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**Question Paper Code: 94103**

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Civil Engineering

19UCE403- Strength of Materials

(Regulations 2019)

Duration: Three hours

Maximum: 100 Marks

PART A - (5x 1 = 5 Marks)

Answer All Questions

- Slenderness ratio of a column is defined as the ratio of its CO1- R  
(a) Least radius of gyration (b) Least lateral dimension  
(c) Maximum lateral dimension (d) Maximum radius of gyration
- In simply supported beam deflection is maximum at \_\_\_\_\_ CO1- U  
(a) Midspan (b) Supports (c) Point of loading (d) Through out
- Which structure will perform better during earthquake? CO1- U  
(a) Statically determinate (b) Statically indeterminate  
(c) Both a and b (d) Depends upon magnitude of earthquake
- If the Euler's load for steel column is 100kN, and the failure load is 125kN, the Rankine's load is equal to CO3- App  
(a) 125kN (b) 155.5kN (c) 55.5kN (d) 60.5kN
- For  $\sigma_1 = \sigma_2 \neq \sigma_3$  and  $\sigma_3 = 0$ , what is the physical boundary for Rankine failure theory? CO1- U  
(a) A rectangle (b) An ellipse (c) A square (d) A parabola

PART – B (5 x 3= 15Marks)

- A simply supported beam of span length carries udl of 1.5kN/m. Determine maximum bending moment. CO2- App
- Explain the Theorem for conjugate beam method? CO1- U

8. Define statically indeterminate beams. CO1- U
9. 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. Determine The ratio of circumferential strain to axial strain. CO3-App
10. Define Shear centre CO1- R

PART – C (5 x 16= 80Marks)

11. (a) A Simply supported beam of length 6 m, carries point load of 3 kN and 6 kN at distance of 2 m and 4 m from the left end. Draw the shear force and bending moment diagram for the beam . CO2-App (16)
- Or
- (b) A rectangular beam 120mm wide and 300mm deep is simply supported over a span of 4m. What udl the beam may carry if the bending stress is not to exceed 120Mpa. The width of the beam is 120mm. CO2-App (16)
12. (a) A simply supported beam of span 9m carries two point loads 210kN & 125kN at 2m and 6m from left support. The self weight of beam is 26kN/m. Determine max slope and deflection at the center. EI is a constant. CO2-App (16)
- Or
- (b) A simply supported beam of span 6m is subjected to a concentrated load of 45 KN at 2m from the left support. Calculate the deflection under the load point. Take  $E=200 \times 10^6 \text{ N/mm}^2$  and  $I=14 \times 10^{-6} \text{ m}^4$  CO2-App (16)
13. (a) A fixed beam AB of length 6m carries point loads of 160 KN and 120 KN at a distance of 2m and 4m from the left end A. Find the fixed end moments and the reactions at the supports. Draw B.M and S.F diagrams CO2-App (16)
- Or
- (b) A continuous beam ABCD 20 m long is fixed at A, simply supported at D and carried on the supports B and C at 5 m and 12 m from the left end A. It carries two concentrated loads of 80 kN and 40 kN at 3 m and 8 m respectively from A and uniformly distributed load of 12 kN/m over the span CD. Analyse the beam by theorem of three moments and draw the shear force and bending moment diagrams. CO2-App (16)

14. (a) A Steel bar of rectangular section 40mm X 50mm pinned at each end is subjected to axial compression. The bar is 2m long. Determine the buckling load and the corresponding axial stress using Euler's formula. Also calculate slenderness ratio if the proportional limit of the material is 200N/mm<sup>2</sup>. Take  $E=2 \times 10^5 \text{ N/mm}^2$  CO3- App (16)

Or

- (b) A closed cylindrical pipes carries liquid with a pressure of 3 N/mm<sup>2</sup>, diameter of the pipe is 250mm and length of pipe is 750mm. Determine circumferential stress and longitudinal stress developed in the cylinder. Also calculate change in diameter, change in length, change in volume. Thickness is 3mm.  $E=2.1 \times 10^5 \text{ N/mm}^2, \mu = .286$ . CO3- App (16)

15. (a) Determine the position of the shear centre for a channel section of 120 mm x 120 mm outside and 10 mm thick. CO3-App (16)

Or

- (b) A beam of T-section (flange: 100 mm X 20 mm; web: 50mm X 10mm) is 2.5 meters in length and is simply supported at the end. It carries a load of 3.2 kN inclined at 20° to the vertical and passing through the centroid of the section. CO3-App (16)

