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

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

Fourth Semester

CE18401 – STRENGTH OF MATERIALS - II

(Civil Engineering)

(Regulation 2018 / 2018A)

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

CO 1 Estimate strain energy and deflections of beams, trusses and frames using strain energy principles.
CO 2 Analyse indeterminate beams and draw Shear Force Diagram and Bending Moment Diagram
CO 3 Estimate the critical load of columns and stresses induced in thick and compound cylinders.
CO 4 Estimate the principal stresses and principal planes due to three dimensional states of stresses and also study the theories of failure in materials.
CO 5 Estimate the stresses due to unsymmetrical bending and stresses in curved beams.

PART- A(10x2=20Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	State the Castigliano's first theorem.	**1**	**1**
2.	Mention the strain energy stored in a cantilever beam subjected to a clockwise moment 'M' at the free end.	**1**	**3**
3.	Find the fixed support moment of a propped cantilever beam of span 'L', when it is subjected to a point load of 'W' at the centre?	**2**	**3**
4.	A fixed beam of span 'L' is subjected to UDL of W/m throughout the span. What are end moments?	**2**	**1**
5.	Give the parameters influencing buckling load of a long column.	**3**	**2**
6.	Write Lame's equations for stresses in thick cylinder.	**3**	**1**
7.	How do you find Deviatoric stress tensor of identity stress tensor?	**4**	**2**
8.	What is maximum shear stress theory of failure?	**4**	**1**
9.	State the reasons for unsymmetrical bending.	**5**	**2**
10.	Write the Winkler – Bach formula for a curved beam.	**5**	**1**

PART- B (5x 14=70Marks)

		Marks	CO	RBT LEVEL
11. (a)	A simply supported beam of 8 m span carries two point loads of 30 kN and 40 kN at 2 m and 4 m respectively from the left end. Find the deflection under 30 kN load. EI = 0.4 x 10^6 kNm^2.	**(14)**	**1**	**3**
	(OR)			
(b)	Find the vertical deflection of the joint C of the truss shown in the following figure 1. Cross sectional area of each member is 8 cm^2. E = 2× 10^5 MPa.	**(14)**	**1**	**3**

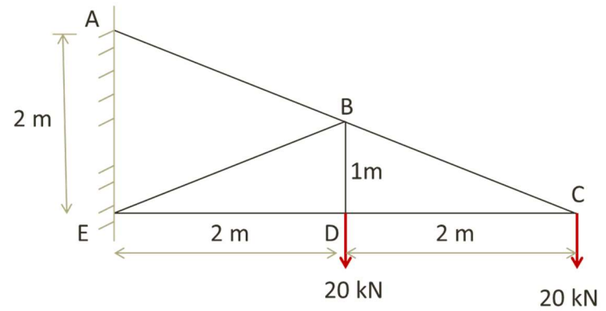

Figure 1

12. (a)	A fixed beam AB of span '3a' is loaded with two point loads W each at a distance 'a' from each support. Draw the B.M and S.F. diagrams.	**(14)**	**2**	**3**
	(OR)			
(b)	Draw B.M. and S.F. diagrams for a continuous beam loaded as shown in figure 2.	**(14)**	**2**	**3**

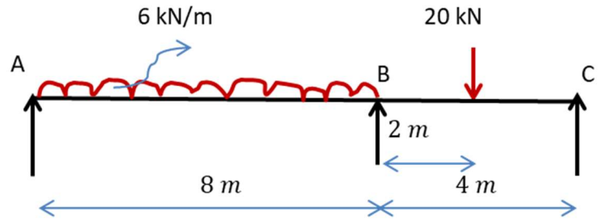

Figure 2

13. (a)	Calculate the crippling stress, using Euler's formula, for a pin-ended 2 m long strut consisting of a tube of 7.5 cm outside diameter and 2.5 mm wall thickness.	**(14)**	**3**	**3**

In compression test, a short length of this tube failed at a load of 315 kN and when tested as a strut with rounded ends, 2m long, it failed at a load of 174 kN. Find from these data the value of the constant in Rankine's formula. Take Young's modulus = 20 MN/cm^2.

(OR)

(b)	The internal and external diameters of a thick hollow cylinder are 8 cm and 12 cm respectively. It is subjected to an external pressure of 40 MPa when the internal is 120 MPa. Calculate the circumferential stresses at the external and internal surfaces and determine the radial and circumferential stresses at the mean radius. Plot the stresses on the thickness of cylinder as base.	**(14)**	**3**	**3**

14. (a)	With respect to the frame of reference oxyz, the following state of stress exists. Determine the principal stresses and their associated directions. $$\tau_{ij} = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$	**(14)**	**4**	**3**

(OR)

(b)	A shaft is subjected to a maximum torque of 12 kNm and a maximum bending moment of 8 kNm at a particular section. If the allowable equivalent stress in simple tension is 100 MN/m^2, find the diameter of the shaft according to the (i) Maximum shear stress theory (ii) Strain energy theory. (iii) Distortion energy theory Poisson's ratio = 0.3	**(14)**	**4**	**3**

15. (a)	A simply supported I-beam of 2 m span carries a central load of 4 kN. The load acts through the centroid, the line of action is inclined at 30° to the vertical direction as shown in the following figure 3. Determine the maximum stress.	**(14)**	**5**	**3**

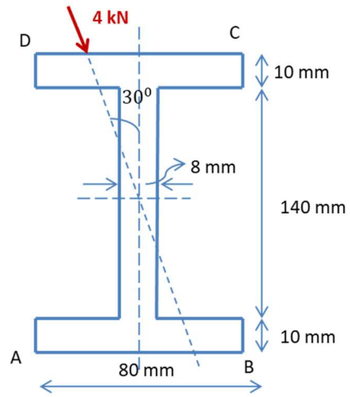

Figure 3

(OR)

(b)	A curved bar of rectangular section of 30 mm width, 40 mm depth and mean radius of curvature of 60 mm is initially unstressed. If a bending moment of 400 Nm is applied to the bar which tends to straighten it, determine the stresses at the inner and outer surface and sketch a diagram to show the variation of stress across the section. Also find the position of the neutral axis.	**(14)**	**5**	**3**

PART- C(1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MN/m^2. Also calculate increase in length, diameter and volume of the vessel. Take E= 200 GN/m^2 and Poisson's ratio = 0.3	**(10)**	3	3