KUMARAGURU
college of technology
character is life

Register Number: ……..

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Fourth Semester

CIVIL ENGINEERING

CEE107: Strength Of Materials

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. A rectangular block of size 200mm x 100mm x 50mm is subjected to a shear stress of 100 N/mm^2. If modulus of rigidity of material is 1 x 10^5, strain energy stored will be
   a) 10 NM b) 25 NM
   c) 50 NM d) 100 NM
2. The castigliano's second theorem can be used to compute deflections.
   a) In statically determinate structures only b) For any type of structure.
   c) At the point under the load only. d) For beams and frames only
3. A beam of length 6 metres carries a point load 120 kN at its centre. The beam is fixed at both ends. The fixing moments at the end is.
   a) 40 kNM b) 90 kNM
   c) 120 kNM d) 150 kNM
4. Three moment theorem for continuous beams was forwarded by
   a) Bernoulli b) Clapeyron
   c) castigliano d) Rankine.
5. The diameter of kern of a circular cross section of diameter d is
   a) d/2 b) d/3
   c) d/4 d) 2d/3
6. Rankine's formula takes into account which of the following.
   a) The effect of slenderness ratio b) Initial curvature of column.
   c) Shape of the column d) The effect of direct compressive stress
7. The ratio between change in volume and original volume of a body is called
   a) Thermal strain b) Shear strain
   c) Volumetric strain d) Compressive strain

8. Maximum principal stress theory is suitable for

   a) Brittle materials b) Ductile materials

   c) Both brittle and ductile material d) Elastic material

9. In an I –section, symmetrical about XX and YY axis, shear centre lines at

   a) Centroid of the top flange b) Centroid of the web

   c) Centroid of the bottom flange d) Outside the section.

10. The variation of bending stress in a curved beam is

   a) Linear b) Parabolic

   c) Uniform d) hyperbolic

PART B (10 x 2 = 20 Marks)

11. Define strain energy density.
12. State the principle of virtual work
13. A cantilever of length 6m carries a point load of 50kN at its centre. The cantilever is propped rigidly at the free end. Determine the reaction at the rigid prop.
14. State the theorem of three moments
15. What is meant by core of section?
16. Distinguish between thin and thick clinder.
17. What is meant by stress tensor?
18. State principal stress theory
19. What are the reasons for unsymmetrical bending?
20. When the load passes through shear centre what effect will be produced in the cross section?

PART C (5 x 14 = 70 Marks)

21. a) (i) A rectangular block of 100 mm^2 base area and 12mm height is fixed on its bottom and subjected to a shear force of 1kN on its top surface. Calculate the strain energy stored in the block and the modulus of resilience. Take C = 0.8 x 10^5 N/mm^2. (4)

   (ii) A simply supported beam of span '*l*' carries a concentrated load P at a distance 'a' from left hand support as shown in fig.1. Using castigliano's theorem determine the deflection under the load. Assume uniform flexural rigidity. (10)

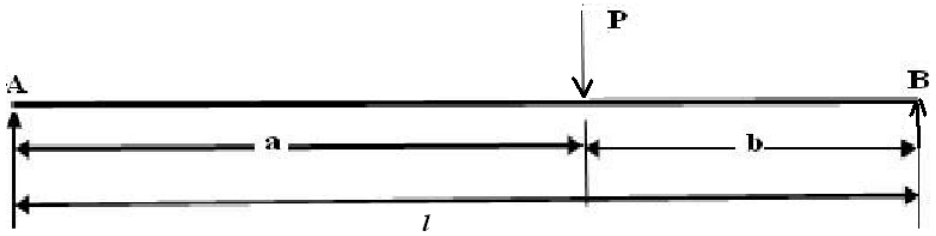

Fig.1

(OR)

b) Determine the deflection at the free an of the overhanging beam shown in fig.2 by unit load method.

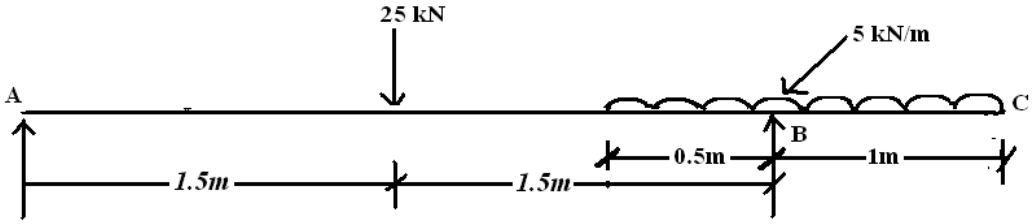

Fig.2

22. a) A fixed beam of span 10m is loaded with UDL of 15 kN/m for a length of 3m starting at a point 2m from the left end. A concentrated load 20 kN at 3m from left end and a load of 30kN at 3m from the right end are acting on the beam. Analyse the beam and draw shear force and bending moment diagrams. EI is constant.

(OR)

b) A continuous beam ABC is fixed at A and simply supported at B and C. AB = 10m and BC = 6m. EI is constant. AB is subjected to UDL 5 kN/m and BC is subjected to concentrated load 10 kN at mid span. Using theorem of three moments, Calculate the support moments an draw the bending moment diagram.

23. a) (i) A short column of rectangular section 160mm x 120mm carries a load of 200 kN. This load point is at a point 40mm from the longer side and 70mm from the shorter side. Determine the maximum tensile and compressive stresses in the section. (7)

(ii) Calculate the safe compressive load on a hollow cast iron column of 150 mm external diameter, 100 mm internal diameter and 10m length. The column is fixed at one end and hinged at other end. Use Euler's formula with a factor of safety of 5 and E = 100 GN/m^2. (7)

(OR)

b) A compound cylinder formed by shrinking one tube to another is subjected to an internal pressure of 100 MN/m^2. Before the fluid is admitted the internal and external diameters of the compound cylinder are 180mm and 300 mm respectively and the diameter at the junction is 240mm. If after shrinking on, the radial pressure at the common surface is 10 MN/m^2, determine the final stresses developed in the compound cylinder.

24. a) In a triaxial stress system the six components of the stress at a point are given below.

σ_x = 60 N/mm^2; σ_y = 50 N/mm^2 ; σ_z = -10 N/mm^2

ζ_{xy} = 30 N/mm^2; ζ_{yz} = 20 N/mm^2 ; ζ_{zx} = 10 N/mm^2.

Find the principal stresses and maximum shear stress.

(OR)

b) Principal stresses at a point in an elastic material are 100 MPa tensile, 50 MPa tensile and 25 MPa compressive. Determine the factor of safety against failure based on various theories. The elastic limit in simple tension is 220 MPa and Poisson's ratio 0.3.

25. a) A beam of T – section (flange -100mm x 20mm; web – 150mm x 10mm) is 3 meters in length and is simply supported at the ends. It carries a concentrated load of 4 kN at mid span inclined at 20^o to the vertical and passing through the centroid of the section. If E = 200 GN/m^2, calculate (i) Maximum tensile stress; (ii) maximum compressive stress (iii) position of neutral axis.

(OR)

b) A curved bar of rectangular section of 30mm width, 40mm depth and mean radius of curvature of 60mm 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 surfaces and sketch a diagram to show the variation of stress across the section. Also find the position of neutral axis.

****