



# MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PC-ROB 402/PC-AUE 401/PC-ME403 Strength of Materials

UPID : 004432

CS/B.TECH(N)/EVEN/SEM-4/4432/2022-2023/1019

Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

## Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (i) Polar moment of Inertia is summation of \_\_\_\_\_
- (ii) What is neutral axis of a beam?
- (iii) What are reasons for a beam to deflect?
- (iv) Shear stress at the center of shaft in case of torsion is \_\_\_\_\_
- (v) What is differential formula for finding beam deflection?
- (vi) Hoop stress is how many times the longitudinal stress in case of thin sphere?
- (vii) Write the Moment of Inertia of a circle about its diameter.
- (viii) Volumetric strain is how many times of hoop strain in case of thin spherical shell?
- (ix) Write the relation between elastic modulus and modulus of rigidity.
- (x) When Shear stress is zero, what is the state of bending moment?
- (xi) Draw The diagram of Mohr's Circle for pure shear.
- (xii) Is always neutral axis passes through centroid of the beam?

## Group-B (Short Answer Type Question)

Answer any three of the following :

[ 5 x 3 = 15 ]

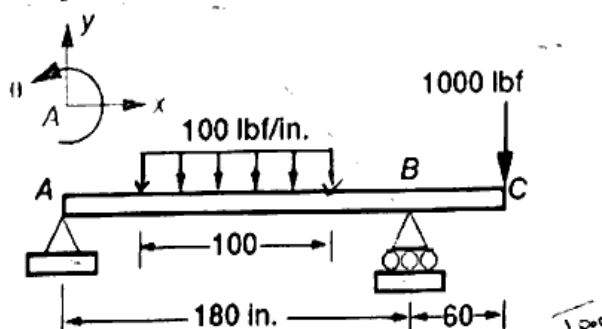
2. Show the stress versus strain curve of a ductile and brittle material. On that curves, show different points. Also show the modulus of toughness on the curve. [5]
3. Derive the Bending Formula of a Beam. [5]
4. Establish the relation between Elastic Modulus(E) and Bulk Modulus(K) of a material. [5]
5. A beam is 3m long and simply supported. In between 1m to 2m, a uniformly distributed load of 5kN/m is given. Find the shear force and bending moment Diagrams of the beam after deducing the equations. [5]
6. Define Poisson's ratio. [5]
- Deduce the range of Poisson's ratio of a material.
- Brittle materials do not any specific yield point, so how yield stress are determined for brittle materials?

## Group-C (Long Answer Type Question)

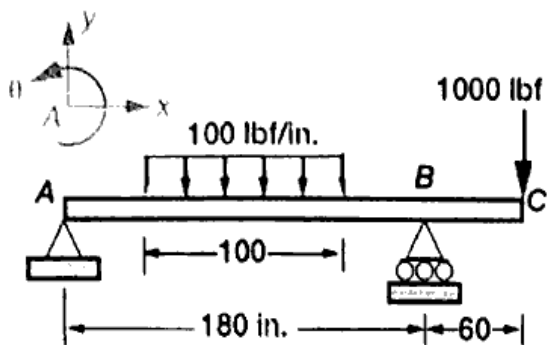
Answer any three of the following :

[ 15 x 3 = 45 ]

7. (a) Find the Shear force diagram of the beam given below [ 6 ]



- (b) Find also the Bending Moment diagram of the beam given below [ 9 ]



8. (a) Find The Euler's Critical load for a column with two end fixed. [ 9 ]  
 (b) A straight bar of alloy, 1m long and 12.5mm by 4.8mm in section, is mounted in a strut-testing machine and loaded axially until it buckles. Assuming the Euler formula to apply, estimate the maximum central deflection before the material attains its yield point of  $208\text{N/mm}^2$ .  $E=70000\text{N/mm}^2$ . [ 6 ]
9. (a) Determine the transverse shear of a I-section. Show the plot of the shear stress. [ 9 ]  
 (b) Determine the transverse shear of a circular cross-section. Show the plot of the shear stress. [ 6 ]
10. (a) Find the value of Maximum deflection of simply supported beam of length with Uniformly distributed load  $W_0$  N/m. EI flexural rigidity of the beam. [ 8 ]  
 (b) What are the limitations of Euler's Column theory? [ 2 ]  
 (c) Derive Rankine-Gordon formula. [ 5 ]
11. A simply supported beam 8m long, is given a distributed force 4kN/m. A concentrated load of 10KN is given at point 3m from LHS of the beam, A concentrated moment of 10KN-m is given at 3m from RHS of the beam. Determine the shear force and bending moment diagram of the beam. Show the equations in the analysis. [ 15 ]

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