Q. Code:986176

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

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

CE18301 – STRENGTH OF MATERIALS - I

(Civil Engineering)

(Regulation 2018/2018A)

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

COURSE OUTCOMES	STATEMENT	RBT LEVEL
	Upon successful completion of the course, the students should be able to	
CO 1	solve problems applying the fundamental concepts of stress, strain, principal stresses and principal planes in mechanics of solids and structures.	**3**
CO 2	analyse determinate beams and determine shear forces, bending moments and stresses in beams.	**3**
CO 3	analyse and determine slope and deflection of determinate beams using appropriate method	**3**
CO 4	design shafts to transmit required power and also design helical springs for its maximum energy storage capacities.	**3**
CO 5	analyze and determine the forces in the members of pin jointed plane truss.	**3**

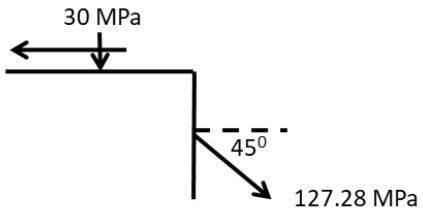
PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	A given material has young's modulus E, modulus of rigidity C and Poisson's ratio 0.25. Find the ratio of Young's modulus to modulus of rigidity?	**1**	**2**
2.	Write the elongation of a bar of uniformly tapering section due to self-weight.	**1**	**1**
3.	A cantilever beam of span 2.5 m carries point load of 10 kN at the free end. What are the values of shear force and moment at support?	**2**	**2**
4.	A rectangular section 30 mm x 40 mm is subjected to a shear force of 12 kN. What is the maximum shear stress setup in the beam?	**2**	**2**
5.	What is the advantage of Macaulay's method?	**3**	**1**
6.	Write the difference between real beam and conjugate beam.	**3**	**1**
7.	Write the relation for the torque and power, a solid shaft can transmit.	**4**	**1**
8.	Why hollow circular shafts are preferred when compared to solid circular shafts?	**4**	**2**
9.	In a pin jointed frame the number of members are 12 and number of joints are 7, then name this type of frame.	**5**	**2**
10.	Under what circumstances the method of section is preferred?	**5**	**1**

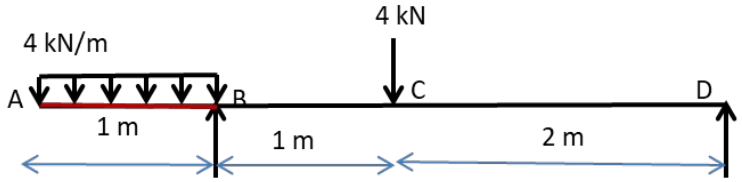
PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	An aluminium rod of 22 mm diameter passes through a steel tube of 25 mm internal diameter and a 3 mm thick. The rod and the tube are screwed together at the ends at a temperature of 150^0 C. Find the stresses in the rod and the tube when the temperature falls to 30^0 C. Assume modulus of elasticity for steel and aluminium as 200 kN/mm^2 and 70 kN/mm^2 respectively. The coefficient of contraction for steel is 12 x $10^{-6}/^0$C and for aluminium it is 23x$10^{-6}/^0$C.	**(14)**	**1**	**3**
	(OR)			
(b)	A state of stress in an element is shown in the figure. Determine the orientation of the principal planes, principal stresses and maximum shear stress.	**(14)**	**1**	**3**



Also determine the normal stress and shear stress on an oblique plane inclined at an angle of 30^0 with the major principal plane.

12. (a)	A 4 m long beam is shown in the following Figure. Find the reactions. Draw the SFD and BMD. Locate the point of contraflexure.	**(14)**	**2**	**3**



(OR)

(b)	An I-section with rectangular ends has the following dimensions. Flanges 100 mm x 10 mm and web 120 mm x 10 mm. If their section is subjected to a bending moment of 6 kNm and a shearing force of 5 kN, find the maximum tensile and shear stress on it.	**(14)**	**2**	**3**
13. (a)	A simply supported beam of 3 m span carries point loads of 120 kN and 80 kN at a distance of 0.6 and 2 metres respectively from the left hand support. If I for the beam = 16 x 108 mm^4 and E= 210 GN/m^2, find the deflection	**(14)**	**3**	**3**

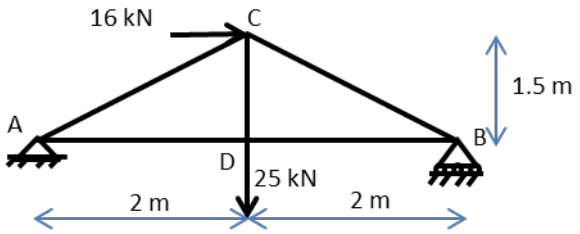
under loads.

(OR)

(b)	A simply supported beam of span 9 m carries a central concentrated load of 300 kN. The moment of inertia of the beam cross section is $2^{\times 10^5\ cm^4}$ for the central 3 m length and half this value for the remaining portion of the span. Find the deflection of the beam at the centre. E=210 kN/$^{mm^2}$.	**(14)**	**3**	**3**
14. (a)	A hollow shaft, having an internal diameter 50% of its external diameter, transmits 600 kW at 150 rpm. Determine the external diameter of the shaft if the shear stress is not to exceed 65 N/mm^2 and the twist in a length of 3 m should not exceed 1.4 degrees. Assume maximum torque 1.2 times the mean torque and modulus f rigidity = 1 x 10^5 N/mm^2.	**(14)**	**4**	**3**

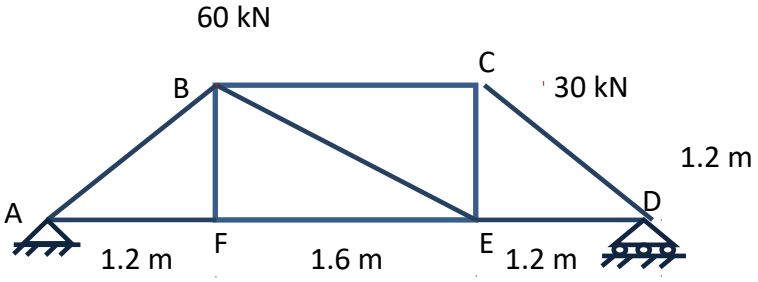
(OR)

(b)	A close-coiled helical spring made out of 8 mm diameter wire has 18 coils. Each coil is of 8 cm mean diameter. If the maximum allowable stress in the spring is 14 kN/cm^2, determine the maximum allowable load on the spring, the elongation of the spring and the total strain energy stored in the spring at that load. Also determine the rigidity of the spring. Take C= 82 GN/m^2.	**(14)**	**4**	**3**
15. (a)	Determine the forces in all the members of the truss shown in Figure.	**(14)**	**5**	**3**



(OR)

(b)	Determine the magnitude and nature of forces in the members AB, AF, BF, BE and FE of the frame shown in Figure.	**(14)**	**5**	**3**



PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A cantilever beam subjected to U.D.L of 'w' kN/m over a span of 'L/3' from the fixed end. Find the slope and defection at the free end using moment area method.	**(10)**	**3**	**3**