Total No. of printed pages = 6

BES-402/SOM/4th Sem/2018/M

STRENGTH OF MATERIALS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

PART – A

1. Choose the correct or most appropriate option(s) : $1 \times 5 = 5$

(i) The unit of strain is

(a) N-mm (b) N/mm

(c) mm (d) no unit

(ii) The change in length due to tensile or compressive force acting on a body is given by

(a) $\frac{PlA}{E}$ (b) $\frac{Pl}{AE}$

(c) $\frac{E}{PlA}$ (d) $\frac{AE}{Pl}$

[Turn over

Where P = Tensile or compressive force

l = Original length of the body

A = Cross-sectional area of the body

E = Young's modulus for the material of the body

(iii) When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the

(a) top layer

(b) bottom layer

(c) neutral layer

(d) every cross-section

(iv) At the neutral axis of a beam, the shear stress is

(a) zero (b) minimum

(c) maximum (d) infinity

(v) When a shaft is subjected to twisting moment, every cross-section of the shaft will be under

(a) tensile stress

(b) compressive stress

(c) shear stress

(d) bending stress

2. Fill up the blanks : $1 \times 5 = 5$

(i) Stress, $\sigma = \frac{\text{.....}}{\text{.....}}$.

(ii) Power transmitted by circular shaft = $\frac{\text{.....}}{\text{.....}}$.

(iii) Hooke's law hold good up to ..... .

(iv) The deformation of the bar per unit length in the direction of the force is known as ..... .

(v) A beam which is fixed at one end and free at the other is called ..... .

3. Write true or false : $1 \times 5 = 5$

(i) When a body is subjected to two equal and opposite pushes, as a result of which the body ends to reduce its length, the stress and strain induced is compressive.

(ii) A simply supported beam is one which is supposed on more than two supports.

(iii) The bending moment at a point on a beam is the algebraic sum of all the moments on either side of the point.

(iv) The bending moment at the ends of a simply supported beam will be zero.

(v) Maximum torque transmitted by a circular solid shaft, $T = \pi/16\tau D^3$.

4. Answer the following questions : $1 \times 10 = 10$

(i) Define strength of materials.

(ii) What is Poisson's ratio ?

(iii) Define normal stress.

(iv) What is bending stress ?

(v) Define principal planes and principal stresses.

(vi) What is bending moment diagram ?

(vii) What is shear force ?

(viii) Define Young's modulus.

(ix) What is Torsion ?

(x) What is polar modulus ?

PART – B

Answer any *five* questions.

1. What is stress-strain diagram ? Explain with diagram. What are the properties that can be obtained from tension test ? Explain. 5+4=9

2. What are the assumptions made during the analysis of Bending equation ? Derive the Bending equation. 4+5=9

3. What are the assumptions made during the analysis of Torsion equation ? Derive the Torsion equation. 4+5=9

4. A simply supported beam has a span of 5m and carries two point loads of 20 kN and 30 kN at a distance 2m and 3m from left side of the beam. Draw the SFD and BMD. 4+5=9

5. (a) A rod 150 cm long and of diameter 25 cm is subjected to an axial pull of 20 kN. If the Young's modulus of elasticity of the material of the rod is 2×10^5 N/mm^2, determine 5

   (i) the stress

   (ii) the strain and

   (iii) the elongation of the rod

(b) Calculate the maximum stress induced in a cast iron pipe of external diameter 40 mm, internal diameter 20 mm and length 4m when the pipe is supported at its ends and carries a point load of 80N at its centre. 4

6. (a) A solid shaft of 150 mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 45 N/mm^2. 4

(b) A solid shaft has to transmit 75 kW at 200 rpm. Taking allowable shear stress as 70 N/mm^2, find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 30%. 5