Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Third Semester

ME18304 – MECHANICS OF SOLIDS

(Mechanical Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Students will predict the behavior of the materials for different loading and support conditions.	3
CO 2	Students will select suitable cross sections for the beams under different loading conditions.	3
CO 3	Students will identify the methodology to find the deflections occurred in beams under different loading conditions.	3
CO 4	Students will select suitable dimensional parameters for the shafts under torsional loads and springs based on calculated stresses, deflection under different conditions.	3
CO 5	Students will determine the suitable dimensions for pressure vessels Given the loading conditions.	3

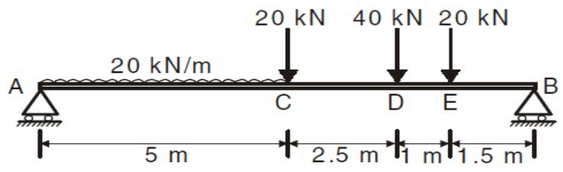
PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	What is the importance of factor of safety?	1	2
2.	A tapering rod has diameter d1 at one end and it tapers uniformly to a diameter d2 at the other end in a length L. If the modulus of elasticity is E, write the expression to find the change in length when subjected to an axial force P.	1	2
3.	What is meant by point of contraflexure?	2	2
4.	How to find the maximum bending moment in a loaded beam using Shear force diagram?	2	2
5.	Write the relation between bending moment and deflection at any section of a beam.	3	2
6.	What are the boundary conditions for a cantilever beam for finding deflection?	3	2
7.	Why hollow circular shafts are preferred when compared to solid circular shafts?	4	2
8.	Write any three types of springs used in engineering applications.	4	2
9.	A cylinder of Internal diameter 100 mm and external diameter 180 mm is filled with gas under pressure ‘p’. Write the expression used to find the Hoop stress for the cylinder?	5	2
10.	What will be the diameter of the Mohr’s circle if the stresses in x and y directions are 100 MPa (Tensile) and 100 MPa (Tensile) respectively?	5	2

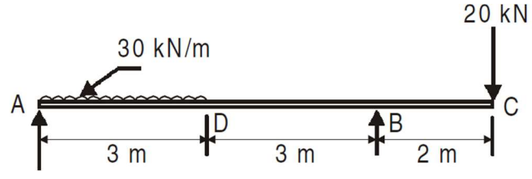
PART- B (5 x 14 = 70 Marks)

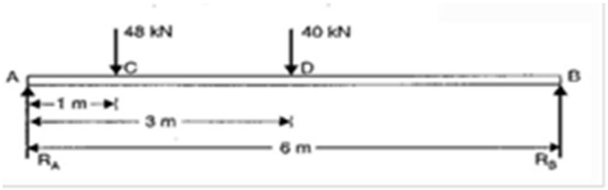
		Marks	CO	RBT LEVEL
11. (a)	A specimen of steel 20 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 80 kN and the load at elastic limit is 102 kN. The maximum load is 130 kN. The total extension at fracture is 56 mm and diameter at neck is 15 mm. Find (i) The stress at elastic limit. (ii) Young’s modulus. (iii) Percentage elongation. (iv) Percentage reduction in area. (v) Ultimate tensile stress.	(14)	2	2
	(OR)			
(b)	A steel cube block of 50 mm side is subjected to a force of 6 kN (Tension), 8 kN (Compression) and 4 kN (Tension) along x, y and z direction respectively. Determine the change in volume of the block. Take E as 200 GPa and Poisson’s ratio is 0.3.	(14)	2	2
12. (a)	Draw the SF and BM diagrams for the beam shown in figure and find out the position and the magnitude of maximum bending moment.	(14)	2	3



(OR)

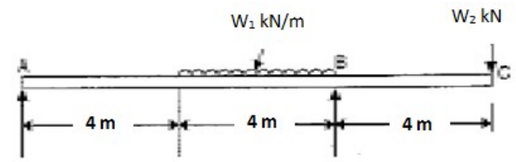
(b)	For the given beam, find the maximum bending moment and the position of point of contraflexure.	(14)	2	3



13. (a)	 For the given beam, find the position and magnitude of maximum deflection. Take E = 2 x 105 N/mm^2 and I = 40 x 106 mm^4.	**(14)**	**3**	**3**
	(OR)			
(b)	A simply supported beam of length 7m carries a point load of 10 kN at a distance of 4m from the left support. Using conjugate beam method, determine the slope at the left support and deflection under the point load. Take E = 2 x 105 N/mm^2 and I = 108 mm^4.	**(14)**	**3**	**3**
14. (a)	The propeller shaft of a large ship has outside diameter 350 mm and inside diameter 250 mm. The shaft is rated for a maximum shear stress of 62 MPa. (a) If the shaft is turning at 500 rpm, what is the maximum horsepower that can be transmitted without exceeding the allowable stress? (b) If the rotational speed of the shaft is doubled but the power requirements remain unchanged, what happens to the shear stress in the shaft	**(14)**	**4**	**3**
	(OR)			
(b)	A closely-coiled helical spring is to carry a load of 1 kN. Its mean coil diameter is to be 10 times that of wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 90 N/mm^2. Also find the number of coil, if the stiffness of spring is 20 N/mm deflection and the modulus of rigidity is 8.4 x 10^4 N/mm^2.	**(14)**	**4**	**3**
15. (a)	The stresses at a point in a component are 100 MPa (tensile) and 50 MPa (compressive). Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 25° with vertical axis. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress using analytical method and verify the same by graphical method.	**(14)**	**5**	**3**
	(OR)			

(b)	A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plates. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25.	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)
(Q.No.16 is compulsory)

		Marks	**CO**	**RBT LEVEL**
16.	 Find the deflection at point C of the given over hanging beam. Take E = 2 x 10^5 N/mm^2, I = 5 x 10^8mm^4, W_1 = 5kN/m & W_2 = 20kN.	**(10)**	**2**	**3**

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