B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

BTCLEVI/BTMEVI/BTELVI/BTCSVI/BTECVI

Term-End Examination,

December 2019

BME-017 : STRENGTH OF MATERIALS

Time : 3 Hours]   *[Maximum Marks : 70*

Note : (i) Answer *any seven* questions.

(ii) All questions carry *equal* marks.

(iii) All notations have their usual meaning.

(iv) Use of scientific calculator is permitted.

1. A bar of mild steel has an overall length of 2100 mm. The length of the bar is 700 mm and diameter is 56 mm. The diameter of the remaining length of 1400 mm is 35 mm. Calculate the extension of the bar due to a applied tensile load of 55 kN along the bar at the ends. Take $E = 200 \text{ GN/m}^2$.   10

2. A rod is 2m long at a temperature of 10°C. Find the expansion of the rod, when the temperature is raised to 80°C. If this expansion is prevented, find the stress induced in the material of the rod.
    Take $E = 1.0 \times 10^5 \text{ MN/m}^2$ and $\alpha = 0.000012$ per degree centigrade.   10

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3. The tensile stress at a point across two mutually perpendicular planes are 120 N/mm² and 60 N/mm². Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress.

    10

4. A beam ABCDE, 6m long is simply supported at A and E. It carries concentrated loads as shown in Figure A. Draw shear force diagram, and bending moment diagram showing principal values at salient points.
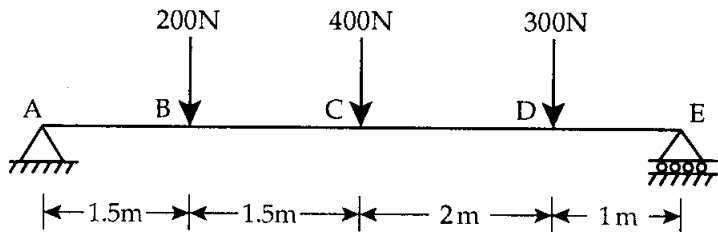
    10

Figure A

5. Prove the relation for a beam.

    10

    $$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

    Where M = Bending moment

    I = Moment of inertia

    σ = Bending stress

    y = Distance from neutral axis

    E = Young's modulus

    R = Radius of curvature.

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6. A rectangular column of width 200 mm and of thickness 150 mm carries a point load of 240 kN at an eccentricity of 10 mm as shown in Figure B. Determine the maximum and minimum stresses in the section of the column. 10
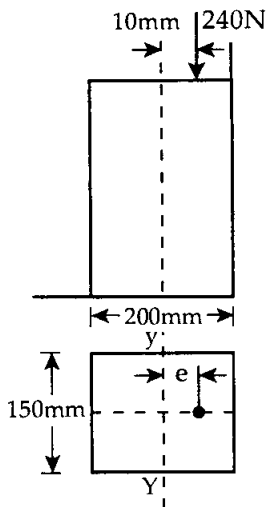

Figure B

7. A steel rod is 2 m long and 50 mm in diameter. An axial pull of 100 kN is suddenly applied to the rod. Calculate the instantaneous stress induced and also the instantaneous elongation produced in the rod.

Take $E = 200 \text{ GN/m}^2$. 10

8. A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire span of 5 m. If the value of E for the beam material is $1 \times 10^4 \text{ N/mm}^2$, find : 10

i) The slope at the supports

ii) Maximum deflection of the beam.

9. A circular shaft of 60 mm diameter transmits torque from one shaft to another. Find the safe torque, which the shaft can transmit, if the shear stress is not to exceed 50 MPa. of the material.   10

10. A cylindrical pipe of diameter 2.0m and thickness 2.0 cm is subjected to an internal fluid pressure of 1.5 N/mm^2. Determine.   10

   i)   Longitudinal stress, and

   ii)   Circumferential stress developed in the pipe material.

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