A   Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code: R5A02

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Fifth Semester

Agricultural Engineering

R21UAG502– STRENGTH OF MATERIALS FOR AGRICULTURE

(Regulations R2021)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The diameter of the steel bar is 20 mm find the sectional area   CO2- App

(a) 620 mm^2 (b)314 mm^2 (c)1140 mm^2 (d) 320 mm^2

2. The ratio of change in length to original length is called   CO1- U

(a) Stress   (b)modulus of elasticity

(c) factor of safety   (d) strain

3. A frame in which all member not lie in a single frame is called   CO1- U

(a) Plain frame   (b) Space frame   (c) deficient frame   (d) redudant frame

4. If the m=5 and the no of joints is 3 then it is called   CO1- U

(a) Plain frame   (b) Space frame

(c) deficient frame   (d) redudant frame

5. SI units of shear force is _____   CO1- U

(a) kN/m   (b) kN-m   (c) kN   (d) m/N

6. In bending moment diagram, if no load acts between two sections, then it is   CO1- U
    represented by _____

(a) horizontal line   (b) inclined line

(c) vertical line   (d) all of the above

7. When two shafts of same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal   CO1- U

   (a) polar moment of inertia   (b) polar modulus

   (c) diameter   (d) angle of twist

8. Torque transmitted by a solid shaft of diameter (d), when subjected to shear stress (τ) is equal to   CO1- U

   (a) $\dfrac{\pi}{32} \times \tau \times d^4$ (b) $\dfrac{\pi}{16} \times \tau \times d^3$ (c) $\dfrac{\pi}{16} \times \tau \times d^4$ (d) $\dfrac{\pi}{32} \times \tau \times d^2$

9. The point at which the deviation of centre is called   CO1- U

   (a) Eccentricity   (b) centre   (c) straight   (d) inclined

10. A beam of length 6 m is SSB at its ends and carries a point load of 40 kN at a distance of 4 m from the left support. Find the deflection of beam   CO2- App

    (a) -9.7 mm   (b) 9.7 mm   (c) 8.9 mm   (d) -8.9 mm

PART – B (5 x 2= 10 Marks)

11. Define poison's ratio   CO1- U

12. List out the types of method of analysis of truss.   CO1- U

13. Draw the bending moment diagram for simply supported load with point load.   CO3- App

14. Find the maximum torque developed by the shaft at 30% of increasing the initial torque and the T= 12×10^6 N-mm   CO4- App

15. State the equation for radius of curvature for deflected beam   CO1- U

PART – C (5 x 16= 80Marks)

16. (a) A bar shown in fig. is subjected to a tensile load of 160 kN. If the stress in the middle portion is subjected to 150 N/ mm^2. Determine (i) diameter of the middle portion also find the (ii) length of the middle portion, if the total elongation of the bar is to be 0.2 mm. Take E= 2×10^5N/mm^2 CO2- Ap   (16)

160 kN ←   6 cm DIA   6 cm DIA   160 kN →

|←   40 cm   →|

Or

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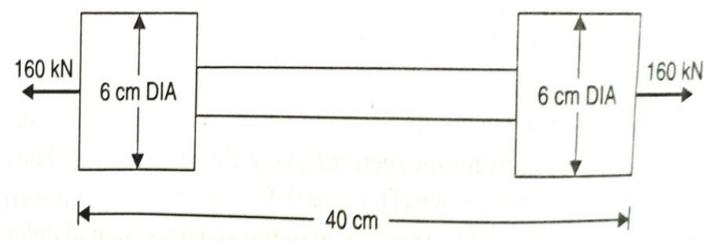
(b) A steel bar 300 mm long, 50 mm wide and 40 mm thick is subjected to a pull of 300 kN in the direction of its length. Determine the change in volume. Take E for steel is $2 \times 10^5 \text{N/mm}^2$ and $\mu=0.25$ CO2- App   (16)

17. (a) Apply the method of joints to determine the forces in all the members of the truss shown in the given figure.   CO2- App   (16)
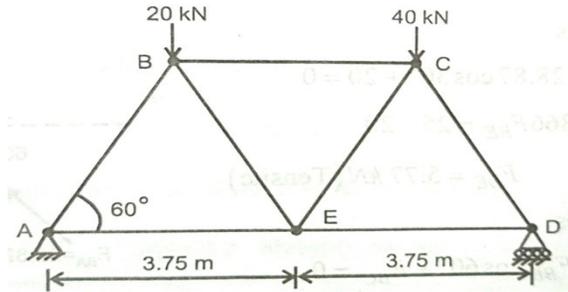

Or

(b) Apply the method of tension coefficient to determine the forces in the members of the truss shown in the given figure   CO2- App   (16)
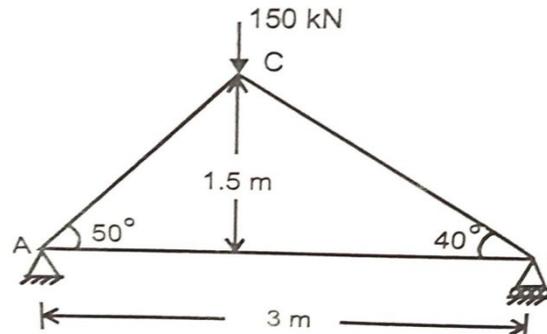
18. (a) Analyze the behavior of a simply supported beam of 9 m length subjected to a UDL of 10 kN/m over a span of 6 m from the left end, and draw the shear force and bending moment diagrams. Also, determine the maximum bending moment.   CO3- Ana   (16)

Or

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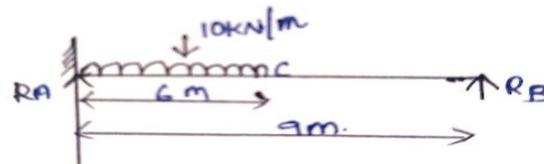
(b) Analyze a cantilever beam of 2 m length subjected to a uniformly   CO3- Ana   (16)
distributed load of 1.5 kN/m over its entire length, and a point
load of 2 kN located 0.5 m from the free end. Determine the
support reaction, and draw the shear force and bending moment
diagrams, showing all key values.
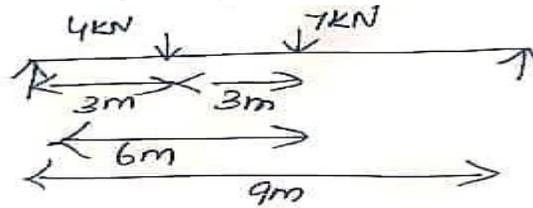
19. (a) A solid steel shaft has to transmit 75 kW at 200 rpm. Taking   CO4- App   (16)
allowable shear stress as 70 N / mm2. Find the suitable diameter
for the shaft, if the maximum torque transmitted at each
revolution exceeds the mean by 30 %.

Or

(b) A steel shaft ABCD having total length of 2.5 m consist of three   CO4- App   (16)
lengths having different section as follows AB is hollow having
outside and inside diameters of 85 mm and 50 mm respectively
and BC and CD are solid, BC having a diameter of 85 mm and
CD a diameter of 70 mm. if the angle of twist is same for each
section, determine the length of each section and total angle of
twist if the maximum shear stress in the hollow portion is 50 N/
mm^2. Take C= 8.2× 10^4 N/mm^2

20. (a) A steel cantilever 6 m long carries two-point loads, 15 KN at free   CO5- App   (16)
end and distance 25KN at a distance of 2.5 m from the free end
find i) Slope at free end ii)Deflection at free end. Take I=
1.3*10^8 mm^4& E= 2* 10^5 N/mm^2.
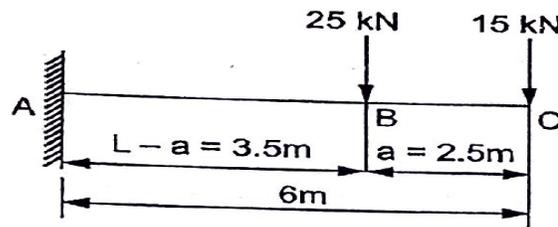
Or

(b) A beam 4 m long, simply supported at its ends, is carrying a   CO5- App   (16)
point load Was centre. If the slope at the ends of the beam should
not exceed 1° , find the deflection at the centre of the beam.

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