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Question Paper Code:U5A03

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Fifth Semester

Agricultural Engineering

21UAG503 – STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. 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
2. Volumetric strain is defined as CO1- U
(a) dV/V (b) dL/L (c) db/b (d) dd/d
3. A frame in which all members lie in the single plane is called CO1- U
(a) Plain frame (b) Space frame (c) deficient frame (d) redundant frame
4. Which equation is used to find out the perfect frame CO1- U
(a) $m= 2j+3$ (b) $m= 2j-2$ (c) $m= 2j-3$ (d) $m= 2j+2$
5. SI units of shear force is _____ CO1- U
(a) kN/m (b) kN-m (c) kN (d) m/N
6. The beam having one end free and one end fixed is called as _____ CO1- U
(a) Cantilever beam (b) Continuous beam
(c) Overhang beam (d) Simply supported beam
7. The units of torsional rigidity is CO1- U
(a) Nmm^2 (b) N/mm (c) N-mm (d) N
8. The power transmitted by shaft SI system is given by _____ CO1- U
(a) $2\pi NT/60$ (b) $3\pi NT/60$ (c) $2\pi NT/45$ (d) $NT/60$ W
9. The point at which the deviation of centre is called CO1- U
(a) Eccentricity (b) centre (c) straight (d) inclined

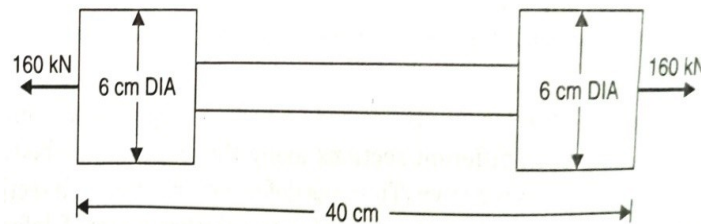
10. The radius of curvature of the deflected beam is CO1- U
- (a) $\frac{M}{I} = \frac{E}{R}$ (b) $\frac{M}{J} = \frac{E}{R}$ (c) $\frac{N}{I} = \frac{E}{R}$ (d) $\frac{M}{C} = \frac{E}{R}$

PART – B (5 x 2= 10 Marks)

11. State thermal stress CO1- U
12. State tension coefficient and what is the unit of it? CO1- U
13. Which place the maximum bending will occur in the beam? CO1- U
14. Explain in detail about polar moment of inertia CO1- U
15. Give the deflection equation of simply supported beam with point load at centre CO1- U

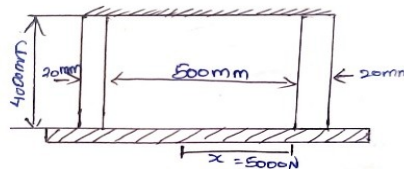
PART – C (5 x 16= 80 Marks)

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/ mm². 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 $E= 2 \times 10^5 \text{N/mm}^2$ CO2- App (16)

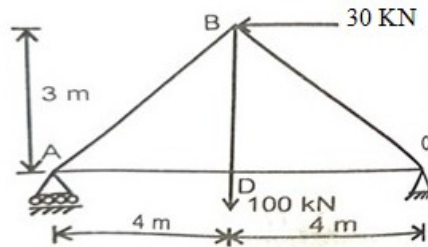


Or

- (b) Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 50 cm apart. Diameters and lengths of each rod are 2 cm and 4 m respectively. A cross bar fixed to the rods at the lower end carries a load of 5000 N such that the cross bars remains horizontal even after loading. Find the stress in each rod and position of the load on the bar. Take $E= 2 \times 10^5 \text{ N/mm}^2$ for steel and take $E= 1 \times 10^5 \text{ N/mm}^2$ for copper CO2- App (16)

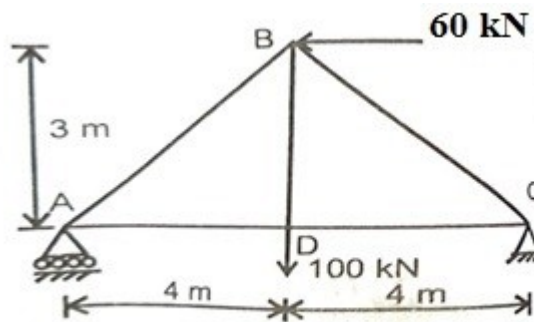


17. (a) Determine the forces in all the members of the truss shown in fig. by using the method of joints. CO2- App (16)

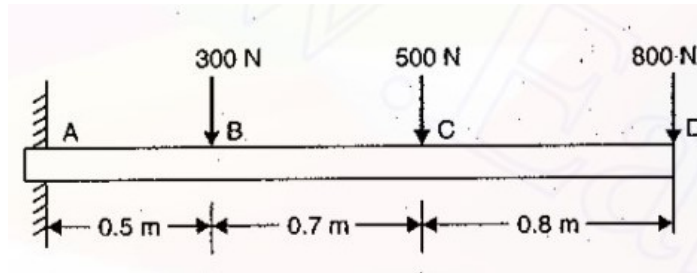


Or

- (b) Determine the forces in all the members of the truss shown in fig. CO2- App (16) by using the method of joints.

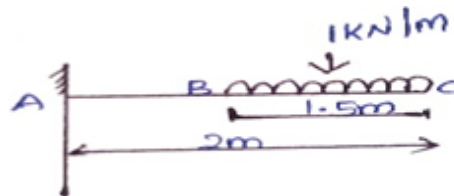


18. (a) Cantilever beam of length 2 m carries the point loads as shown in fig. Draw the shear force and BM diagrams for the cantilever beam. CO2- App (16)



Or

- (b) A cantilever beam of length 2 m carries a uniformly distributed load of 1 kN/m run over the entire length of 1.5 m from the free end draw the shear force and bending moment diagrams for the cantilever. CO2- App (16)



19. (a) Derive the equation for torque developed by the hollow circular shaft and give the assumptions. CO2- App (16)

Or

- (b) Determine the diameter of the solid shaft which will transmits 90 kW at 300 rpm also determine the length of the shaft if the twist must not to exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm². Take the value of modulus of rigidity is 8×10^4 N/mm² CO2- App (16)
20. (a) Derive the equation of deflection for a simply supported beam with point load at midpoint. CO2- App (16)
- Or
- (b) Determine (i) slope at the left support (ii) deflection under the load and (iii) maximum deflection of a simply supported beam of the length 5 m, which is carrying a point load of 5 kN at a distance of 3 m from the left end. Take E for the material of the beam = 2.1×10^5 N/mm² and $I = 1 \times 10^8$ mm⁴ CO2- App (16)