19/05/14 (N) AN

G 509 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Civil Engineering

CE 010 403—MECHANICS OF SOLIDS—II (CE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is conjugate beam ? Draw the conjugate beam for simply supported beam.
2. State and explain the Maxwell's reciprocal theorem. Why it is called law of reciprocal deflections ?
3. Why are influence lines for statistically determinate beams invariably made of straight lines ?
4. What are the differences in behaviour between the saddle support and the pulley support provided at the top of the pylon in a cable suspended bridge ?
5. Define principal planes and principal stresses.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Show how the moment area method and the conjugate beam method are closely related to each other.
7. Derive the equation for the strain energy due to bending.
8. Under uniformly distributed loading in a simply supported beam, the shear force at the mid-span location is zero, under dead load, but not under live load. Is this statement true or false ? Explain.
9. What are the advantages of providing internal hinge in the middle of the stiffening girder ? Explain.
10. Obtain an expression for the maximum principal stress on an oblique section of a rectangular body, when it is subjected to a direct stress in one plane only.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. A horizontal beam AB is freely supported at A and B, 8 m apart and carries a uniformly distributed load of 15 kN/m run (including its own weight). A clockwise moment of 160 kN-m is applied to the beam at a point C, 3 m from the left hand support A. Calculate the slope of the beam at C. Given EI = 40,000 kN-m^2.

Or

12. A beam of length l is simply supported at the ends and carries a concentrated load W at a distance a from each end. Find the slope at each end and under each load. Also find the deflection under each load and at the centre.

13. A mild steel bar 100 mm diameter is bent as shown in fig 1. It is fixed horizontally at A and a load of 500 N hangs at D. Draw the bending moment diagram for the parts AB, BC and CD indicating the maximum values. Find the maximum bending stress. Also find the deflection at D. Take E = 2×10^5 N/Mm^2.

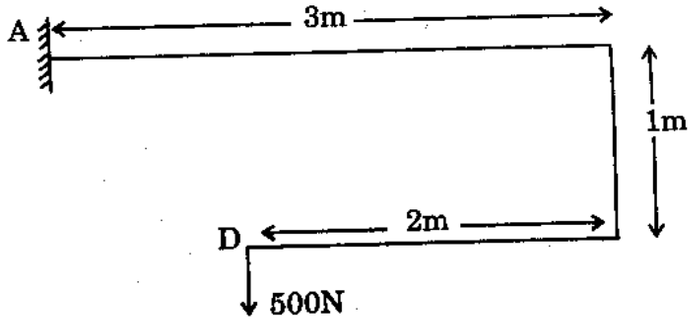

Figure. 1

Or

14. Find the vertical deflection of A of the structure shown in fig 2. All members have the same sectional area.

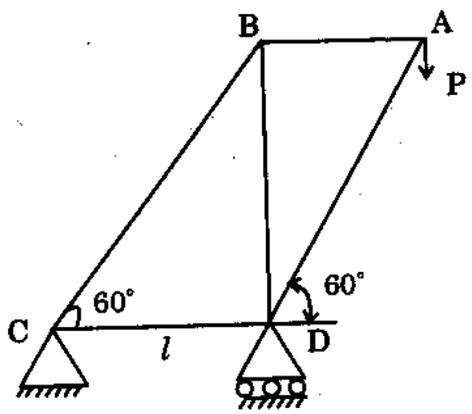

Figure. 2

15. A uniformly distributed live load of 60kN/m run, of length 5 meters moves on a girder of span 16 meters. Find the maximum shear force and bending moment at a section 6 meters from the left end. Also calculate the maximum shear force and absolute maximum bending moment.

Or

16. The load system shown in fig 3 below moves from right to left along a girder of span 20 meters. Find the maximum shear force at a section 7.5 meters from the left end.

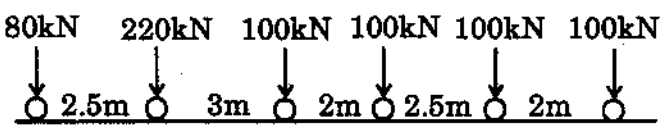

Figure. 3

17. A three-hinged parabolic arch of span 20 meter and rise 4 meter carries a uniformly distributed load of 20 kN/m run on the left half of the span. Calculate the maximum bending moment for the arch.

Or

18. Three-hinged stiffening girder of a suspension bridge of span 120 m is subjected to two point loads of 240 kN and 300 kN at distances 25 m and 80 m from the left end. Find the shear force and bending moment for the girder at a distance of 40 m from the left end. The supporting cable has a central dip of 12 m. Also find the maximum tension in the cable and draw the BM diagram for the girder.

19. A rectangular block of material is subjected to a tensile stress of 100 N/mm^2 on one plane and a tensile stress of 50 N/mm^2 on a plane at right angles, together with shear stresses of 60 N/mm^2 on the same planes. Find

    (a) the direction of the principal planes ;

    (b) the magnitude of the principal stresses ; and

    (c) the magnitude of the greatest shear stress.

Or

20. A beam 3 m long of I-section is freely supported at its ends with the web vertical. It carries concentrated loads of 100 kN. at 0.6 m. from each end. The flanges are each 150 mm wide and 25 mm thick, the overall depth being 400 mm. The thickness of the web is 12.5 mm. Calculate the principal stresses and the maximum shearing stress in a section of the beam where the bending moment and shearing force, both have maximum values.

(5 × 12 = 60 marks)