C

Reg. No. :

Question Paper Code: 53103

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

Third Semester

Civil Engineering

15UCE303 - MECHANICS OF SOLIDS - I

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Poisson's ratio is defined as ratio of   CO1 R

   (a) linear stress / Linear strain   (b) lateral stress / longitudinal strain

   (c) Longitudinal strain/ Lateral strain   (d) lateral strain/ Longitudinal strain

2.   A body is subjected to a tensile stress of 1200 MPa on one plane and   CO2- App
   another tensile stress of 600 MPa on a plane at right angles to the
   former. It is also subjected to a shear stress of 400 MPa on the same
   planes. The maximum normal stress will be

   (a) 400 MPa   (b) 500 MPa   (c) 900 MPa   (d) 1400 MPa

3. Which of the following statements is false about frame/truss?   CO3-U

   (a) Bent member is never used in a truss

   (b) Internal hinges are used to connect members in a truss

   (c) All members in the truss are two force members

   (d) Multiforce members can be used in a frame

4. What do you meant by point of contra flexure?   CO4- R

   (a) It is the point of maximum bending stress   (b) It is the point of zero bending stress

   (c) It is the point of maximum shear stress   (d) It is the point of minimum shear force

5. Two closely coiled helical springs 'A' and 'B' are equal in all respects but   CO5- App
   the number of turns of spring 'A' is half that of spring 'B' The ratio of
   deflections in spring 'A' to spring 'B' is

   (a) 1/8   (b) 1/4   (c) 1/2   (d) 1

6. Determine the total elongation of the bar shown in the figure. The bar has a uniform cross section of 1000 mm^2 and E = 2 x10^8 kN/m^2.   CO1 App

100 kN → | | → 160 kN   140 kN ← | | ← 120 kN

← 500 mm → ← 1000 mm → ← 500 mm →
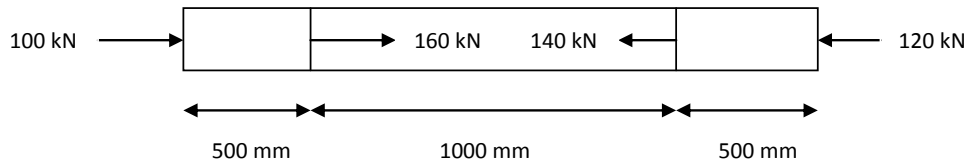
7. How will you find major principal stress and minor principal stress? Also mention how to locate the direction of principal planes.   CO2 R

8. Differentiate between determinate and indeterminate structures.   CO3 R

9. Define shear force and bending moment.   CO4 R

10. A close coil helical spring has a radius of 100 mm and is made of 10 mm diameter wire consisting of 10 turns. If modulus of rigidity is 0.22x10^5 N/mm^2 determine the deflection if it is subjected to a compressive load of 5 kN.   CO5 App

PART – C (5 x 16= 80Marks)

11. (a) A reinforced concrete column 500 mm × 500 mm in a section is reinforced with 4 steel bars of 25 mm diameter; one in each corner, the column is carrying a load of 1000 KN. Find the stress in the concrete and steel bars. Take E for steel = 210×10^3 N/mm^2 and E for concrete = 14×10^3 N/mm^2 CO1- App   (16)

Or

(b) The following data refers to an bar subjected to a tensile test: CO1- App   (16)
Diameter of the bar = 30mm, Tensile load = 54kN
Gauge length = 300mm, Extension of the bar = 0.112 mm
Change in diameter = 0.00366,
Calculate passions ratio and values of three modulii.

12. (a) A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 200 MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100 MPa. Determine the principal stresses and their directions. Also, find maximum shear stress.   CO2- App   (16)

Or

(b) a point in a strained material the principal stresses are 90 MPa tensile and 60 MPa compressive. Calculate: CO2- App   (16)
(i) The normal and shearing stresses on a plane at an angle 55^0 to the axis of tensile stress.
(ii) The resultant stress.
(iii) Maximum shear stress.
Inclination of the plane on which the normal stress is zero and the magnitude of the shear stress.

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13. (a) A truss of 12 m span is loaded as shown in the figure. Determine   CO3- Ana   (16)
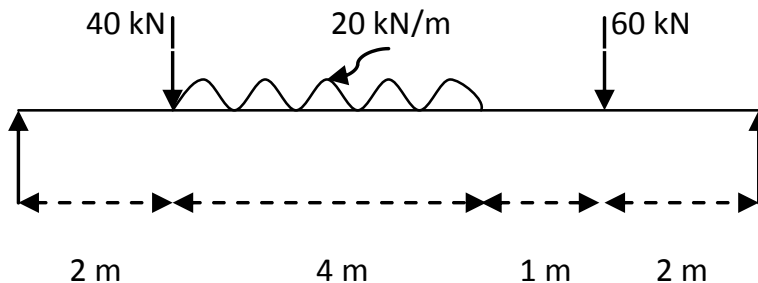the forces in the members of the truss by method of joints.
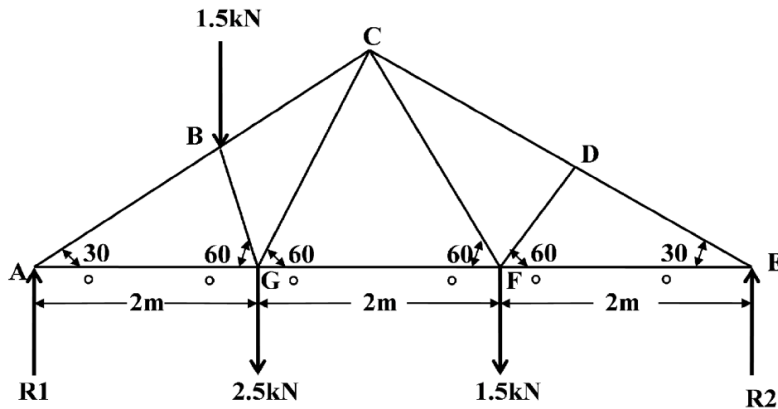
Or

(b) Determine the forces in all members of a cantilever truss as   CO3- Ana   (16)
shown in figure below.
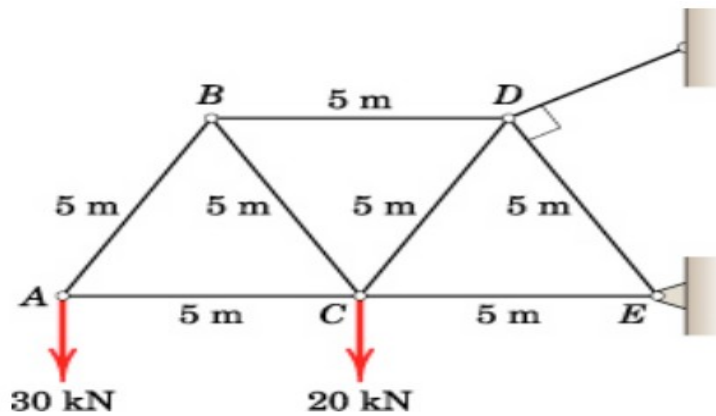
14. (a) Draw the bending moment and shear force diagram of the beam   CO4 App   (16)
shown in the figure and locate the point of maximum moment as
well find its magnitude.

Or

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(b) A timber beam of rectangular cross section of length 8 m is simply supported. The beam carries a UDL of 2 kN/m run over the entire length and a point load of 10 kN at 3 m from the left support. If the depth is twice the width and the bending stress in the timber is not to exceed 8 N/mm2, find the suitable dimensions of the section. CO4 App (16)

15. (a) A hollow steel shaft 3m long must transmit a torque of 25kNm. The total angle of twist in this length is not to exceed 2.5^0 and the allowable shearing stress is 90MPa. Determine the inside and outside diameter of the shaft if $G = 85$GPa. CO5 App (16)

Or

(b) A railway wagon weighing 50 kN and moving at a speed of 10 km/hour is to be stopped by a buffer of 4 springs whose allowable maximum compression is 150 mm. Find out the number of turns of each spring if the diameter of the spring wire is 14 mm and the diameter of the coil   100 mm. Assume modulus of rigidity as 1 $x10^5$ N/mm^2. CO5 App (16)