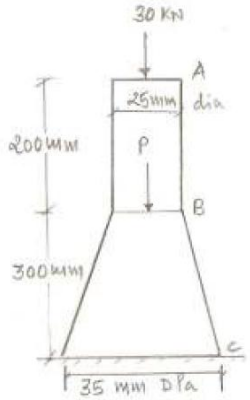
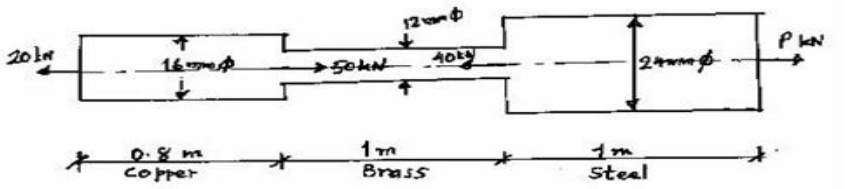
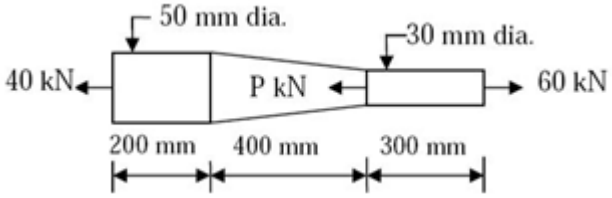
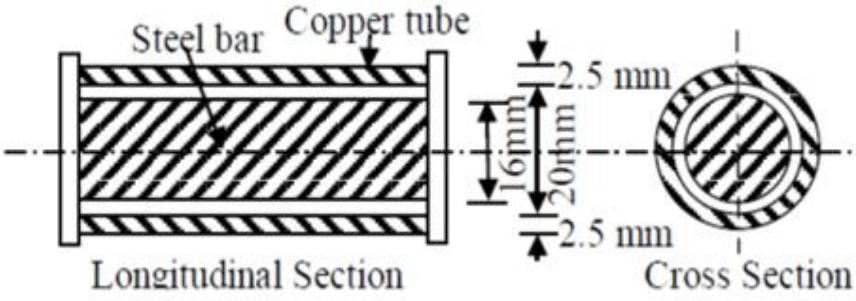
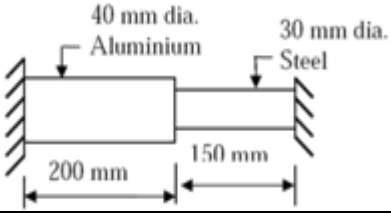
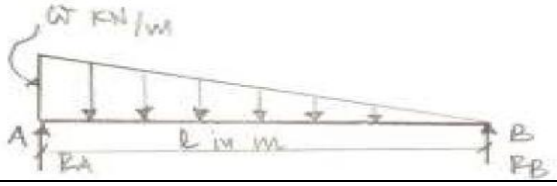
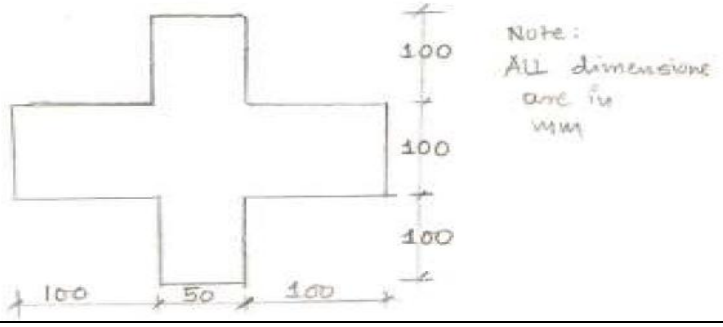
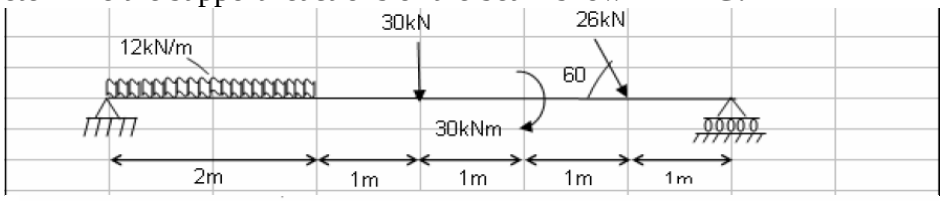
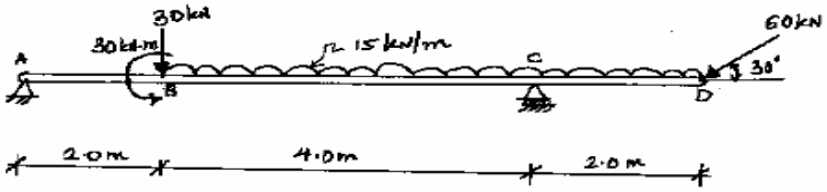
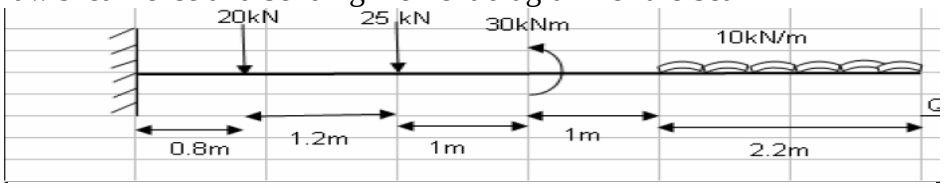
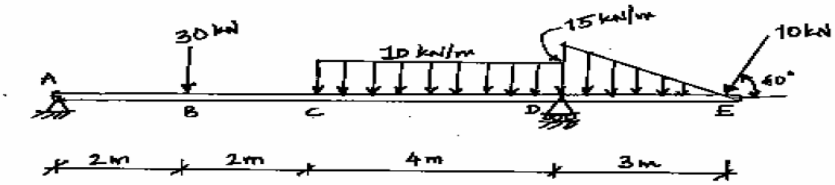
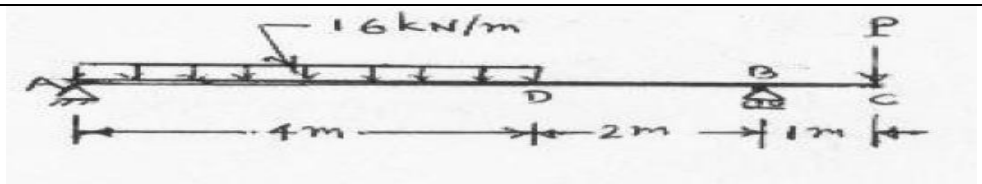
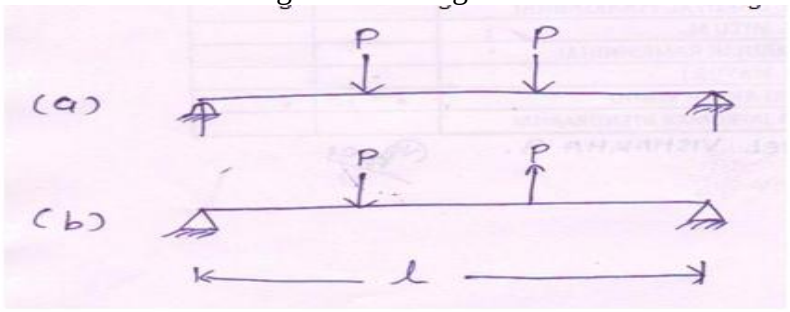
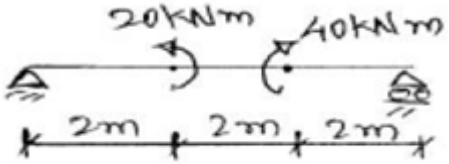
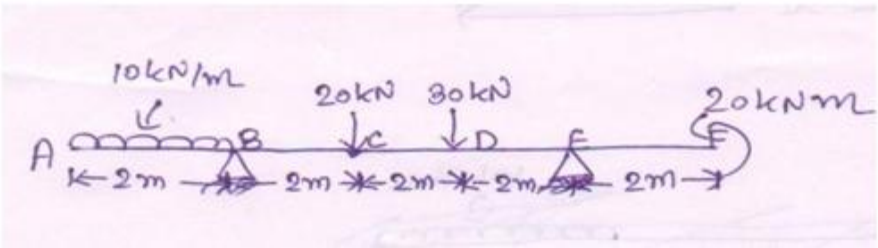
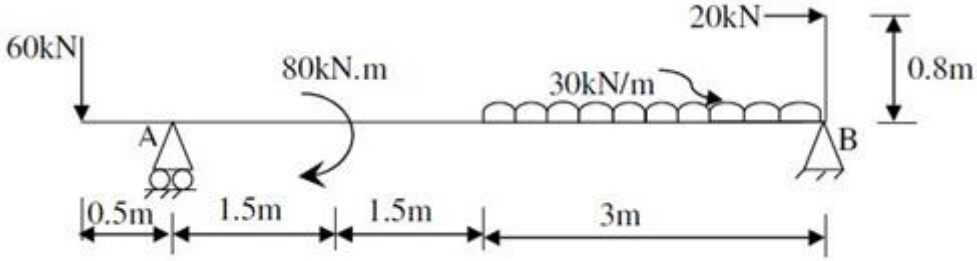
ALPHA COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
MECHANICS OF SOLIDS (2130003)
ASSIGNMENT 1
SIMPLE STRESSES AND STRAINS

SN	QUESTION	YEAR	MARK
1	State and prove the relationship between shearing stress and rate of change of bending moment at a section in a loaded beam.	JAN 2011	5
2	A bar ABC is loaded as shown in Fig- 10 , in which portion AB is of uniform section and portion BC is of tapering section. Calculate the value of load P so that the total deformation is 0.3mm. Neglect the deformation due to self weight. Calculate the change in volume of portion AB. Take E= 110 GPa and 1/m=0.25. 	JAN 2011	5
3	Explain the terms compressive strain, shear strain, volumetric strain	JAN 2011	3
4	A rectangular block of 50mmX 50mmX300mm is subjected to tensile stress of 200 N/mm2 along the length in x direction and compressive stresses of 120 N/mm2 on the remaining all faces in y and z directions. Find the strains produced along x ,y and z directions and calculate change in the volume. If 1/m = 0.25 & E = 200 KN/mm2	JAN 2011	6
5	Define force and explain different type of force system with figures.	DEC 2010 DEC 2009	3
6	A point in a strained material is subjected to a tensile stress of 120N/mm2 and a compressive stress of 60N/mm2 acting at right angles to each other. Determine the Normal, tangential and resultant stress on a plane inclined at 300 in anticlockwise direction with the direction of compressive stress.	DEC 2010	6
7	A circular rod of 25 mm diameter and 500 mm long is subjected to a tensile force of 50 kN. Determine modulus of rigidity, bulk modulus and change in volume if Poisson's ratio = 0.3 and Young's modulus E = 2 ×105 N/mm2.	JUN 2012	7
8	A circular rod of diameter 20 mm and 500 mm long is subjected to a tensile force 50kN. The modulus of elasticity for steel may be taken as 200 kN/mm2. Find stress, strain and elongation of the bar due to applied load.	JUN 2012	4
9	Derive the relation between modulus of elasticity and modulus of rigidity.	JUN 2012	3
10	Define the stress, strain, modulus of elasticity, Poisson's ratio, modulus of rigidity and bulk modulus. Explain homogeneous material, composite element and prismatic element.	DEC 2011, JAN 2016	4
11	A stepped bar is loaded as shown in Fig. Calculate the stresses in each part and total change in the length of the bar. Take Esteel= 200 GPa, Ecopper=100 GPa and Ebrass=80 GPa.	MAR 2009, APR 2010, JAN 2014	5

			
12	An assembly of steel bars as shown in the fig is in equilibrium. Find force P and the net elongation of the assembly. Take Es = 2 x 105 MPa. 	DEC 2008, DEC 2015	7
13	A Steel circular bar of 16mm diameter is placed inside a copper tube having internaldiameter of 20mm and thickness of 2.5mm as shown in fig**.** Both the ends are rigidly fixed and temperature of assembly is increased by 60° C. Compute magnitude and nature of stresses produced in each material. Take modulus of elasticity of steel and copper as 200GPa and 100GPa respectively. Consider Co-efficient of thermal expansion (per °C) for steel and copper as 12 x 10-6 and 18 x 10-6 respectively. 	APR 2010	9
14	An assembly made up from Aluminium and Steel bars as shown in the fig, is initially stress free at temperature 32° C .The assembly is heated to bring its temperature to82° C. Find the stresses developed in each bar. The coefficient of thermal expansions is 1.25 x 10-5/ ° C & 2.25 x 10-5/ °C for steel and aluminium respectively. Take Es =200 GPa & Eal = 75 GPa. 	DEC 2008, JAN 2014, DEC 2014	5
15	A rectangular block of 50mmX 50mmX300mm is subjected to tensile stress of 200 N/mm^2 along the length in x direction and compressive stresses of 120 N/mm^2 on the remaining all faces in y and z directions. Find the strains produced along x, y and z directions and calculate change in the volume. If 1/m = 0.25 & E = 200 KN/mm2.	JAN 2011	5
16	Derive The Relation between A). E,K and μ B). E, G and μ C). E,G, and K	JUN 2009, JAN 2011, DEC 2014	3

ALPHA COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
MECHANICS OF SOLIDS (2130003)
ASSIGNMENT 2
REACTIONS, SFD AND BMD

SN	QUESTION	YEAR	MARK
1	Determine reaction for the beam loaded and supported as shown in the Fig 	JAN 2011	2
2	Fig shows a beam cross section subjected to shearing force of 200 KN. Determine the shearing stress at neutral axis and sketch the shear stress distribution diagram across the section. 	JAN 2011	5
3	Determine the support reactions of the beam shown in **FIG.**   Fig.3	DEC 2010, MAR 2009	7
4	Draw shear force and bending moment diagram for the beam  	DEC 2010, MAR 2009	6
5	Determine load P such that the reactions at A & B are equal for the beam shown in **fig.** Draw shear force and bending moment diagrams and locate point ofcontra flexure.	MAR 2009	7

			
6	• Derive the relation between the rate of loading, shear force, and bending moment in a beam • Define shear force, bending moment, point of contraflexure • Draw sketches of different types of beams with different loads and supports.	DEC 2008, JAN 2011	7
7	Draw shear force and bending moment diagram for beam shown in figure. 	DEC 2010, JUN 2014	4
8	Draw the Shear Force and Bending Moment Diagrams for the beam loaded as shown in Figure. 	DEC 2010, JAN 2015	4
9	Draw shear force and bending moment diagram for the beam shown in figure 	MAR 2009, DEC 2013	7
10	Draw shear force, bending moment and axial force diagram diagram for the beam shown in figure. 	DEC 2013, JAN 2016	7

ALPHA COLLEGE OF ENGINEERING AND TECHNOLOGY
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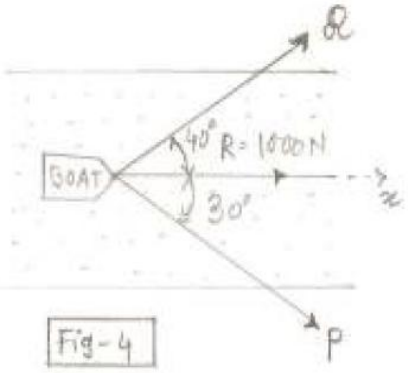
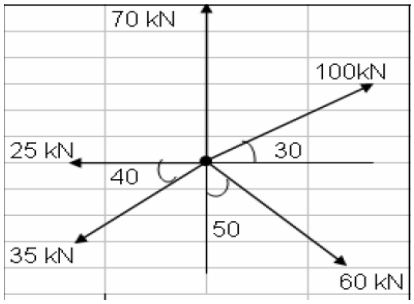
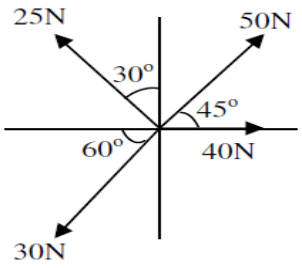
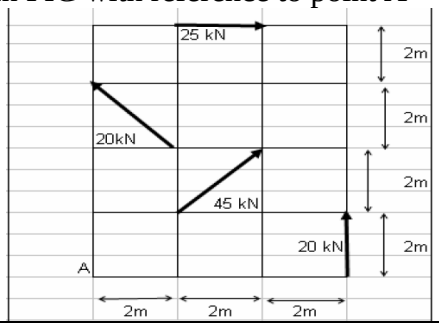
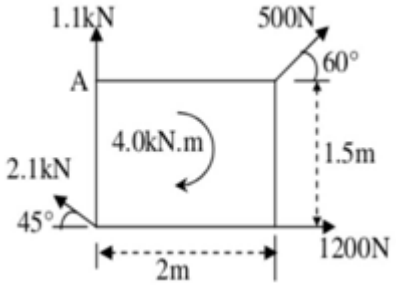
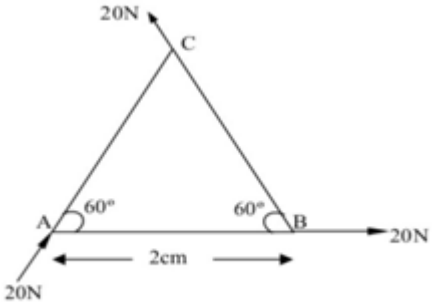
ASSIGNMENT 3
COPLANAR AND CONCURRENT FORCES

SN	QUESTION	YEAR	MARK
1	For coplanar force system prove that " The algebraic sum of the moments of all the forces about any point is equal to the moment of their resultant force about the same point "	JAN 2011	4
2	A boat is pulled along the river by two ropes with pulls P & Q inclined at 30° and 40° to the x-axis as shown in Fig. Find *a)* P and Q if their resultant R is 1000 N , parallel to x-axis *b)* If P is inclined at 30° to x-axis find the minimum value of Q if R is same.  Fig-4	JAN 2011	6
3	Determine magnitude and direction of resultant force of the force system shown In FIG.  	DEC 2010, JUN 2012	4
4	Determine the magnitude direction and position of resultant force of the force system given in FIG with reference to point A 	DEC 2010	5
5	State: (i) Law of Parallelogram of Forces. (ii) Law of Triangle of Forces. (iii) Law of Transmissibility (iv) Lami's theorem	MAY 2013, JUN 2015	4
6	Enlist equilibrium conditions for co-planer non -concurrent forces. Determine the resultant and locate the same with respect to point 'A' of a	DEC 2013, JAN 2014	7

	non-concurrent force system shown in fig.  		
7	State and prove VERIGNON'S Principle of moments.	JUN 2009, APR 2010, JUN 2012	4
8	Define resultant of force-couple system. Also briefly explain about location of result.	DEC 2012, DEC 2008	5
9	Three forces are acting on a weightless equilateral triangular plate as shown in Fig. Determine the magnitude, direction and position of the resultant force.  	JUN 2010	7
10	The following forces are acting at a point, find the magnitude and direction of the resultant force. 1. 550N acting towards North 2. 900N acting at 40° towards South of West 3. 1.25 kN acting at 60° towards South of East 4. 400N acting from West to East	Jan 2013	7

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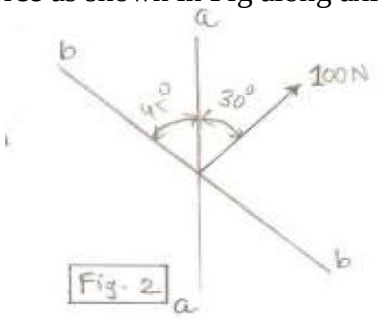
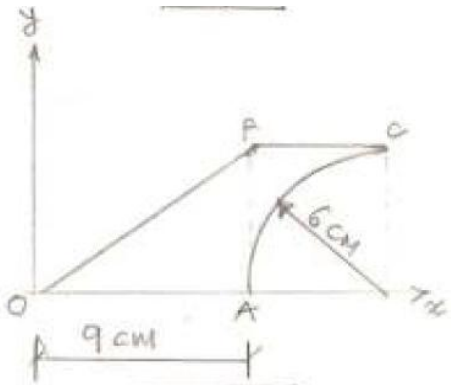
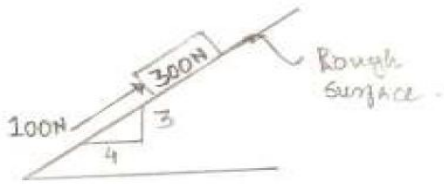
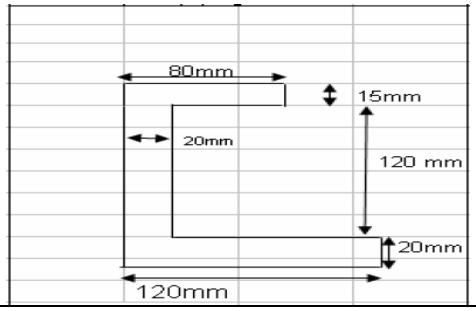
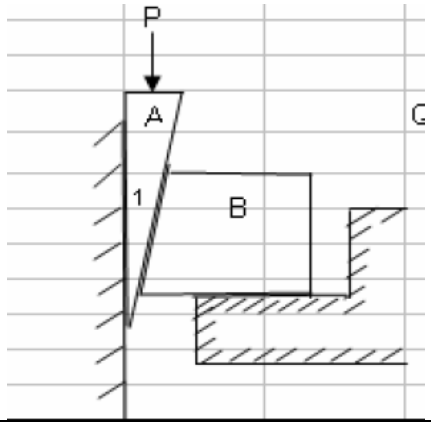
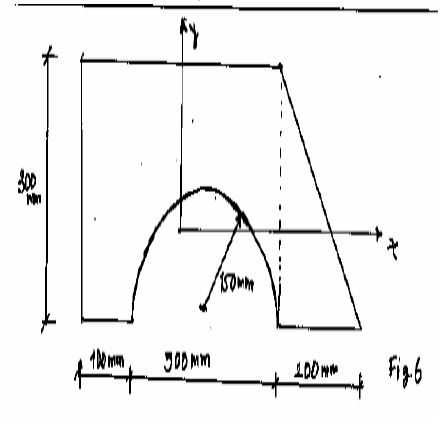
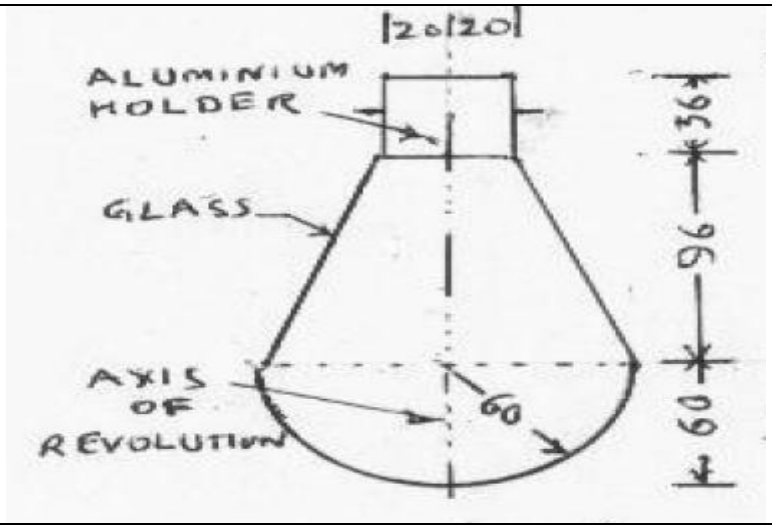
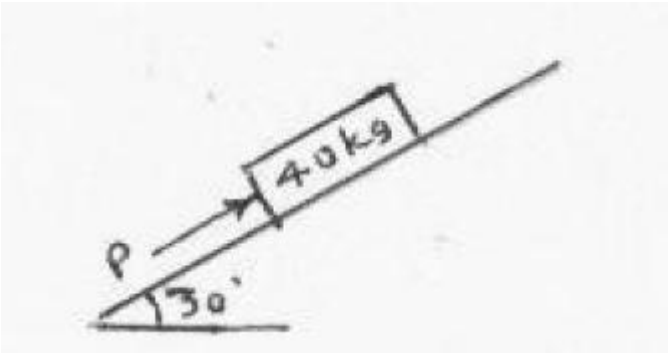
ASSIGNMENT 4
CG, MI AND FRICTIONS

SN	QUESTION	YEAR	MARK
1	Do as directed i) A 500 N vertical force is applied to a 60 cm long bar OA hinged at O and inclined at 60° to the horizontal as shown in Fig- 1, Determine *a)* The moment of the 500 N force about O *b)* The smallest force applied at A which gives the same moment about O *c)*At what distance from O, a vertical force of 1500 N force should be applied which gives the same moment about point O ii) What do you understand by a couple? Prove that the moment of couple does not depend upon the location of the point about which moments of the couple are taken. iii) Resolve 100 N force as shown in Fig along axis a-a and b-b. 	JAN 2011	9
2	Derive equation of centroid for a triangular lamina from its base.	JAN 2011, JUN 2013	4
3	Find the moment of inertia about the y-axis and x-axis for the area shown in Fig 	JAN 2011	6
4	A 100 N force acts as shown in Fig on a 300 N block placed on an inclined plane. The static and kinetic coefficients of friction between the block and the plane are 0.25 and 0.20 respectively. Determine whether the block is in equilibrium, and find the value of the friction force. 	JAN 2011	6

5	State Pappus Guldinus Theorem for surface of revolution.	DEC 2010, JUN 2012, APR 2014, APR 2016	3
6	Determine the location of centroid and moment of inertia of the given lamina in **FIG** about centroidal X axis. 	DEC 2010	5
7	A ladder 6 m long, rests on horizontal ground and leans against a smooth vertical wall making an angle of 200 with the wall. Its weight is 1000 N and it is on the point of sliding when a man weighing 500 N stands on it at a distance of 2.2 m from the foot of the ladder. Calculate the coefficient of friction.	DEC 2010, MAR 2009	5
8	Define Friction, Coefficient of friction and angle of repose.	DEC 2010	3
9	A 150 wedge 'A' is pushed to move block 'B' weighing 1200 N as shown in**FIG.** Determine the minimum force 'P' required to move the block if the coefficient of friction for all contact surfaces is 0.25. Neglect the self weight wedge. 	DEC 2014	7
10	Determine the location of centroid, IXX and IYY of lamina shown in **Fig.** 	MAR 2009	7
11	Find surface area of the glass to manufacture an electric bulb shown in **fig,** using first theorem of Pappu-Guldinus.	APR 2010	7

			
12	A 40kg mass is placed on the inclined plane, making 300 with horizontal, as shown in **fig.** A push P is applied parallel to the plane. If co-efficient of static fiction between the plane and the mass is 0.25, find the maximum and the minimum values of P between which the mass will be in the equilibrium. 	APR 2010	7
13	A ladder of length 4 m, weighing 200 N is placed against a vertical wall making an angle of 60o with the floor. The coefficient of friction between the wall and the ladder is 0.2 and that between floor and the ladder is 0.3. The ladder, in addition to its own weight, has to support a man weighing 600 N at a distance of 3 m from foot of ladder. Calculate the minimum horizontal force to be applied at foot of ladder to prevent slipping.	JUN 2012	7
14	Find the Moment of Inertia of a rectangular area about its centroidal x and y axis using the Parallel axis theorem.	JULY 2017	7
15	Differentiate between centroid and center of gravity.	JUN 2014, DEC 2015	4
16	Determine the second moment of area of a rectangular about an axis through the centroid and parallel to the base.	DEC 2008, JUN 2011, JUN 2012	7

ALPHA COLLEGE OF ENGINEERING AND TECHNOLOGY
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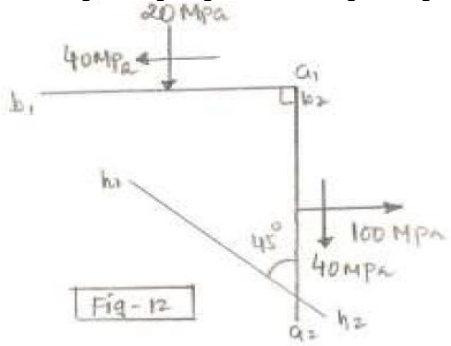
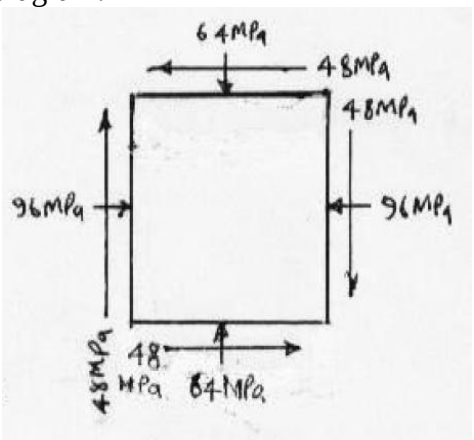
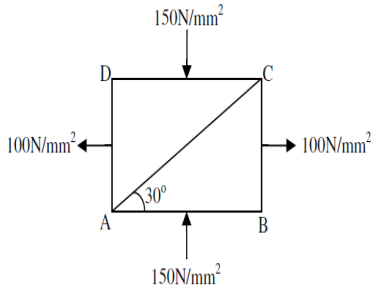
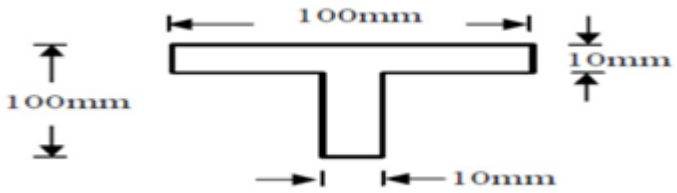
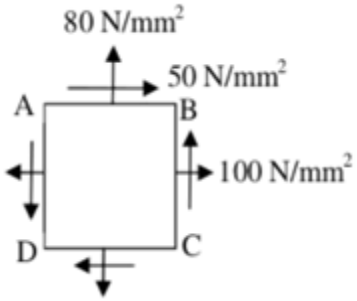
MECHANICS OF SOLIDS (2130003)
ASSIGNMENT 5
STRESSES IN BEAMS, PRINCIPAL STRESS ANS STRAINS

SN	QUESTION	YEAR	MARK
1	At a point in a strained material, the stresses are as shown in Fig on two perpendicular planes. Find principal planes and principal stresses. 	JAN 2011	6
2	Explain principal planes and principal stresses.	DEC 2010, JUN 2012	3
3	A simply supported beam of span 10m, having rectangular cross-section 150mm wide x 300mm deep subjected to uniformly distributed load of 20 kN/m. Compute the values maximum shear stress and bending stress produced in the beam.	MAR 2009	5
4	A point in two dimensional stressed bodY is shown in **fig.** Determine the magnitudes and directions of principal stresses, using analytical method or by Mohr circle diagram. 	MAR 2009	7
5	The direct stresses at a point in the strained material are 150 N/mm2compressive and 100 N/mm2 tensile as shown in **fig**. There is no shear stress. Find the normal and tangential stresses on the plane AC. Alsofind the resultant stress on AC. 	JUN 2012	7
6	Determine the Stress, Strain, Modulus of Elasticity and Poisson's Ratio	JULY 2011	7

	from the following results for a bar tested on UTM: Diameter= 20mm; Gauge length = 150 mm; Increase in Gauge length = 14mm; Decrease in diameter = 0.85 mm; Tensile load = 6 kN		
7	Write down the assumptions made in the theory of Pure Bending.Derive the equation of bending stress.	JULY 2011	3
8	Determine the maximum bending stress and draw bending stress distribution in a section as shown in **Fig.**, if it is subjected to a bending moment of 20kN-m. 	JUN 2009, APR 2010, MAR 2011	7
9	Prove that the maximum shear stress in a rectangular section of a beam is 1.5 times of average shear stress.	JUN 2012, DEC 2015	4
10	Explain Shear stress distribution for a beam section.	DEC 2008, JUL 2010, JAN 2013	4
11	Prove that the maximum shear stress in a circular section of a beam is 4/3 times of average shear stress	DEC 2013, JAN 2015	7
12	A solid steel circular shaft is required to transmit a torque of 6.5 kNm. Determine minimum diameter of the shaft, if shear stress is limited to 40 N/mm 2 and angle of twist should not exceed 0.5o per meter. Take Modulus of rigidity C = 85 Gpa.	DEC 2014	7
13	At a point in a strained material the state of stress is as shown in fig. Determine (i) location of principal planes (ii) principal stresses and (iii) maximum shear stress and location of plane on which it acts. 	SEP 2009, DEC 2015	7