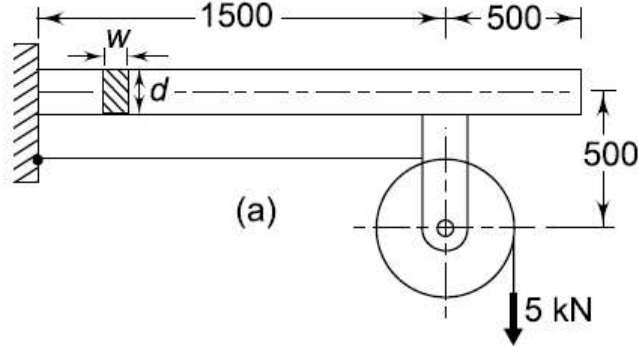


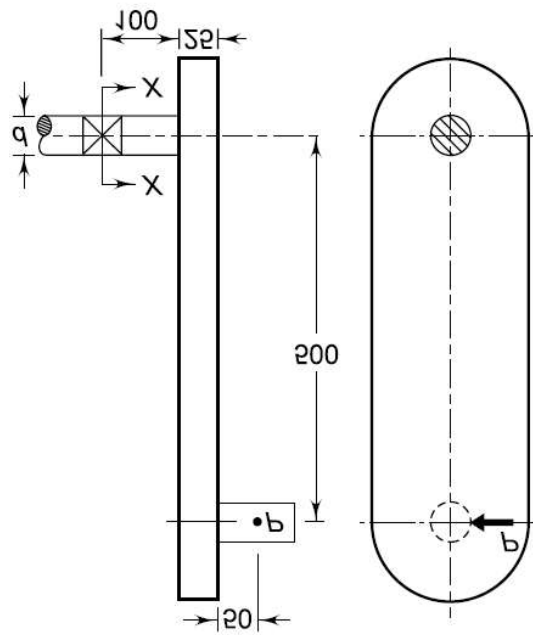
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM
III B. Tech I Semester Regular/Supplementary Examinations, April/May -2025
DESIGN OF MACHINE MEMBERS-I
(MECHANICAL ENGINEERING)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
 All Questions Carry Equal Marks

UNIT-I			
1.	a)	Draw S-N curve for mild steel and explain its significance.	[5M]
	b)	<p>A cantilever beam of rectangular cross-section is used to support a pulley as shown in Fig. The tension in the wire rope is 5 kN. The beam is made of cast iron FG 200 and the factor of safety is 2.5. The ratio of depth to width of the cross-section is 2. Determine the dimensions of the cross-section of the beam.</p>  <p align="right">(a)</p> <p align="right">All dimensions are in mm</p>	[9M]
(OR)			
2.	a)	Explain briefly the various theory of failures.	[7M]
	b)	<p>The dimensions of an overhang crank are given in Fig. The force P acting at the crankpin is 1 kN. The crank is made of steel 30C8 ($S_{yt} = 400 \text{ N/mm}^2$) and the factor of safety is 2. Using maximum shear stress theory of failure, determine the diameter d at the section - XX.</p>	[7M]



All dimensions are in mm

UNIT-II

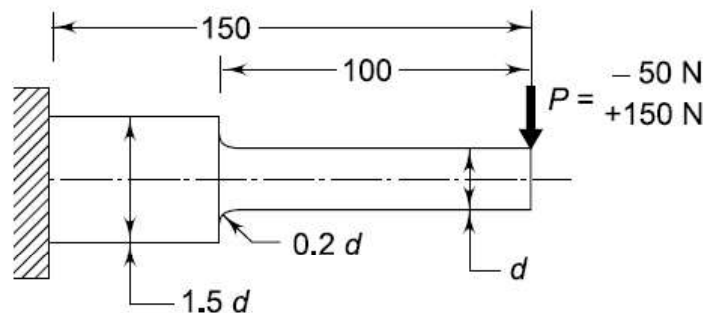
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| 3. | a) | Explain Goodman failure. | [5M] |
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| b) | A circular bar of 0.5 m length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size factor of 0.85, surface finish factor of 0.9. The material properties of bar is given by: Ultimate strength of 650 MPa, Yield strength of 500 MPa and Endurance strength of 350 MPa. | [9M] |
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(OR)

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| 4. | a) | Explain briefly about Soderberg and Goodman lines with neat sketches. | [7M] |
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| b) | A cantilever beam made of cold drawn steel 40C8 ($S_{ut} = 600$ N/mm ² and $S_{yt} = 380$ N/mm ²) is shown in Fig. The force P acting at the free end varies from -50 N to +150 N. The expected reliability is 90% and the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter 'd' of the beam at the fillet cross-section. | [7M] |
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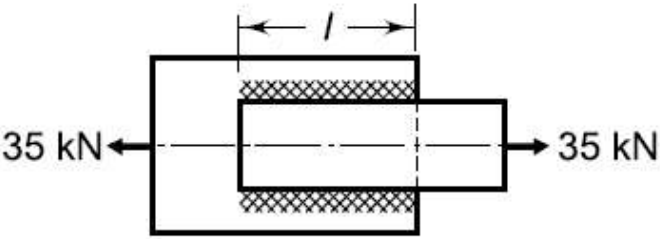
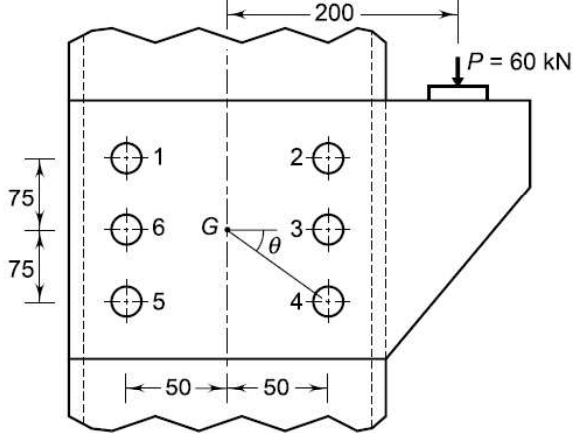


All dimensions are in mm

UNIT-III

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| 5. | a) | What are the advantages of welded joints compared with riveted joints? | [5M] |
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| b) | Two plates are joined together by means of fillet welds as shown in Fig. The leg dimension of the welds is 10 mm and the permissible shear stress at the throat cross-section is 75 | [9M] |
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		<p>N/mm². Determine the length of each weld, if 15 mm weld length is required for starting and stopping of the weld run.</p> 	
		(OR)	
6.	a)	Explain with sketches the different types of failures and efficiencies of the riveted joints.	[7M]
	b)	<p>A bracket is attached to a vertical column by means of six identical rivets as shown in Fig. 8. It is subjected to an eccentric force of 60 kN at a distance of 200 mm from the centre of the column. The maximum permissible shear stress for the rivets is 150 N/mm².</p> <p>(i) Which rivet is subjected to maximum shear force? (ii) What is the magnitude of maximum force? (iii) Determine the diameter of rivet.</p>  <p>All dimensions are in mm</p>	[7M]
		UNIT-IV	
7.	a)	Briefly explain the procedure to design a shaft based on any two theories of failures.	[7M]
	b)	It is required to design a knuckle joint to connect circular shafts subjected to an axial force of 50 kN. The rods are coaxial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. The allowable tensile, compressive and shear stress in the rod and pin material is limited to 80MPa, 100MPa and 40MPa respectively.	[7M]
		(OR)	
8.	a)	What is the difference between rigid and flexible couplings?	[4M]
	b)	<p>The following specifications are given for a rigid coupling:</p> <p>outer diameter of flanges = 160 mm diameter of recess = 95 mm number of bolts = 6 pre-load of each bolt = 10 kN coefficient of friction = 0.15</p>	[10 M]

		<i>speed of rotation = 100 rpm</i> <i>The bolts are fitted in large clearance holes.</i> <i>Calculate the power transmitting capacity of the coupling.</i>	
		UNIT-V	
9.	a)	What is helical torsion spring? How does it differ from helical compression spring?	[4M]
	b)	<p>A concentric spring consists of two helical compression springs one inside the other. The free length of the outer spring is 15 mm greater than that of the inner spring. The wire diameter and mean coil diameter of the inner spring are 5 and 30 mm respectively. Also, the wire diameter and mean coil diameter of the outer spring are 6 and 36 mm respectively. The number of active coils in the inner and outer springs are 8 and 10 respectively. Assume same material for two springs and the modulus of rigidity of spring material is 81370 N/mm². The composite spring is subjected to a maximum axial force of 1000 N. Calculate:</p> <p>(i) the compression of each spring; (ii) the force transmitted by each spring; and (iii) the maximum torsional shear stress induced in each spring.</p>	[10 M]
		(OR)	
10.	a)	What are graduated-length and full-length leaves in multi-leaf spring?	[4M]
	b)	<p>A semi-elliptic leaf spring consists of two extra full-length leaves and eight graduated length leaves, including the master leaf. The centre-to-centre distance between the two eyes of the spring is 1 m. The maximum force acting on the spring is 10 kN and the width of each leaf is 50 mm. The spring is initially pre-loaded in such a way that when the load is maximum, the stresses induced in all the leaves are equal to 350 N/mm². The modulus of elasticity of the leaf material is 207 000 N/mm². Determine</p> <p>(i) the thickness of leaves; and (ii) the deflection of the spring at maximum load.</p>	[10 M]
