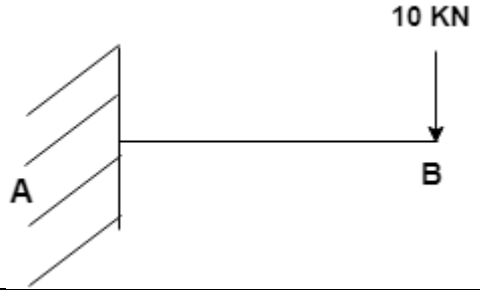
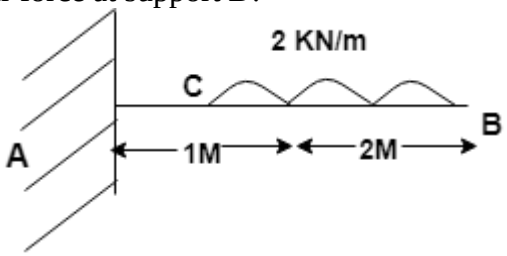
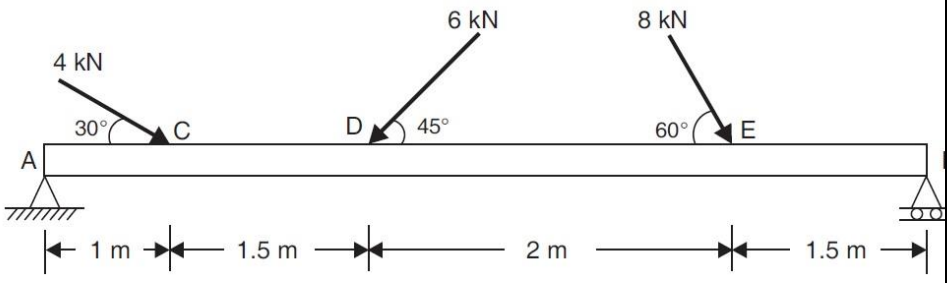
Name: Enrolment No:	UPES

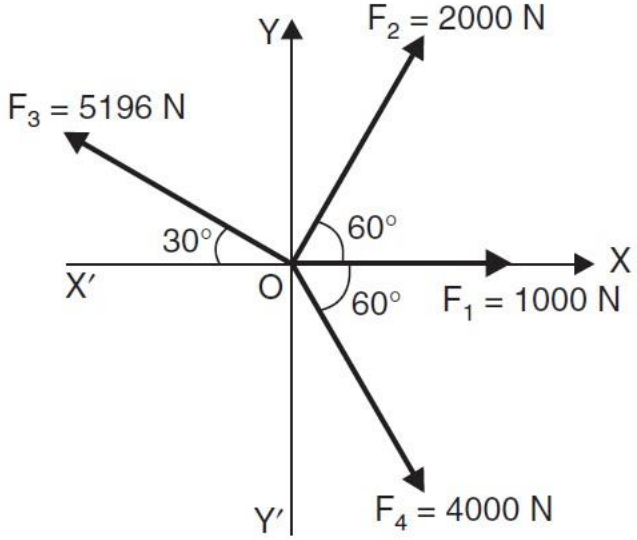
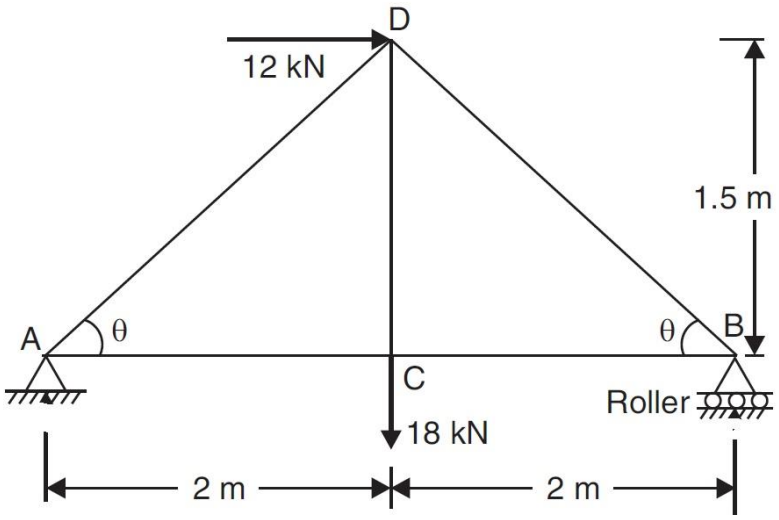
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2020

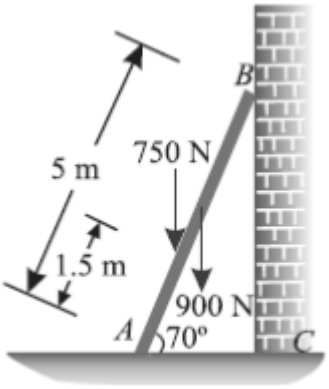
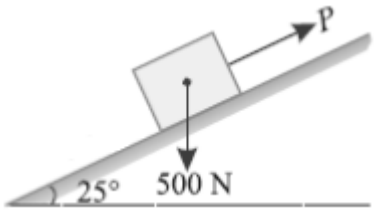
Course: B.Tech (ET) +LLB (IPR) **Semester: XII**
Course: Mechanics of Materials **Time: 03 hrs.**
Course code: GNEG 253 **Max. Marks: 100**
No. of pages: 1 **Instructions:**

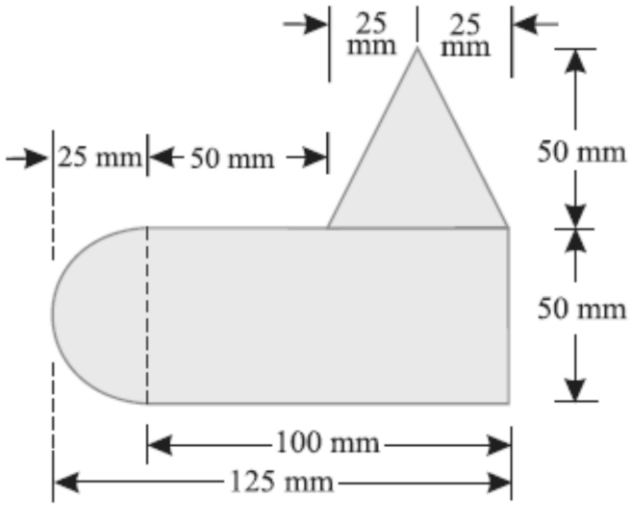
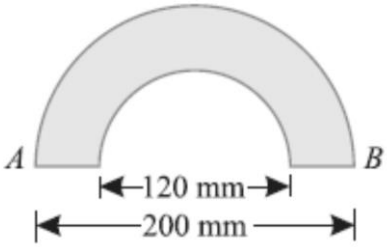
Q. No.	Question Statement	Answer
	Section A (15×2)	
1.	Moment of a force about a point is defined as, force multiplied by its _____ distance from the point. (a) Parallel (b) Perpendicular (c) Linear (d) None of the above	**(b) Perpendicular**
2.	The force system where multiple forces intersect each other at a single point is called (a) Parallel (b) Concurrent (c) Collinear (d) Non concurrent non parallel	**(b) Concurrent**
3.	The principle of transmissibility of forces states that (a) Force can be shifted to any other point in the body along its line of action. (b) Force can be shifted to any other point in the body regardless of its direction (c) Force can be shifted to any other point in the body in the opposite direction. (d) Force can be shifted to any other point in the body perpendicular to its line of action.	**(a)** Force can be shifted to any other point in the body along its line of action.
4.	The condition for a perfect truss having *m* members and *j* joints is (a) m = 2j + 3 (b) m = 3j – 2 (c) m = 2j – 3 (d) m = 3j + 2	**(c) m = 2j – 3**
5.	One of the assumptions used when analyzing a simple truss is that the members are joined together by _____ (a) Welding (b) Riveting (c) Bolting (d) Super glue	**(b) Riveting**

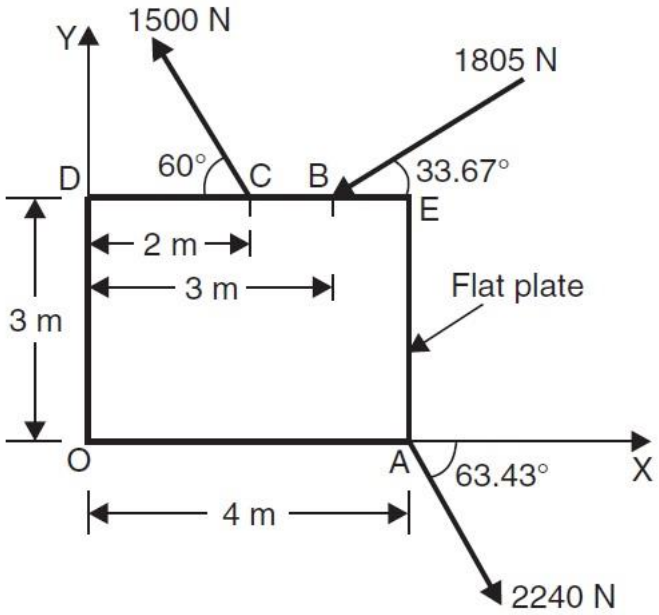
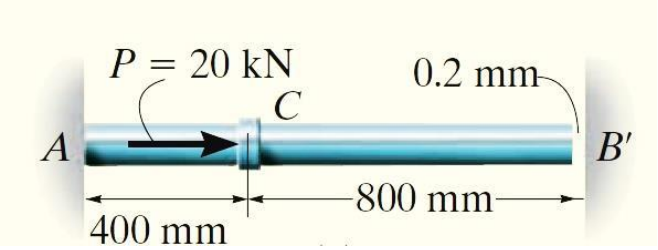
6.	Which of the following statement is correct? (a) The force of friction does not depend upon the area of contact (b) The magnitude of limiting friction bears a constant ratio to the normal reaction between the two surfaces (c) The static friction is slightly less than the limiting friction. (d) All of (a), (b) and (c)	**(d) All of (a), (b) and (c)**
7.	The force of friction always acts in a direction opposite to that (a) In which the body tends to move (b) In which the body is moving (c) Both (a) and (b) (d) None of the two	**(c) Both (a) and (b)**
8.	A circular hole of radius (r) is cut out from a circular disc of radius (2r) in such a way that the diameter of the hole is the radius of the disc. The centroid of the resulting plate lies at (a) Centre of a disc (b) Centre of the hole (c) Somewhere in the disc (d) somewhere in the hole	**(c) Somewhere in the disc**
9.	Q.4 The moment of inertia of a triangular section of base (b) and height (h) about an axis through its centroid and parallel to the base is given by the relation, (a) $\frac{bh^3}{12}$ (b) $\frac{bh^3}{24}$ (c) $\frac{bh^3}{36}$ (d) $\frac{bh^3}{48}$	**(c)** $\boldsymbol{\frac{bh^3}{36}}$
10.	Q.5 The moment of inertia of a circular lamina, diameter (d), about a centroidal axis lying in its plane is, (a) $\frac{\pi d^4}{16}$ (b) $\frac{\pi d^4}{64}$ (c) $\frac{\pi d^4}{32}$ (d) $\frac{\pi d^4}{96}$	**(b)** $\boldsymbol{\frac{\pi d^4}{64}}$
11.	What is the maximum shear force, when a cantilever beam is loaded with udl throughout? (a) w×l (b) w (c) w/l (d) w+l	**(a) w×l**
12.	What will be the variation in BMD for the diagram? [Assume l = 2m]. 	**(c) Triangular**

	(a) Rectangular (b) Trapezoidal (c) Triangular (d) Square	
13.	The stress in a rod is 70 N/mm^2 and the modulus of elasticity is 2 x 10^5 N/mm^2. What will be the strain in the rod? (a) 0.00052 (b) 0.00035 (c) 0.00030 (d) 0.00047	**(b) 0.00035**
14.	What is the shear force at support B?  (a) 5 kN (b) 3 kN (c) 2 kN (d) 0 kN	**(d) 0 kN**
15.	What is the bending moment at end supports of a simply supported beam? (a) Maximum (b) Minimum (c) Zero (d) Uniform	**(c) Zero**
	Section B (10×5)	
16.	Determine the support reactions at B for the beam as shown in Figure.  **(a)** R_B = 5.3 kN **(b) R_B = 6.3 kN** **(c) R_B = 7.3 kN** **(d) R_B = 8.3 kN**	**(c) R_B = 7.3 kN**
17.	Determine the magnitude and direction of the resultant of the forces acting on a point as shown in Figure.	**(a) R=145.46 N, θ = 35.10**

	 (a) **R=145.46 N, θ = 35.10** (b) **R=165.46 N, θ = 25.10** (c) **R=115.46 N, θ = 45.10** (d) **R=125.46 N, θ = 55.10**	
18.	Calculate the magnitude and nature of force in member CD.  (a) **28 kN (Compresive)** (b) **28 kN (Tensile)** (c) **18 kN (Tensile)** (d) **18 kN (Compressive)**	**(c) 18 kN (Tensile)**
19.	A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 meter from the bottom	**(a) 0.15**

	of the ladder. Calculate the coefficient of friction between the ladder and the floor.  (a) 0.15 (b) 0.20 (c) 0.25 (d) 0.30	
20.	A body of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the plane as shown below Determine the minimum value of P for which the equilibrium can exist if the angle of friction is 20°.  (a) 58.3 N (b) 32.8 N (c) 29.3 N (d) 46.4 N	**(d) 46.4 N**
21.	Locate the centroid of the plane area shown in figure below.	**(b) (71.1, 32.2)**

	 (a) (71.1, 56.1) (b) (71.1, 32.2) (c) (62.8, 32.2) (d) (62.8, 56.1)	
22.	A hollow semicircular section has its outer and inner diameter of 200 mm and 120 mm respectively as shown below. What is its moment of inertia about the base AB?  (a) 34.21×10^6 mm^4 (b) 45.16×10^6 mm^4 (c) 52.11×10^6 mm^4 (d) 66.46×10^6 mm^4	**(a) 34.21 × 10^6 mm^4**
23.	A uniformly distributed load of 20 kN/m acts on a simply supported beam of rectangular cross section of width 20 mm and depth 60 mm. What is the maximum bending stress acting on the beam of 5m? a. 5030 MPa b. 5208 MPa c. 6600 MPa d. 6200 MPa	**(b) 5208 MPa**
24.	A hollow shaft outside diameter 120 mm and thickness 20 mm. Find polar moment of inertia. a) 16.36 × 106 mm^4 b) 18.45 × 106 mm^4 c) 21.3 × 106 mm^4 d) 22.5 × 106 mm^4	**(a) 16.36 × 106 mm^4**

25.	A steel rod 10 mm in diameter and 1m long is heated from 20 to 100 degree celcius, E = 200 GPa and coefficient of thermal expansion is 12×10^{-6} per degree celcius. Calculate the thermal stress developed? a) 192 MPa(tensile) b) 212 MPa(tensile) c) 192MPa(compressive) d) 212 MPa(compressive)	**(c) 192MPa(compressive)**
	Section C (2×10)	
26.	Find the moment of the forces acting on a plate as shown in Figure about point O.  (a) 1778.12 Nm (b) 1234.34 Nm (c) 1445.33 Nm (d) 1659.55 Nm	**(d) 1659.55 Nm**
27.	The steel rod shown in Figure has a diameter of 10 mm. It is fixed to the wall at A, and before it is loaded there is a gap between the wall at and the rod of 0.2 mm. Determine the reactions at A and Neglect the size of the collar at C. Take *E* = 200 GPa.  (a) 13.55 (b) 14.68	**(c) 15.95 kN**

	(c) 15.95 (d) 16.88	