



## BRAINWARE UNIVERSITY

Term End Examination 2022  
 Programme – B.Tech.(ME)-2021  
 Course Name – Strength of Materials  
 Course Code - PCC-ME301  
 ( Semester III )

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 Barasat, Kolkata - 741015

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) An alloy specimen has a modulus of elasticity of 120 Gpa and poisson's ratio of 0.33. Determine the modulus of rigidity.
- a) 45 Gpa  
 b) 78 Gpa  
 c) 120 Gpa  
 d) none of these
- (ii) in an experiment, a steel specimen of 13 mm diameter was found to elongate 0.2 mm in a 200 mm gauge length when it was subjected to a tensile force of 26.8 Kn. If the specimen was tested within the elastic range, what is the value of young's modulus for the steel specimen?
- a) 201.9 Gpa  
 b) 789 Gpa  
 c) 123 Gpa  
 d) none of these
- (iii) At the point of contraflexure, the value of bending moment is
- a) Zero  
 b) Maximum  
 c) Can't be determined  
 d) Minimum
- (iv) \_\_\_\_\_ positive/negative bending moments occur where shear force changes its sign.
- a) Minimum  
 b) Zero  
 c) Maximum  
 d) Remains same
- (v) Two shafts made of the same material have the same length and are joined in series. If the ratio of their diameters is 2, then the ratio of shear stresses is
- a) 8  
 b) 16  
 c) 4  
 d) 2
- (vi) Two shafts made of the same material have the same length and are joined in series. If the ratio of their diameters is 2, then the ratio of their angles of twist is
- a) 8  
 b) 16  
 c) 4  
 d) 2
- (vii) At hinge, the moments will be \_\_\_\_\_

- a) Zero
  - b) Maximum
  - c) Can't be determined
  - d) Minimum
- (viii) In simply supported beam deflection is maximum at \_\_\_\_\_.
- a) Midspan
  - b) Supports
  - c) Point of loading
  - d) Through out
- (ix) What is the formula of theorem of parallel axis?
- a)  $I_{xx} = IG + ah^2$
  - b)  $I_{xx} = IG - ah^2$
  - c)  $IG = I_{xx} + ah^2$
  - d) none of these
- (x) The radius of gyration of a circular plate of diameter 10 cm \_\_\_\_\_.
- a) 2.5 cm
  - b) 1 cm
  - c) 3 cm
  - d) none of these
- (xi) A \_\_\_\_\_ material does not undergo any deformation under the action of external force.
- a) rigid
  - b) elastic
  - c) amorphous
  - d) none of these
- (xii) Plastic deformation or permanent set occurs in a material body if it stressed beyond \_\_\_\_\_ limit.
- a) plastic
  - b) elastic
  - c) proportional
  - d) none of these
- (xiii) Unit of Young's modulus is same as that of
- a) strain
  - b) force
  - c) stress
  - d) none of these
- (xiv) The ratio of crippling load to working load is called
- a) factor of safety
  - b) buckling factor
  - c) critical factor
  - d) all of the above
- (xv) Euler's formula for buckling load is applicable to
- a) Short column
  - b) Medium column
  - c) Long column
  - d) Medium and long column

**Group-B**

(Short Answer Type Questions)

3 x 5=15

2. "A Mild Steel Bar 20 mm in diameter, 20 cm long was tested to destruction. During the test, the (3) following observations were recorded. Load at elastic limit = 65 KN Extension at elastic limit = 0.22 mm Load at upper yield point = 70 KN Maximum load = 130 KN Breaking load = 110 KN Diameter at neck = 14 mm Final length = 25 cm Determine:- i) Modulus of Elasticity. ii) Upper Yield Stress. iii) Ultimate Stress. "
3. State Parallel Axis Theorem. (3)
4. The Bending Stress in beams at any section x is given by - (3)

$$\sigma_x = [6M/80\{(80 + 3x/100)^2\}] ; \text{KN/mm}^2$$

Where, M = Bending Moment at any distance x from the free end.

Formulate :-

- i) The Position where Bending Stress will be Maximum.
- ii) The magnitude of the Maximum Bending Stress.

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5. What do you mean by Polar moment of inertia and radius of gyration? (3)

OR

State Maxwell's Reciprocal Theorem. (3)

6. Write down the difference between bending moment and moment of resistance. (3)

OR

Define Section Modulus. (3)

**Group-C**

(Long Answer Type Questions)

5 x 6=30

7. Show that, bending stress at a particular section of a beam at any layer is directly proportional (5)  
to the distance of the layer from the neutral axis.

8. Draw the sketch for stress vs strain diagram of mild steel and show & explain features of the (5)  
significant points on it.

9. In a square column, the length of the column is 40 times the length of each side of the square (5)  
section. If both ends of the column are pinned and  $E = 2 \times 10^4 \text{ KN/cm}^2$ , evaluate the critical  
stress set up in the column.

10. The external and internal diameters of a thick cylinder are respectively 800 mm and 400 mm. (5)  
The cylinder is subjected to an external and internal fluid pressures of 100 Gpa and 10 Gpa.  
Estimate the maximum and minimum hoop stress induced in the shell material. Sketch the  
radial pressure and hoop stress distribution.

11. Derive the torsion equation with usual notations. (5)

OR

What do you mean by Polar modulus and Torsional rigidity? Hollow shaft is preferred to solid (5)  
shaft for transmitting torque-why?

12. "A T-section has the following dimensions:- Flange:- 15 cm  $\times$  1 cm Web:- 19 cm  $\times$  1.5 cm. (5)  
Solve the moment of inertia and radius of gyration of the section about its centroidal axes  
parallel to the flange and perpendicular to the flange. "

OR

What is the difference between a column and a strut? What do you mean by Slenderness (5)  
Ratio? Write down the limitations of Euler's formula for critical load.