

Total No. of printed pages = 4

CE 181302

Roll No. of candidate

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Anantapur, Andhra Pradesh  
584002

B.Tech. 3<sup>rd</sup> Semester End-Term Examination

CE

SOLID MECHANICS

(New Regulation and New Syllabus)

Full Marks – 70

Time – Three hours

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

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answer for the following multiple choice questions:

(10 × 1 = 10)

(i) Stress is-

- (a) External force applied on a body per unit area
- (b) Restoring force per unit area
- (c) Deformation of the body
- (d) All of the above

(ii) Modulus of elasticity is the ratio of-

- (a) Lateral stress to longitudinal stress
- (b) Deformation to original length
- (c) Stress to strain
- (d) Stress to original length

(iii) Relationship between modulus of elasticity (E) and modulus of rigidity (G) is-

- (a)  $G = 2E(1-\mu)$
- (b)  $E = G/(1+\mu)$
- (c)  $G = E/2(1+\mu)$
- (d)  $E = G(1-\mu)$

(iv) Principal stress is which have -

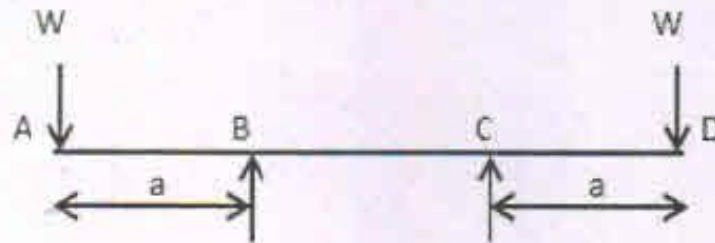
- (a) No deformation
- (b) No shear stress
- (c) No direct stress
- (d) None of the above

[Turn over

(v) When a body is subjected to the mutually perpendicular stresses ( $\sigma_x$  and  $\sigma_y$ ) then the centre of the Mohr's circle from y- axis is taken as

- (a)  $(\sigma_x + \sigma_y)/2$  (b)  $(\sigma_x - \sigma_y)/2$   
 (c)  $2\sigma_x\sigma_y$  (d)  $\sigma_x/2\sigma_y$

(vi) Which part of the beam is under pure bending?



- (a) AB (b) BC  
 (c) CD (d) None

(vii) Effective length for a column with one end fixed and other end hinged is-

- (a) 2 times of its actual length  
 (b) Equal to its actual length  
 (c)  $1/\sqrt{2}$  times of its actual length  
 (d) 0.5 times its actual length

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(viii) Strut is a-

- (a) Vertical column (b) Horizontal column  
 (c) Inclined column (d) Both (b) and (c)

(ix) A thin cylindrical vessel has wall thickness-

- (a) Equal to  $1/20^{\text{th}}$  of its internal diameter  
 (b) Less than  $1/20^{\text{th}}$  of its internal diameter  
 (c) Greater than  $1/20^{\text{th}}$  of its internal diameter  
 (d) None

(x) Polar moment of inertia of a solid shaft of diameter D is

- (a)  $\pi D^3/16$  (b)  $\pi D^3/32$   
 (c)  $\pi D^4/16$  (d)  $\pi D^4/32$

2. (a) Define a composite bar. (2)
- (b) Establish the relation for volumetric strain of a rectangular bar subjected to three mutually perpendicular forces. (7)
- (c) A bar of 20mm diameter is subjected to a pull of 60KN, The measured extension on gauge length of 180mm is 0,2mm and change in diameter is 0.002mm, calculate
- (i) Young's modulus,
- (ii) Poisson's ratio and
- (iii) Bulk modulus (6)
3. (a) What are the stresses acting on an oblique plane? Find the expressions for these stresses by analytical method. (3+6)
- (b) At a point in a strained material, the principle stresses are  $100 \text{ N/mm}^2$  tensile and  $40 \text{ N/mm}^2$  compressive. Determine the normal stress, shear stress, resultant stress by Mohr's circle method if the plane is inclined at  $60^\circ$  to the axis of the major principal stress. (6)
4. (a) What is section modulus? Find out the expression for section modulus of a rectangular section. (2+3)
- (b) Establish the expression for shear stress in a simply supported beam of definite length carrying a UDL. (10)
5. (a) Find the maximum deflection when a beam column with both ends hinged condition is subjected to both axial compressive load or thrust and a transverse point load at the centre. (8)
- (b) A hollow cylindrical cast iron column is 5 m long with one end fixed and other end hinged. Determine the minimum diameter of the column if it has to carry a safe load of 270 KN with a factor of safety of 5. Take internal diameter as 0.8 times the external diameter, Take crushing stress as  $550 \text{ N/mm}^2$  and Rankine's constant as  $1/1600$ . (7)
6. (a) Mention the types of rivet joint. Two steel plates of 10mm thickness are joined by double riveted lap joint. The rivet diameter is 15mm and pitch 50cm, if tensile stress is  $120 \text{ N/mm}^2$ , compressive stress  $160 \text{ N/mm}^2$  and shear stress  $90 \text{ N/mm}^2$ . Determine the strength and efficiency of the rivet joint. (2+8)

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- (b) A cylinder of thickness 150mm has withstand maximum internal pressure of  $1.5\text{N/mm}^2$ . If the ultimate tensile stress in the material of the cylinder is  $270\text{N/mm}^2$ , factor of safety 3.0 and joint efficiency 80%, determine the diameter of the cylinder. (5)
7. (a) Find the maximum shear stress induced in a solid circular shaft of diameter 180mm when the shaft transmits 150KW power at 200r.p.m. (5)
- (b) Find out the expression for torque transmitted by a hollow circular shaft. (10)

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