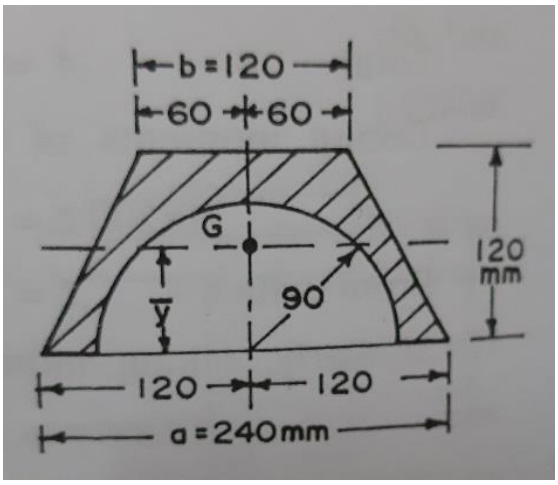
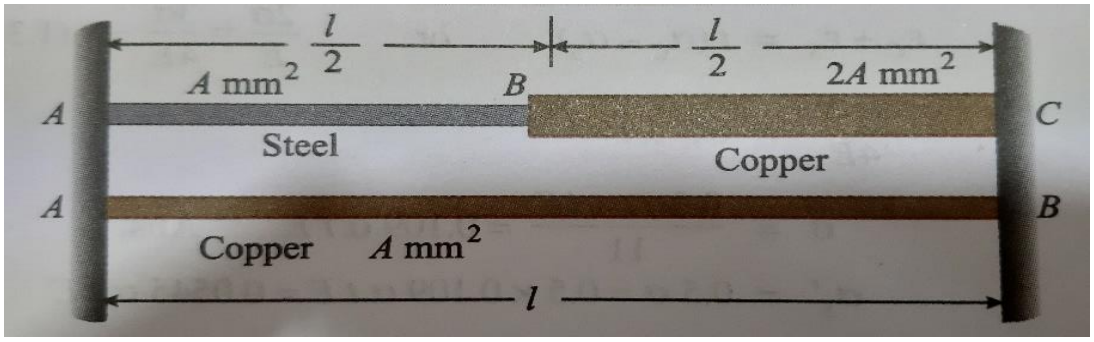
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

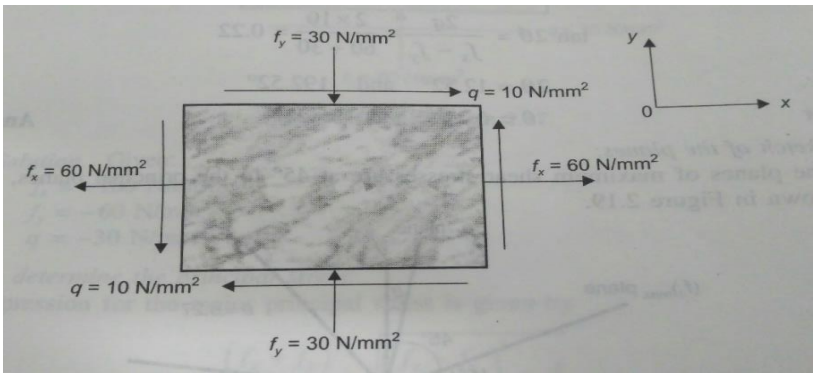
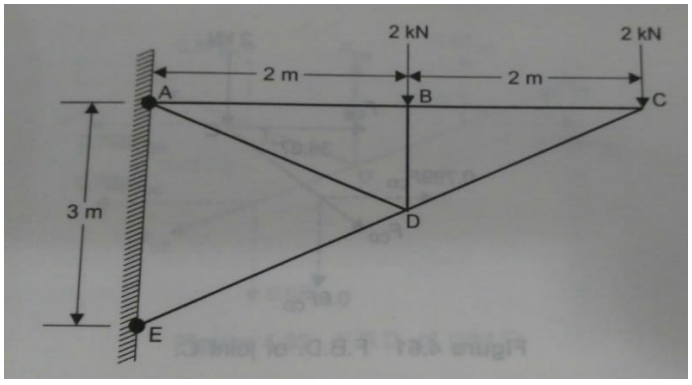
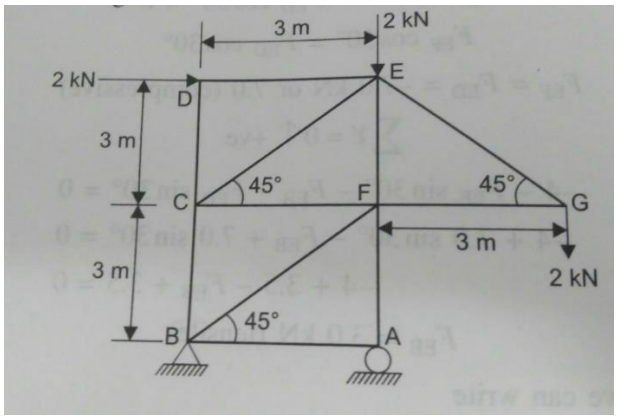
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

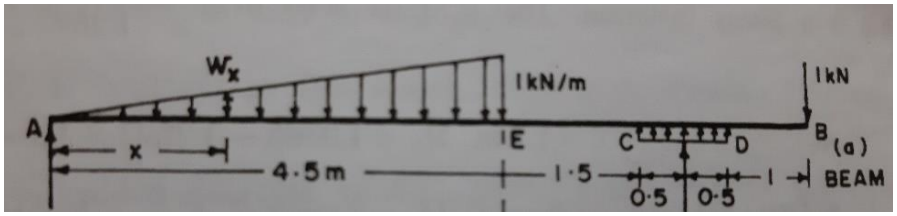
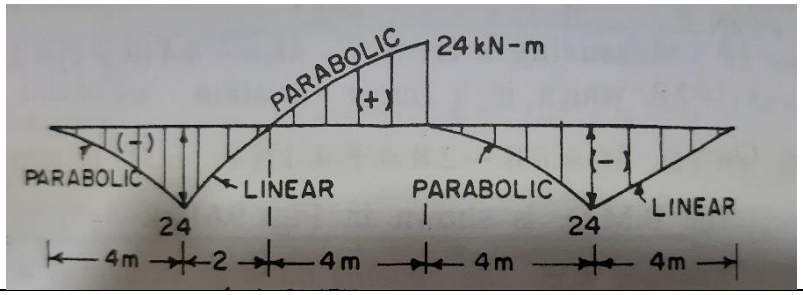
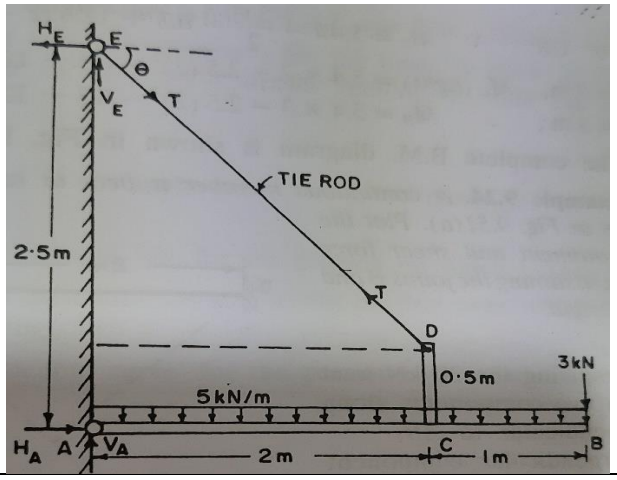
Programme Name: **B. Tech. FSE** **Semester : IV**
Course Name : **Strength of Materials** **Time : 03 hrs**
Course Code : **GNEG 227** **Max. Marks : 100**
Nos. of page(s) :

SECTION A

S. No.		Marks	CO
Q 1	**MCQ** a. A rod is enclosed centrally in a tube and the assembly is tightened by rigid washers. If the assembly is subjected to a compressive load, then i. Rod is subjected to a compressive load, ii. Tube is subjected to a compressive load, iii. Both are subjected to a compressive load, iv. Rod is subjected to a compressive load, while the tube is subjected to a tensile load. b. When a body is subjected to a direct tensile stress (σ) in one plane, then the tangential stress on an oblique section of the body inclined at an angle (θ) to normal of the section is equal to i. $\sigma \sin \theta$ ii. $\sigma \cos \theta$ iii. $\sigma \sin^2 \theta$ iv. $\sigma \cos^2 \theta$ c. The total strain energy stored in a body is known as i. Impact energy ii. Resilience iii. Proof resilience iv. Modulus of resilience d. When a cantilever is loaded at its free end, maximum compressive stress shall develop at i. Bottom fiber ii. Top fiber iii. Neutral axis iv. Centre of gravity	**4**	**CO1**
Q 2	**Define** a. Flexural rigidity b. Section modulus c. Principle plane d. Redundant frame	**4**	**CO1**

Q 3	Determine the position of centroid of the plane as shown in fig.  	**4**	**CO3**
Q 4	An axial pull of 20 kN suddenly applied on a steel rod 2.5 m long and 1000 mm2 in cross-section. Calculate the strain energy, which can be absorbed in the rod. Take E = 200 GPa.	**4**	**CO2**
Q 5	Show that in a strained material subjected to two-dimensional stress, the sum of the normal components of the stresses on any two mutually perpendicular plane is constant.	**4**	**CO2**
	SECTION B		
Q 6	A composite bar is made up by connecting a steel member and a copper member, rigidly fixed at their ends as shown in fig.  The cross-sectional area of the steel member is A mm^2 for half of the length and 2A mm^2 for another half of the length, while that for the copper member is A mm^2. The coefficient of expansion for the steel and copper are α and 1.3α, while elastic modulii are E and 0.5E respectively. Determine the stresses induced in both the members when the composite bar is subjected to a rise of temperature of t degrees.	**10**	**CO4**
Q 7	Compare the flexural strength of following three beams of equal weight. i. I-section 100 mm * 200 mm having 10 mm flange thickness and 8 mm thickness. ii. A rectangular section having depth equal to twice the width. iii. Solid circular section.	**10**	**CO3**

Q 8	A plane element is subjected to stresses as shown in figure. Determine the principle stresses, the maximum shear stress and their plane. Sketch the planes determined.  	**10**	**CO4**
Q 9	Determine the forces in the various members of the cantilever truss shown in figure using method of joints.  **OR** Find the method of joints of the forces in the members of the truss shown in figure:  	**10**	**CO4**

	SECTION-C		
Q 10	A beam AB, 8 m long and supported at A, has a simple support of 1 m length between C and D. Assuming uniformly distributed reaction between C and D, draw the S.F. and B.M. diagrams for the loading shown in Fig.  **OR** A beam ABCD is supported at B & C and has overhangs AB and CD. The B.M. diagram for the beam is shown in fig. Draw the loading on the beam and S.F. diagram.  	**20**	**CO5**
Q 11	A beam AB, 3 m long, is hinged to a wall at the end A and is supported by a tie road DE which is hinged to the wall at end E and also hinged to a vertical bracket CD at end D, as shown in fig. the beam carries a U.D.L. of 5 kN/m throughout its length along with a point load 3 kN at its free end B. Draw the S.F. and B.M. diagrams for the beam, indicating principle values.  	**20**	**CO5**

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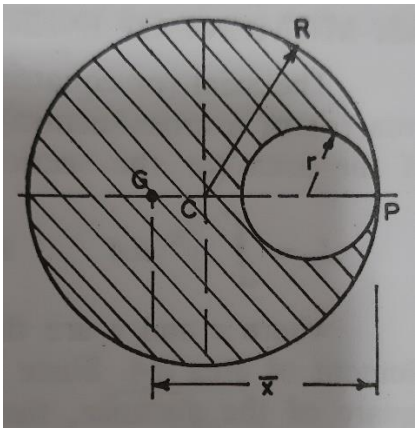
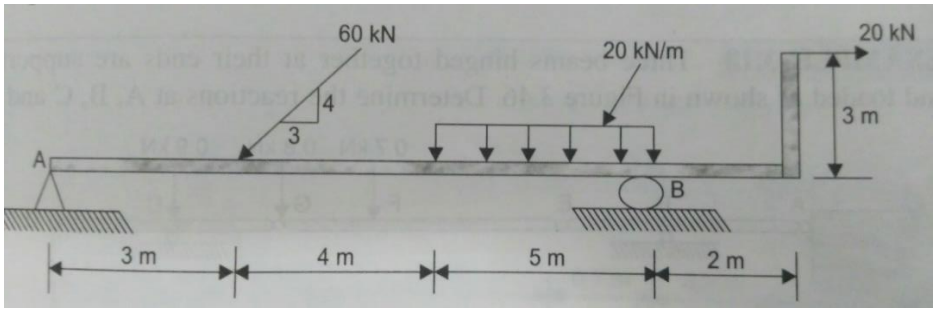
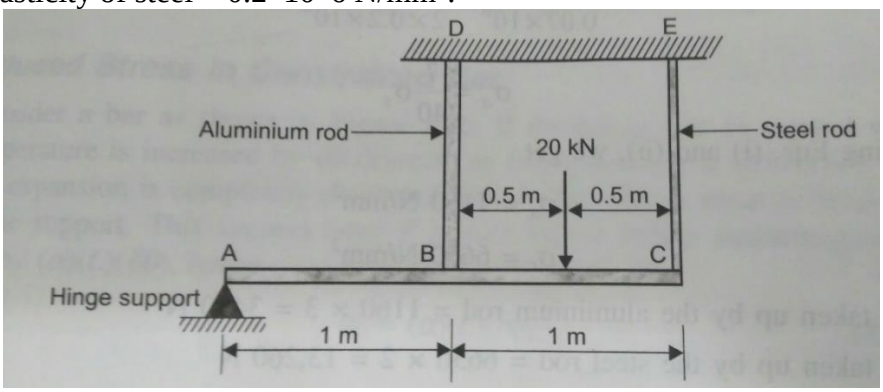
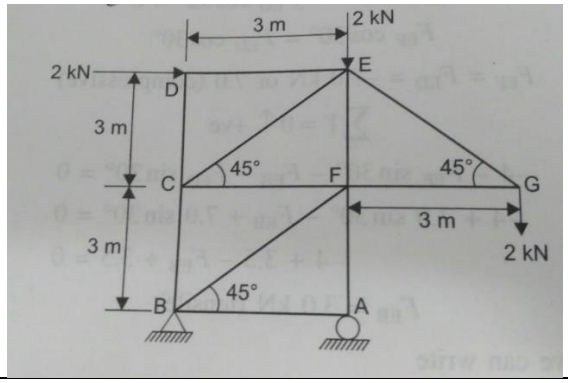
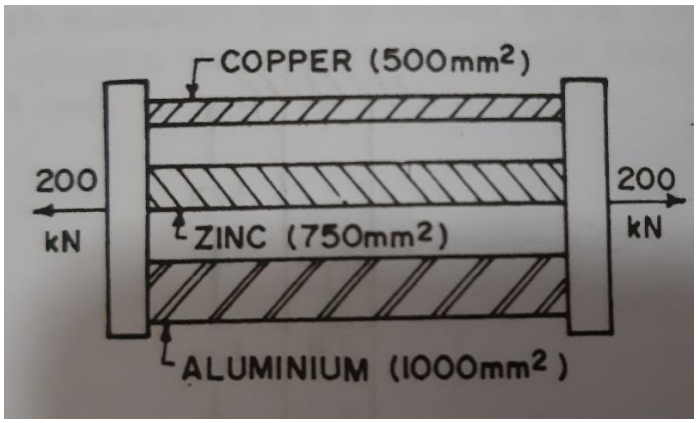
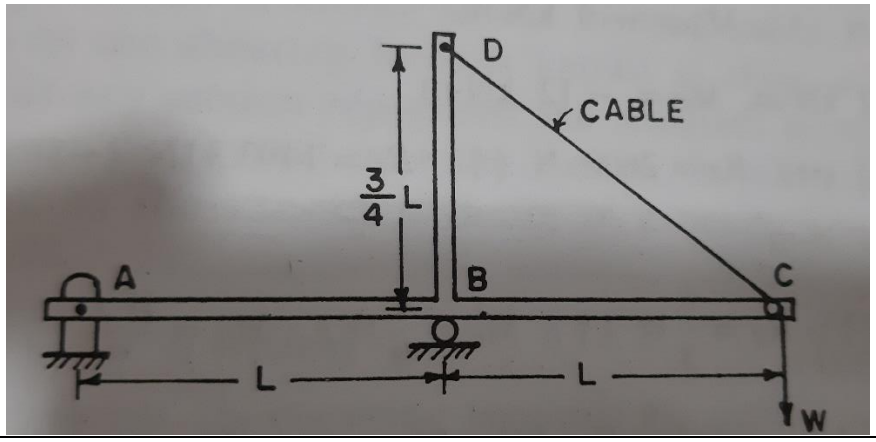
Nos. of page(s) :

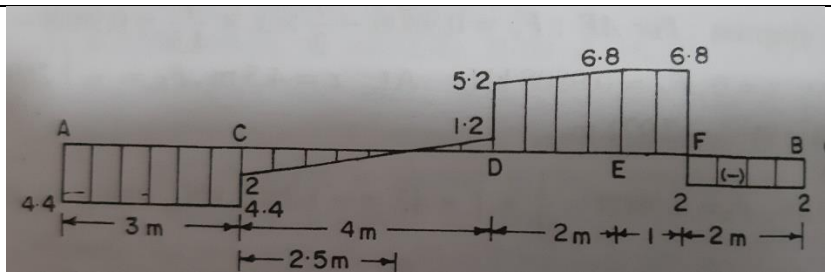
SECTION A

S. No.		Marks	CO
Q 1	**Define** a. Curvature of Section b. Neutral Axis c. Angle of Obliquity d. Redundant frame	**4**	**CO1**
Q 2	A piece of material is subjected to tensile stress of 70 N/mm^2 and 50 N/mm^2 at right angles to each other. Find fully the stresses on a plane the normal of which makes an angle of 35 degree with large tensile stress.	**4**	**CO2**
Q 3	A circular sheet of metal has radius R. if a hole of radius r is made as shown in figure, determine the position of centroid of the remaining part. 	**4**	**CO3**
Q 4	Two elastic bars of the same material and length, one of circular section of diameter d and the other of square section of side d, absorb the same amount of energy delivered by axial forces. Compare the stresses in two bars.	**4**	**CO2**
Q 5	Derive the equation of normal and tensile stresses of oblique plane using Mohr's circle for two unlike stresses p1 and p2.	**4**	**CO1**

SECTION B

Q 6	Determine the SF and BM at every point of the overhang beam as shown in figure. 	**10**	**CO4**
Q 7	A timber beam of rectangular section is to support a load of 20 kN over a span of 4 m. If the depth of the section is to be twice the breath, and the stress in the timber is not to exceed 60 N/mm^2, find the dimensions of the cross-section.	**10**	**CO3**
Q 8	As shown in figure, a rigid bar ABC hinged at A and suspended at two points B and C by two equal bars BD and CE made of aluminum and steel respectively. The bar carries a load of 20 kN midway between B and C. The cross sectional area of the aluminum bar is 3 mm^2 and that of steel bar is 2 mm^2. Determine the load taken by two bars. Assume modulus of elasticity of aluminum = 0.07*10^6 N/mm^2 and modulus of elasticity of steel = 0.2*10^6 N/mm^2.  **OR** Find the method of joints of the forces in the members of the truss shown in figure: 	**10**	**CO4**

Q 9	Three bars, made of copper, zinc and aluminum are of equal length and have cross-section 0f 500, 750 and 1000 sq. mm respectively. The are rigidly connected at their ends, as shown in figure. If this compound member is subjected to a longitudinal pull of 200 kN, estimate the proportion of load carried by each rod and the induced stresses. Take E_c = 1.3*10^5 N/mm^2 , E_z = 1*10^5 N/mm^2, E_a = 0.8*10^5 N/mm^2 	**10**	**CO4**
SECTION-C			
Q 10	Construct S.F and B. M diagrams for the beam ABC, loaded as shown in figure. The cable passes over a small frictionless pulley in C, and supports a weight W. 	**20**	**CO5**
Q 11	The S. F. diagram for a beam AB, hinged at both the ends is shown in figure. Determine the loading on the beam and draw the B. M. diagram, indicating principal values.	**20**	**CO5**



OR

The bending moment diagram of a beam AD, hinged at A and D, is shown in figure. Determine the loading on the beam and draw the SF diagram.