Name: Enrolment No:	UPES

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

Programme Name: B.Tech/Mechanical and ADE **Semester : VI**
Course Name : Strength of materials
Course Code : MECH 2012 **Max. Marks : 100**
Nos. of page(s) : 06
Instructions: Attempt all the questions as directed. Assume suitable data if missing.

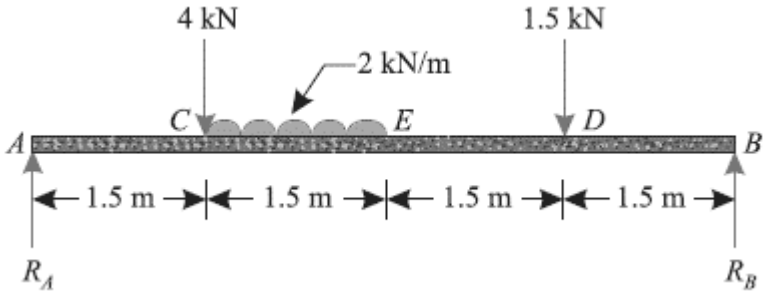
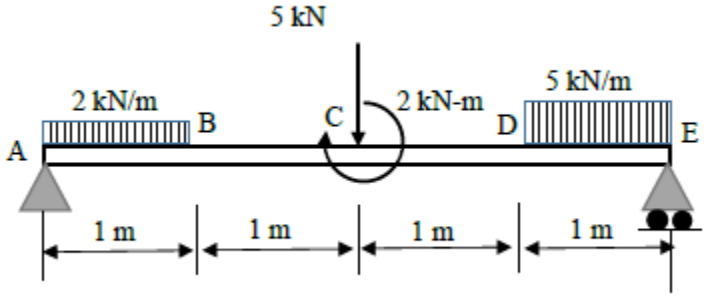
SECTION A

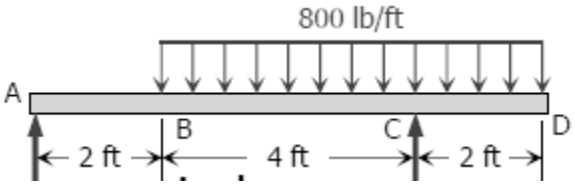
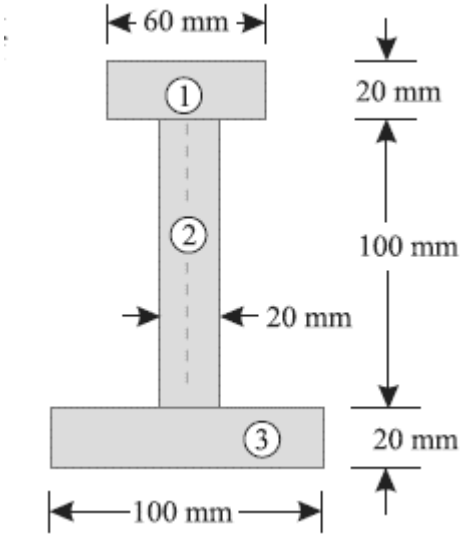
S. No.	MCQ	Marks	CO
1	The bending moment at end supports of a simply supported beam subjected to a couple of 200 N-m at both the supports will be; (a)Maximum (b) Zero (c) **200 N-m (d)** Nothing can be said		
2	Two identical circular rods of same diameter and same length are subjected to same magnitude of axial tensile force. One of the rods is made out of mild steel having the modulus of elasticity of 206 GPa. The other rod is made out of cast iron having the modulus of elasticity of 100 GPa. Assume both the materials to be homogeneous and isotropic and the axial force causes the same amount of uniform stress in both the rods. The stresses developed are within the proportional limit of the respective materials. Which of the following observations is correct; (a) Both rods elongate by the same amount (b) Mild steel rod elongates more than the cast iron rod (c) **Cast iron rod elongates more than the mild steel rod** (d) As the stresses are equal strains are also equal in both the rods		
3	A material has a Poisson's ratio of 0.5. If uniform pressure of 300 GPa is applied to that in one direction material, the volumetric strain of it will be; (a) 0.50 (b) 0.20 (c) 0.25 (d) **Zero**		
4	A block 100 mm x 100 mm base and 10 mm height. direct shear stress in the element, when a tangential force of 10 kN is applied to the upper edge to a displacement 1mm relative to lower face, will be; a) 1 Pa **b) 1 MPa** c) 10 MPa d) 100 Pa		
5	A steel bar 600 mm long and having 30 mm diameter, is turned down to 25 mm diameter for one fourth of its length. It is heated at 30 degree C above		

	room temperature, clamped at both ends and then allowed to cool to room temperature. If the distance between the clamps is unchanged, the maximum stress in the bar ($\alpha = 12.5 \times 10^{-6}$ per C and E = 200 GN/m^2) is a) 25 MN/m^2 b) 40 MN/m^2 c) 50 MN/m^2 **d) 75 MN/m^2**		
6	A steel rod 10mm in diameter and 1m long is heated from 20 to 100 degree Celsius, E = 200 GPa and coefficient of thermal expansion is 12 x10^{-6} per degree Celsius, if the rod expands freely thermal stress developed will be? a) 192 MPa (tensile) b) 212 MPa (tensile) c) 192MPa (compressive) **d) None of the above**		
7	Which one of the following is the correct statement? If for a beam *dM /dx=0* for its whole length, the beam is a cantilever: (a) Free from any load (b) Subjected to a concentrated load at its free end (c) **Subjected to an end moment** (d) Subjected to a udl over its whole span		
8	For a portion of beam, the pure bending takes place. For this portion of beam shear force will be; a) Constant b) Zero **c) Both a and b** d) None of the above		
9	The highest stress that a material can withstand for a specified length of time without excessive deformation is called: (a) Fatigue strength (b) Endurance strength (c) **Creep strength** (d) Creep rupture strength		
10	The torsional moment capacity of a circular shaft are compared by; **a) Polar modulus** b) Section modulus c) Moment of inertia d) Polar moment of inertia		
11	Which one of the following statements is correct? If a helical spring is halved in length, its spring stiffness (a) Remains same (b) Halves (c) **Doubles** (d) Triples		
12	A horizontal beam with square cross-section is simply supported with sides of the square horizontal and vertical and carries a distributed loading that produces maximum bending stress ‘S’ in the beam. When the beam is placed with one of the diagonals horizontal the maximum bending stress will be:		

	(a) 0.707S (b) S (c) 2S (d) **1.44S**		
13.	Two beams, one having square cross section and another circular cross-section, are subjected to the same amount of bending moment. If the cross sectional area as well as the material of both the beams are the same then; (a) Maximum bending stress developed in both the beams is the same (b) **The circular beam experiences more bending stress than the square one** (c) The square beam experiences more bending stress than the circular one (d) As the material is same both the beams will experience same deformation		
14	Which one of the following is represented by the area of the S.F diagram from one end upto a given location on the beam? (a) **B.M. at the location** (b) Load at the location (c) Slope at the location (d) Deflection at the location		
15	The radius of Mohre's circle for a rectangular block subjected to tensile stress of 200 N/mm^2 on both the direction will be; a) 100 N/mm2 b) 200 N.mm2 **c) Zero** d) Insufficient data		
16	The slop at fixed support will be; a) Maximum b) Minimum **c) Zero** d) None of the above		
17	For a linearly elastic, isotropic and homogeneous material, the number of elastic constants required to relate stress and strain is: (a) **Two** (b) Three (c) Four (d) Six		
18	A wooden beam of rectangular cross-section 10 cm deep by 5 cm wide carries maximum shear force of 2000 kg. Shear stress at neutral axis of the beam section is: (a) Zero (b) 40 kgf/cm^2 (c) **60 kgf/cm^2** (d) 80 kgf/cm^2		
19	In case of a beam of circular cross-section subjected to transverse loading, the maximum shear stress developed in the beam is greater than the average shear stress by: (a) 50% (b) **33%** (c) 25% (d) 10 %		
20	Consider the following statements: Two beams of identical cross-section but of different materials carry same bending moment at a particular section, then 1. The maximum bending stress at that section in the two beams will be same. 2. The maximum shearing stress at that section in the two beams will be same. 3. Maximum bending stress at that section will depend upon the elastic modulus of		

	the beam material. 4. Curvature of the beam having greater value of E will be larger. Which of the statements given above are correct? (a) **1 and 2 only** (b) 1, 3 and 4 (c) 1, 2 and 3 (d) 2, 3 and 4		
21	A steel shaft 'A' of diameter 'd' and length 'l' is subjected to a torque 'T' Another shaft 'B' made of aluminium of the same diameter 'd' and length 0.5*l* is also subjected to the same torque 'T'. The shear modulus of steel is 2.5 times the shear modulus of aluminium. The shear stress in the steel shaft is 100 MPa. The shear stress in the aluminium shaft, in MPa, is: (a) 40 (b) 50 (c) **100** (d) 250		
22	A solid circular rod AB of diameter D and length L is fixed at both ends. A torque T is applied at a section X such that AX = L/4 and BX = 3L/4. What is the maximum shear stress developed in the rod? (a) $16T/\pi D^3$ (b) $\mathbf{12T/\pi D^3}$ (c) $8T/\pi D^3$ (d) $4T/\pi D^3$		
23	A thin cylindrical shell is subjected to internal pressure p. The Poisson's ratio of the material of the shell is 0.3. Due to internal pressure, the shell is subjected to circumferential strain and axial strain. The ratio of circumferential strain to axial strain is: (a) 0.425 (b) 2.25 (c) 0.225 (d) 4.25		
24	A thin cylinder with both ends closed is subjected to internal pressure p. The longitudinal stress at the surface has been calculated as 'S'. Maximum shear stress at the surface will be equal to: (a) 2 S (b) 1.5 S (c) S (d) **0.5 S**		
25	Consider the following statements: In a thick walled cylindrical pressure vessel subjected to internal pressure, the Tangential and radial stresses are: 1. Minimum at outer side 2. Minimum at inner side 3. Maximum at inner side and both reduce to zero at outer wall 4. Maximum at inner wall but the radial stress reduces to zero at outer wall Which of the statements given above is/are correct? (a) 1 and 2 (b) 1 and 3 (c) **1 and 4** (d) 4 only		

SECTION B			
S. NO.	Assignment		**CO**
Q 1	A beam is loaded as shown in figure below. Compute; a. Deflection at point E and D. b. The maximum deflection c. Slop at end A and B 	**15**	**CO3**
Q 2	(a) A cylindrical shell is 3 m long; 1 m in diameter and the thickness of metal is 10 mm. It is subjected to an internal pressure of 150 N/cm^2. Calculate the change in dimensions of the shell and the maximum intensity of shear stress induced. Given E= 200 GPa and Poisson's ratio =0.3. (b) Two shafts of the same material and same lengths are subjected to the same torque. If the first shaft is of a solid circular section, the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts	**08** **07**	**CO2**
Q 3	(a) Starting thereon all the important values of shear force and bending moment, construct the shear force and bending moment diagrams for the beam loaded as shown in figure. State the position of points of inflexion on the beam if any.  (b) Draw the shear force and bending moment diagram for the beam loaded as shown in figure below. State the position of points of inflexion on the beam if any.	**08**	**CO4**

		**07**	
Q 4	A simply supported beam of 2-m span carries a uniformly distributed load of 200 KN/m over the whole span; the cross section of beam is an I- section with a top flange as 60 mm x 20 mm, bottom flange as 100 mm x 20 mm and the web as 100 mm x 20 mm. The overall depth of the section is 120 mm. Determine the maximum shear stress in the beam and draw the stress distribution over the depth of the section. Also, calculate the percentage of shear force that is carried by the web.  **OR**	**15**	**CO4**
Q. 5	At a point in a bracket, the stress on two mutually perpendicular planes are 100 N/mm^2 (tensile) and 50 N/mm^2 (tensile). The shear stress across the planes is 80 N/mm^2. Find using Mohr stress circle or otherwise calculate: a. Magnitude and direction of the resultant stress on plane making an angle of 20^0 with the plane of the first stress. b. Maximum shear stress and location of its plane. c. Principal stresses and the location of principal planes.	**15**	**CO3**