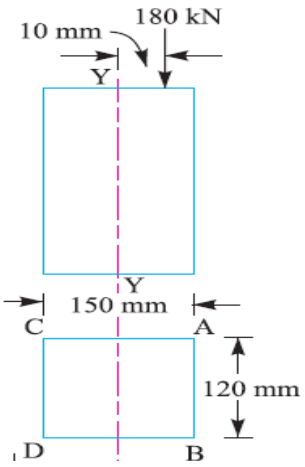
Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	Explain Rankine's theory.	CO1- U	
2.	Give some methods of reducing stress concentration.	CO1- U	
3.	Brief about how coupling are specified?	CO1- U	
4.	Under what circumstances flexible couplings are used?	CO1- U	
5.	What do you understand by the term riveted joint?	CO1- U	
6.	Enumerate the different types of riveted joints and rivets.	CO1- U	
7.	Distinguish between close coiled and open coiled springs.	CO1- U	
8.	When two concentric springs of stiffness 100N/mm respectively are subjected to an axial load of 750N, what will be the deflection of each spring?	CO2-App	
9.	Summarize few commonly used friction materials.	CO1- U	
10.	Explain why heat dissipation is necessary in clutches?	CO1- U	

PART – B (5 x 16= 80 Marks)

11.	(a)	A rectangular strut is 150 mm wide and 120 mm thick. It carries a load of 180 kN at an eccentricity of 10 mm in a plane bisecting the thickness as shown in Figure. Find the maximum and minimum intensities of stress in the section.	CO2- App	(16)



Or

(b) A steel rod is subjected to a reversed axial load of 180 kN. Find the diameter of the rod for a factor of safety of 2. Neglect column action. The material has an ultimate tensile strength of 1070 MPa and yield strength of 910 MPa. The endurance limit in reversed bending may be assumed to be one-half of the ultimate tensile strength. Other correction factors may be taken as follows: For axial loading = 0.7; For machined surface = 0.8 ; For size = 0.85 ; For stress concentration = 1.0 — CO2- App — (16)

12. (a) A solid circular shaft is subjected to a bending moment of 3000 Nm. And a torque of 1000 N.m. the shaft is made of 45C8 steel having ultimate stress of 700 Mpa & a ultimate shear stress of 500 Mpa. Assuming a factor of safety as 6, determine the diameter of the shaft. — CO3- App — (16)

Or

(b) Design of protective type flange coupling for the following requirements — CO3- App — (16)

(i) Power to be transmitted = 10 KW

(ii) Speed of the shaft =960 rpm

Select suitable materials and suitable stresses.

13. (a) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. — CO2- App — (16)

Or

(b) A stream engine cylinder has an effective diameter of 350 mm and the maximum stream pressure acting on the cylinder cover is 1.25 N/mm^2. Calculate the number and size of studs required to fix the cylinder cover, assuming the permissible stress in the studs as 33 Mpa. — CO2- App — (16)

14. (a) Design a leaf spring for the following specifications: Total load = 140 kN, Number of springs supporting the load = 4, Maximum number of leaves = 10, Span of the spring = 1000 mm and Permissible deflection = 80 mm. Take Young's modulus, E = 200 kN/mm^2 and allowable stress in spring material as 600 MPa. CO4- App (16)

Or

(b) Select a suitable deep groove ball bearing for a drilling machines spindle of 50 mm diameter. Thrust is 2 KN spindle speed is 3000 rpm. Desired life is 3000 hrs. CO4- App (16)

15. (a) Design a fabric belt to transmit 10 kw at 450 rpm from an engine to a line shaft as 1200 rpm. The diameter of the engine pulley is 600 mm and the distance of the shaft from the engine is 2 m. CO4- App (16)

Or

(b) A single plate clutch, effective on both sides, is required to transmit 30 kW at 1400 rpm. Determine the inner and outer diameter of friction surfaces if the co-efficient of friction is 0.25, ratio of diameter is1.5 and the maximum pressure is not to exceed 0.2 N/mm^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. CO4- App (16)