BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER: V/ADD**
BRANCH: PIE **SESSION: MO/2025**

SUBJECT: PE328 DESIGN OF MACHINE ELEMENTS

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions, each of 5 marks, for a total of 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper, etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1	In the design of machine elements, a component may fail by elastic deflection, general yielding, or fracture. Explain each mode of failure and discuss its significance in the design of machine elements.	[5]	1	2,3
Q.2	A wall bracket with a rectangular cross-section is shown in Fig. 1. The depth of the cross-section is twice the width. The force P acting on the bracket at 60 degrees to the vertical is 5 kN. The material of the bracket is grey cast iron FG 200, and the factor of safety is 3.5. Determine the dimensions of the cross-section of the bracket.	[5]	1	3

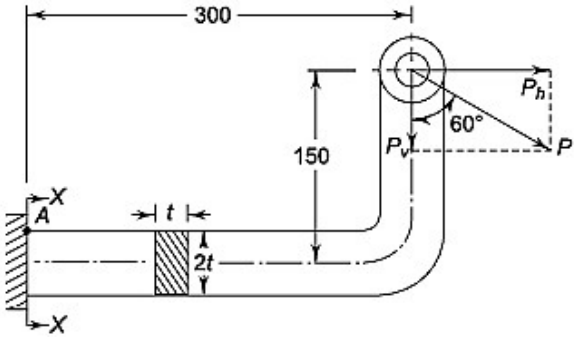

Fig. 1

Q.3	It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The material for all the components is selected as plain carbon steel of Grade 30C8 (Syt = 400 N/mm^2). The thickness of each eye at the fork end is 25 mm, and the thickness of the eye at the eye-end is 40 mm. The yield strength in compression is assumed equal to the yield strength in tension. A factor of safety n = 5 is to be used. Determine the (i) the diameter of the rod, (ii) the diameter of the knuckle pin based on shear and bending conditions, and (iii) check whether the bearing stress induced in the eye end is within the allowable limit.	[5]	2	3
Q.4	A circular beam, 50 mm in diameter, is welded to a support by means of a fillet weld as shown in Fig. 2. Determine the size of the weld if the permissible shear stress in the weld is limited to 100 N/mm^2.	[5]	2	3

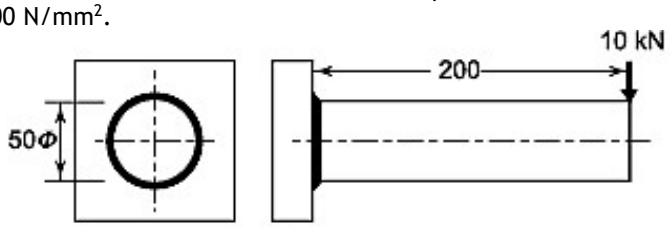

Fig. 2

PTO

Q.5 A crane-runway bracket is fastened to the roof truss by means of two identical bolts, as shown in Fig. 3. Determine the size of the bolts if the permissible tensile stress in the bolts is limited to 75 N/mm^2. [5] 3 3

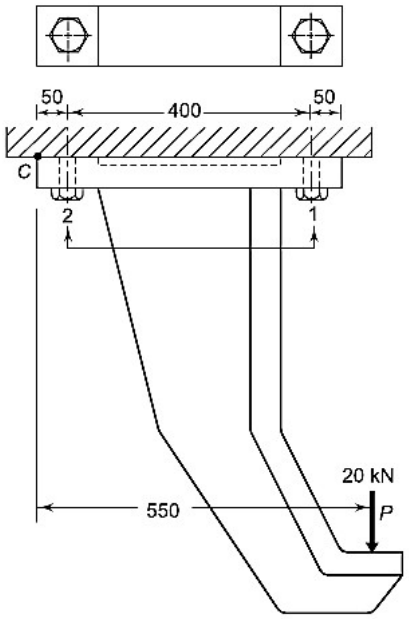

Fig. 3

Basic dimensions for ISO metric screw threads (coarse series)

Designation	*Nominal or major dia d/D (mm)*	*Pitch (p) (mm)*	*Pitch diameter d_p/ D_P (mm)*	*Minor diameter (mm)*		*Tensile stress area (mm^2)*
				d_c	*D_c*	
M 4	4	0.70	3.545	3.141	3.242	8.78
M 5	5	0.80	4.480	4.019	4.134	14.20
M 6	6	1.00	5.350	4.773	4.917	20.10
M 8	8	1.25	7.188	6.466	6.647	36.60
M 10	10	1.50	9.026	8.160	8.376	58.00
M 12	12	1.75	10.863	9.853	10.106	84.30
M 16	16	2.00	14.701	13.546	13.835	157
M 20	20	2.50	18.376	16.933	17.294	245
M 24	24	3.00	22.051	20.319	20.752	353
M 30	30	3.50	27.727	25.706	26.211	561
M 36	36	4.00	33.402	31.093	31.670	817
M 42	42	4.50	39.077	36.479	37.129	1120
M 48	48	5.00	44.752	41.866	42.587	1470
M 56	56	5.50	52.428	49.252	50.046	2030
M 64	64	6.00	60.103	56.639	57.505	2680
M 72	72	6.00	68.103	64.639	65.505	3460
M 80	80	6.00	76.103	72.639	73.505	4340
M 90	90	6.00	86.103	82.639	83.505	5590
M 100	100	6.00	96.103	92.639	93.505	7000