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C09–M–403

# 3503

## BOARD DIPLOMA EXAMINATION, (C–09)

## MARCH/APRIL—2016

## DME—FOURTH SEMESTER EXAMINATION

STRENGTH OF MATERIALS

*Time* : 3 hours ] [ *Total Marks* : 80

**PART—A** 3×10=30

***Instructions*** : (1) Answer **all** questions.

(2) Each question carries **three** marks.

**1.** Define the following terms : 1½+1½

*(a)* Stress

*(b)* Strain

**2.** A punch operates with a force of 12 kN to produce 50 mm diameter blanks from a material of 15 mm thick. Estimate *(a)* the shear stress in the plate and *(b)* the compressive stress in the punch. 1½+1½

**3.** Define the following terms : 1½+1½

*(a)* Resilience

*(b)* Modulus of resilience

**4.** List out different types of beams depending upon the end conditions.

**5.** A cantilever beam of 3 m long carries a point load of 4 kN at free end. Draw shear force and bending moment diagrams. 1½+1½

**6.** State any three assumptions made in theory of simple bending. 1+1+1

**7.** Define the following terms : 1½+1½

*(a)* Neutral axis

*(b)* Moment of resistance

**8.** A solid shaft is to transmit 350 kW at 110 r.p.m. If the maximum shear stress induced in the shaft must not exceed 90 $N/mm^2$, find the diameter of the shaft.

**9.** State any three applications of springs. 1+1+1

**10.** *(a)* Define a thin cylindrical shell. 1½

*(b)* Name the stresses setup in a thin cylindrical shell subjected to internal fluid pressure. 1½

## PART—B

10×5=50

***Instructions*** : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

**11.** The following results are obtained from a tensile test on a m.s. specimen :

Diameter of specimen = 16 mm
Gauge length = 80 mm
Extension at a load of 75 kN = 0·15 mm
Load at yield point = 90 kN
Maximum load = 130 kN
Length at fracture = 106 mm
Diameter at neck = 9·8 mm

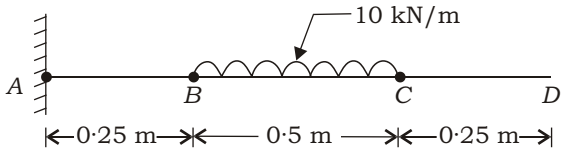
Calculate *(a)* Young's modulus of elasticity, *(b)* stress at yield point, *(c)* ultimate stress, *(d)* working stress taking factor of safety as 3, *(e)* percentage elongation and *(f)* percentage reduction in area.

**12.** A bar of 25 mm diameter is subjected to an axial pull of 62·5 kN. The extension over a gauge length of 200 mm is 0·4 mm and decrease in diameter is 0·013 mm. Calculate *(a)* modulus of elasticity, *(b)* modulus of rigidity, *(c)* bulk modulus and *(d)* Poisson's ratio.

**13.** An MS bar of length 2 m and has a diameter of 50 mm, hangs vertically. A load of 20 kN falls on a collar attached to the lower end. Find the maximum stress, when *(a)* height of fall is 150 mm, *(b)* load is applied suddenly without impact and *(c)* the load is applied gradually.

Assume modulus of elasticity of mild steel, $E$ 2 $10^5$ N/mm$^2$

**14.** Draw shear force and bending moment diagrams for the cantilever beam loaded as shown in the figure below :




**15.** A simply supported beam of length 5 m carries a uniformly distributed load of 2 kN/m over entire span and a point load of 25 kN at a distance of 2 m from left end support. Draw shear force and bending moment diagrams.

**16.** A cantilever 2 m long is loaded with a point load of 800 N at the free end and a uniformly distributed load of 3 kN/m over 1·2 m from the fixed end. If the section is rectangular 75 mm × 150 mm deep, calculate the slope and deflection at the free end.

Take $E$ 1 1 $10^5$ N/mm$^2$

**17.** A solid steel shaft 100 mm diameter transmits 75 kW at 150 r.p.m. Calculate *(a)* torque on the shaft, *(b)* the maximum shear stress induced, *(c)* the angle of twist in a length of 600 mm and *(d)* the shear stress at a radius of 30 mm.

Take modulus of rigidity, $G$ 0 8 $10^5$ N/mm$^2$

**18.** *(a)* A close coiled helical spring of 100 mm mean diameter is made of 10 mm diameter rod and has 18 turns. The spring carries an axial load of 190 N. Determine *(i)* shear stress and *(ii)* deflection, when carrying this load. Assume $G$ 0 8 $10^5$ N/mm$^2$

*(b)* A boiler shell is to be made of 12 mm thick plate having limiting tensile stress of 100 N/mm$^2$. If the efficiencies of longitudinal and circumferential joints are 75% and 35% respectively, determine the maximum permissible diameter of the shell to withstand a steam pressure of 1·2 N/mm$^2$.

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