Course Name: Strength of Materials

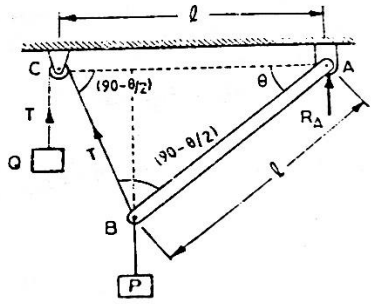
Course Outcomes (CO):

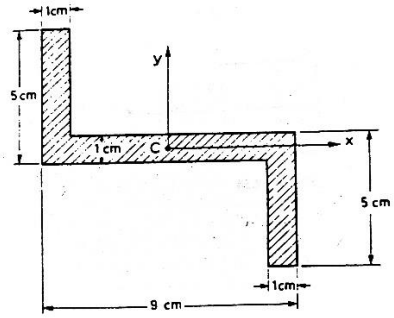
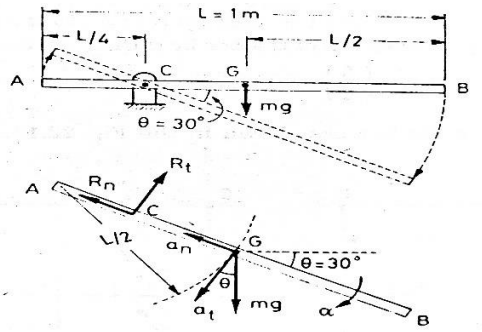
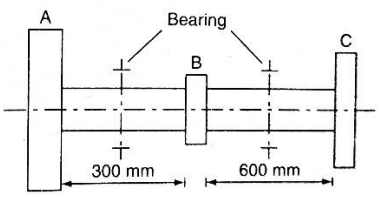
The course should enable the students to:

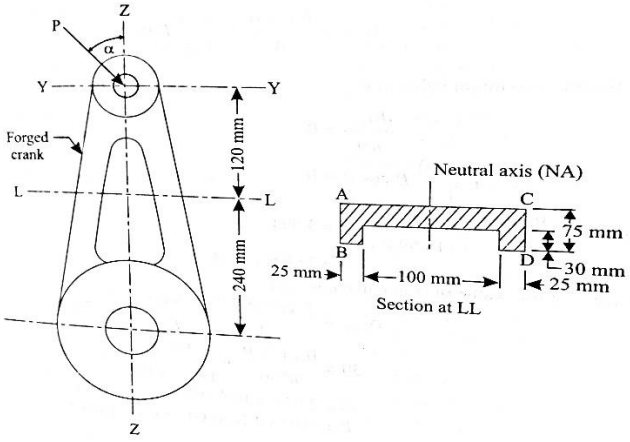
1. Confidently tackle equilibrium equations, moments and inertia problems.
2. To solve real field problems through evaluating the relationship between stress and strain.
3. To understand the shear force and bending moment diagrams of symmetrical beams.
4. To determine deflection, bending and shear stresses developed in beams of various sections
5. To understand and apply the concept of stress and strain to analyze and design structural members and machine parts under axial load, shear load, bending moment and torsion.

Model Question Paper
Total Duration (H:M): 3:00
Course: Strength of Materials
Maximum Marks :100

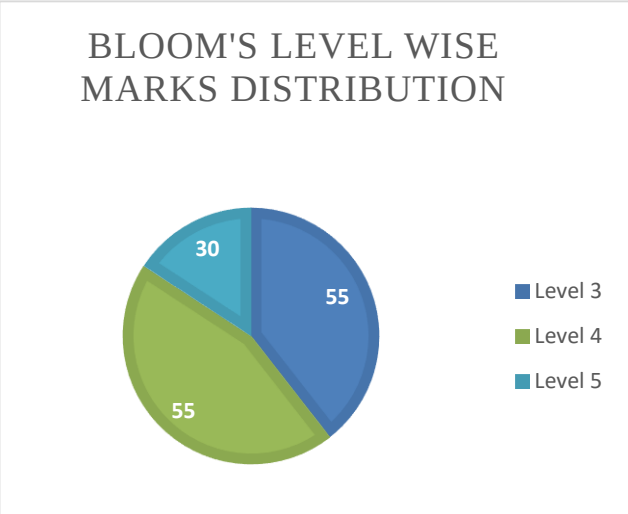
Note:(1) *From Unit- I, attempt all questions.*
From Unit II, Unit III, Unit IV & Unit-V attempt only two questions each.

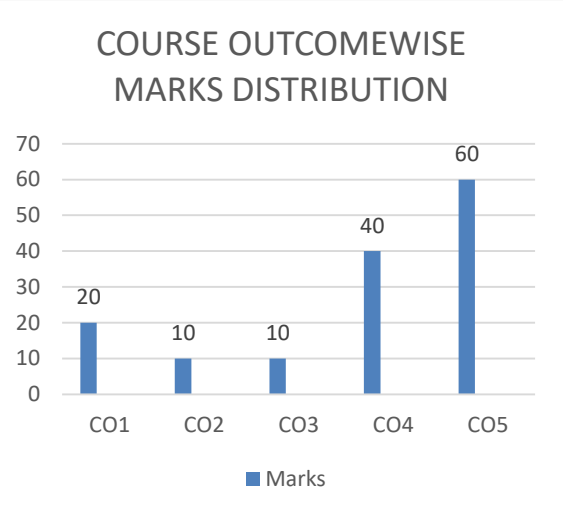
Q. No	Questions	Marks	CO	BL
	UNIT-I			
1a)	A uniform rod AB of negligible weight is hinged at the end A and supported at end B by a string as Shown. Find the value of angle θ corresponding to the position of equilibrium of the bar if Q = P/2. 	5	CO1	L3
1b)	Find the product of inertia of the are shown with respect to the centroidal x and y axes. Also find the angle θ defining the directions of principal axes through the centroid and the principal moments of inertia.	5	CO1	L4

				
1c)	A thin uniform rod AB of length L = 1m and mass m = 10 kg is hinged at the point C which is at a distance of 0.25 m from the end A. The rod is released from the horizontal position. Find (a) the angular velocity of the rod when it has rotated through 30° (b) the reaction at the hinge. 	10	CO1	L3
	UNIT-II			
3a)	Prove that sum of two normal stresses along two mutually orthogonal axes is always constant.	10	CO2	L3
3b)	A thin steel tube 75 mm in diameter is 3 mm thick. If the allowable shear stress is 80 MN/m^2 and modulus of rigidity is 80 GN/m^2 find: (i) Safe twisting moment that can be applied to the tube; (ii) The twist in a length of 600 mm.	10	CO4	L4
3c)	The solid shaft as shown in figure is made of steel. It has a uniform diameter of 40 mm and it runs at 525 rpm. A driving belt feeds 50 hp to pulley A; whereas 30 hp and 20 hp, respectively, are taken off from the other two pulleys, B and C. find out the maximum shear stress induced in the shaft and the total angle of twist. Take G = 100 GPa. 	10	CO4	L5
	UNIT-III			

4a)	A simply supported beam of length 10 m carries a uniformly varying load whose intensity varies from a maximum value of 5 kN/m at both ends to zero at the Centre of the beam. It is desired to replace the beam with another simply supported beam which will be subjected to the same maximum 'bending moment' and 'shear force' as in the case of the previous simply supported beam. Determine the length and rate of loading for the second beam, if it is subjected to a uniformly distributed load over its whole length. Draw the variation of SF and BM in both the cases.	10	CO3	L4
4b)	Prove that maximum shear stress in rectangular beam is 1.5 times the average shear stress, while it is 1.33 times for a beam with circular cross-section.	10	CO4	L3
4c)	Figure shows a forged crank with a section along the line LL. The thrust P of connecting rod acts on the crank at an angle θ as shown. If the stress at the section LL were not to exceed 30 N/mm^2, find the maximum value of the thrust P. Assume the ZZ axis passes through the centroid of the section LL. 	10	CO5	L5
	UNIT-IV			
5a)	Find by Macaulay's method, the central deflection of a fixed beam loaded with uniformly distributed load throughout the span.	10	CO4	L3
5b)	Derive the expressions, from first principles, for strain energy stored in structural members under direct load and bending.	10	CO5	L3
5c)	Discuss, in general, theories of failure for ductile and brittle materials.	10	CO5	L4
	UNIT-V			
6a)	Derive the expressions for circumferential and radial stresses in the wall of thick cylinders.	10	CO5	L4
6b)	A cylindrical water tank of height 25 m, inside diameter 2.2 m, having vertical axis is open at the top. The tank is made of steel having yield stress of 210 MN/m^2. determine the thickness of steel used when the tank is full of water.	10	CO5	L5

	Given: Efficiency of the longitudinal joint = 70%; Factor of safety = 3.			
6c)	Derive the expression for change in dimension of a thin cylindrical shell due to an internal pressure.	10	CO5	L4





BL–Bloom'sTaxonomyLevels(1-Remembering,2-Understanding,3 –Applying,4– Analysing,5 –Evaluating,6-Creating)

CO–CourseOutcomes