Reg. No. :

Question Paper Code : X10239

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2021
Third/Fourth Semester
Aeronautical Engineering
CE 8395 – STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS
(Common to Aerospace Engineering/Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define Stress.
2. What is principle of super position ?
3. What is meant by transverse loading on beam ?
4. Define flitched beam.
5. Write down the expression for torque transmitted by hollow shaft.
6. What are the various types of springs ?
7. What are the methods for finding out the slope and deflection at a section ?
8. When Macaulay's method is preferred ?
9. List out the modes of failure in thin cylindrical shell due to an internal pressure.
10. State Lame's theorem.

PART – B **(5×13=65 Marks)**

11. a) A tensile test was conducted on a mild steel bar. The following data was obtained from the test.
    i) Diameter of the steel bar = 3 cm
    ii) Gauge length of the bar = 20 cm
    iii) Load at elastic limit = 250 kN
    iv) Extension at a load of 150 kN = 0.21 mm
    v) Maximum load = 380 kN
    vi) Total extension = 60 mm
    vii) Diameter of rod at failure = 2.25 cm

    Determine : 1) The Young's modulus (2) The stress at elastic limit (3) The percentage of elongation (4) The percentage decreases in area.

    (OR)

    b) At a certain point in a strained material, the intensities of stresses on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by a shear stress of magnitude 10 N/mm^2. Find the location of principal plane and evaluate the principal stresses.

12. a) A cantilever 1.5 m long is loaded with a UDL of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25m from the free end. Draw the shear force and bending moment diagrams of the cantilever.

    (OR)

    b) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine
    i) Average shear stress
    ii) Maximum shear stress
    iii) Shear stress at a distance of 25 mm above the neutral axis.

13. a) A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm^2.

    (OR)

    b) Find the expression for the close – coiled helical spring at the centre due to axial load 'W'.

14. a)

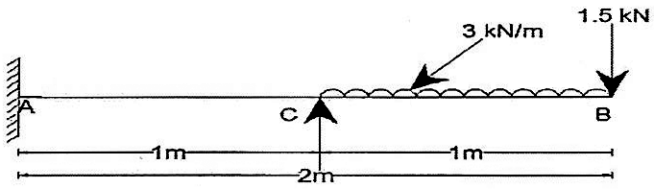

fig. 1.

A two metres long cantilever of rectangular section 150 mm wide and 300 mm deep is loaded as shown in fig. 1. Calculate the deflection at the free end. Take $E = 10.5\ GN/m^2$.

(OR)

b) A simply supported beam of span 'l' is carrying concentrated 'W' at the centre and a UDL of intensity of 'w' per unit length. Show that Maxwell's reciprocal theorem holds good at the centre of the beam

15. a) A cylindrical Shell 3 m long which is closed as the ends an internal diameter of one metre and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of $1.5\ N/mm^2$ and $\mu = 0.3$.

(OR)

b) Find the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of $8\ N/mm^2$. The maximum hoop stress in the section is not to exceed $35\ N/mm^2$.

PART – C **(1×15=15 Marks)**

16. a) The bar shown in fig. 2 is subjected to a tensile load of 160 kN. If the stress in the middle portion is limited to $150\ N/mm^2$, determine the diameter of the middle portion. Find also the length of the middle portion if the total elongation of the bar is to be 0.2 mm. Young's modulus is given as equal to $2.1 \times 10^5\ N/mm^2$.

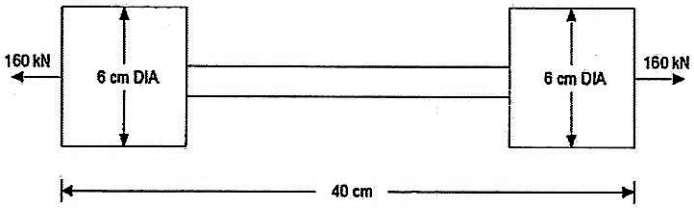

fig. 2

(OR)

b) A simply supported beam of length 4 m carries a point load of 3 kN at a distance of 1 m from each end. If $E = 2 \times 10^5\ N/mm^2$ and $I = 10^8\ mm^4$ for the beam, then using conjugate beam method determine :

i) Slope at each end and under each load.

ii) Deflection under each load and at the centre.