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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Civil Engineering

CE 6402 — STRENGTH OF MATERIALS

(Common to Fourth Semester Petrochemical Engineering and Third Semester Plastic Technology and Polymer Technology)

(Regulations 2013)

Time: Three hours

Maximum: 100 marks

Answer ALL questions.

PART A — $(10 \times 2 = 20 \text{ marks})$

- 1. A tensile load of 60 kN is gradually applied to a circular bar of 40 m diameter and 5 m long. If $E=2.0\times10^5$ N/mm², determine the strain energy absorbed by the rod.
- 2. State "principle of virtual work".
- 3. What are indeterminate beams? Give two examples.
- 4. Write the expression of theorem of three moment equation.
- 5. What are the causes of failure of a column?
- 6. What are the methods of reducing hoop stress in cylindrical shells?
- 7. Define stress tensor.
- 8. State Guest's theory.
- 9. Differentiate between symmetrical and unsymmetrical bending.
- 10. Write Winkler Bach formula and explain the terms.

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PART B - (5 × 13 = 65 marks)

11. (a) A tension bar 5 m long is made up of two parts, 3 metre of its length has a cross-sectional area of $10 \, \text{cm}^2$ while the remaining 2 m has a cross-sectional area of $20 \, \text{cm}^2$. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5 \, \text{N/mm}^2$.

Or

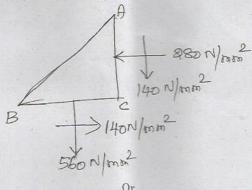
- (b) State and prove Maxwell's reciprocal theorem.
- 12. (a) A fixed beam AB of length 6 m carries point loads of 160 kN and 120 kN at a distance of 2 m and 4 m from the left end A. Find the fixed end moments, support reaction, and also draw B.M and S.F. diagrams.

Or

- (b) Draw the S.F and B.M diagram of a continuous beam ABC of length 10 m which is fixed at A and is supported on B and C. The beam carries a uniformly distributed load of 2 kN/m length over the entire length. The spans AB and BC are equal to 5 m each.
- (a) Derive an expression for crippling load when one end of the column is fixed and the other end is force.

Or

- (b) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm². Also sketch the radial pressure distribution and hoop stress distribution across the section.
- 14. (a) At a point in a strained material, on plane BC there are normal and shear stresses of 560 N/mm² and 140 N/mm² respectively. On plane AC, perpendicular to plane BC, there are normal and shear stresses of 280 N/mm² and 140 N/mm² respectively as shown in Fig. below, Determine the following:
 - (i) Principal stresses and location of the planes on which they act.
 - (ii) Maximum shear stress.



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	(b)	According to the theory of maximum shear stress, determined diameter of a bolt which is subjected to an axial pull of 9 kN with a transverse shear force of 4.5 kN. Elastic limit in the 225 N/mm ² , factor of safety = 3 and Poisson's ratio = 0.3.	together			
15.	(a)	A beam of T-section (flange: $100 \text{ mm} \times 20 \text{ mm}$; web: $150 \text{ mm} \times 10 \text{ mm}$) is $2.5 \text{ metres in length and is simply supported at the ends. It carries a load of 3.2 \text{ kN} inclined at 20^{\circ} to the vertical and passing through the centroid of the section. If E = 200 \text{ GN/m}^2, calculate:$				
		(i) Maximum tensile and compressive stress				
		(ii) Position of the neutral axis.				
		Or				
	(b)	Derive the value of 'h2' for a triangular section of a curved bar.				
		PART C — (1 × 15 = 15 marks)				
16.	(a)	Explain the following:				
	(3)	(i) Principle of virtual work.	/E\			
		(ii) Castigliano's theorems.	(5)			
		(iii) Strain energy due to torsion.	(5)			
		with chergy and worston.	(5)			
		Or				
	(b)	Explain the following:				
		(i) The failure of short columns under compression.	(7)			
		(ii) Distortion energy theories.	(8)			
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