

# CBCS SCHEME



15AE34

Third Semester B.E. Degree Examination, July/August 2021

## Mechanics of Materials

Time: 3 hrs.

Max. Marks:80

Note: Answer any FIVE full questions.

- Derive the equilibrium equations for a three dimensional stress system in Cartesian coordinate system. (10 Marks)
  - Draw stress-strain curve for mild steel material and mention salient points. (06 Marks)
- A bar of 800 mm length is attached rigidly at A and B as shown in Fig.Q2(a). Forces of 30 kN and 60 kN acts as shown on the bar. If  $E = 200$  GPa, determine the reaction at two ends. If the bar diameter is 25 mm, find the stresses and change in length for each portion.

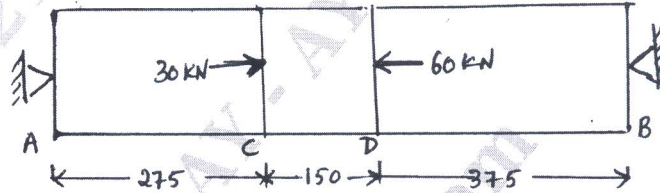


Fig.Q2(a)

(10 Marks)

- Explain plane stress and plane strain condition with relevant equations and examples. (06 Marks)
- State and prove the implications of Euler Bernoulli beam theory. (10 Marks)
    - Derive the equilibrium equations for a beam subjected to transverse loads. (06 Marks)  - Formulate the sectional constitutive law of three dimensional Euler Bernoulli beam theory. (10 Marks)
    - Determine the displacement field and axial force for the beam shown in Fig.Q4(b).

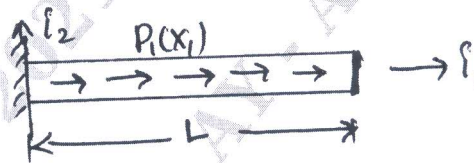


Fig.Q4(b)

(06 Marks)

  - Derive torsion equation with usual notation. (08 Marks)
  - A solid shaft is to transmit 192 KW at 450 rpm. Taking the allowable shear stress for material as 70 MPa, find the diameter of solid shaft. What percentage of saving in weight would be done if this shaft were to be replaced by a Hollow shaft, whose internal diameter is 0.8 times its external diameter. The length, material, power to be transmitted are equal in both cases. Torsional strength of both solid and Hollow shaft should be same. (08 Marks)

- Formulate Bredth Batho equation for torsion of closed section beams. (08 Marks)
  - Briefly explain:
    - the thin wall assumptions
    - shear flow(08 Marks)

15AE34

- 7 a. Explain the principle of virtual work for a particle. (08 Marks)  
b. Differentiate the principle of virtual work and principle of complimentary virtual work. (08 Marks)
- 8 a. What is a conservative force? Derive the expressions for work done by conservative forces along any path joining two points. (08 Marks)  
b. State and prove Maxwell's reciprocal theorem. (08 Marks)
- 9 Explain Kirchhoff's plate theory and derive the following with assumptions:  
(i) Total displacement field  
(ii) Strain field (16 Marks)
- 10 a. Explain Tresca's and Von-Mises criterion's in detail for uniaxial stress state, plane state of stress and pure shear state. (10 Marks)  
b. Briefly explain Buckling of plates. (06 Marks)

\* \* \* \* \*