

1059
B.E. (Mechanical Engineering) Fourth Semester
MEC-402: Machines of Materials – II

Max. Marks: 50

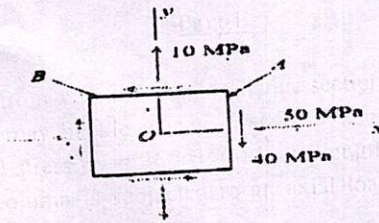
Allowed: 3 Hours

Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.
x-x-x

- (a) Briefly describe Normal stress Failure Criterion.
- (b) Calculate the value of shear stress acting on a plane of circular bar which is subjected to axial tensile load of 100 KN. Take Diameter of bar = 40 mm, $\theta = 42^\circ$.
- (c) Name various types of columns. Also write modes of failure in case of columns.
- (d) What are the different types of mechanisms in case of plastic analysis? Differentiate between upper and lower bound theory.
- (e) Differentiate between static and kinematic indeterminacy of structures. (2x5 = 10 Marks)

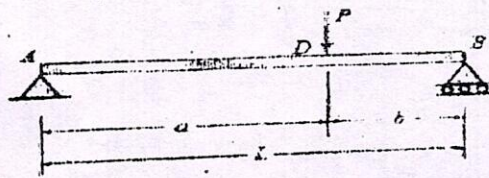
Part-A

Q3. At a point on the surface of a generator shaft the stresses are $\sigma_x = -50$ MPa, $\sigma_y = 10$ MPa, and $\tau_{xy} = -40$ MPa, as shown in Figure below. Using Mohr's circle, Determine: (a) the stresses acting on an element inclined at an angle $\theta = 45^\circ$, (b) Principal stresses, and (c) the maximum shear stresses. (Consider only the in-plane stresses, and show all results on sketches of properly oriented elements). (10 Marks)



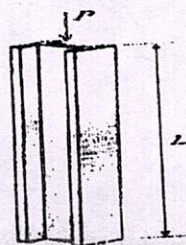
- (a) Compare various fracture and yield criteria with the help of neat sketch. (5 Marks)
- (b) Describe Photoelasticity method used for stress analysis with help of neat sketches. (5 Marks)

Q4. A simple beam ADB supports a concentrated load P acting at the position as shown in Figure below. Using Moment Area Method determine the angle of rotation θ_A at support "A" and the deflection at point "D" under the load P. (Note: The beam has length L and constant flexural rigidity EI). (10 Marks)



Part-B

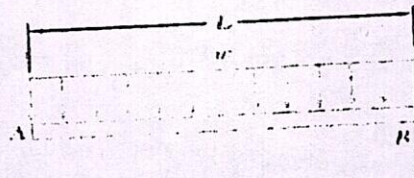
Q5. A steel column is constructed from a W 10x60 wide-flange section as shown in figure below. Assume that the column has pin supports and may buckle in any direction. Also, assume that the steel has modulus of elasticity $E = 29,000$ ksi and yield stress $\sigma_y = 36$ ksi. (a) If the length of the column is $L = 20$ ft, what is the allowable axial load? (b) If the column is subjected to an axial load $P = 200$ kips, what is the maximum permissible length? (10 Marks)



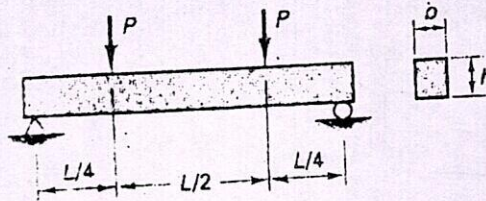
Sub. Code: 7047

(2)

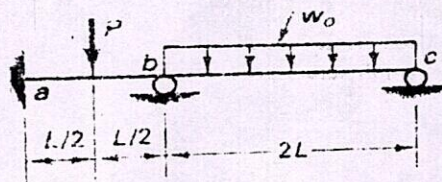
Q6. (a) The cantilever beam AB supports a uniformly distributed load w as shown in the figure below. Using Castigliano's Theorem determine the deflection and slope at point A. (5 Marks)



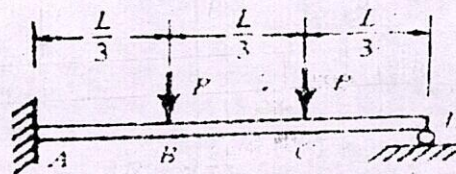
(b) Using Conservation energy method determine the deflections at load points due to application of both forces P for the elastic beam as shown in figure below. (5 Marks)



Q7. (a) Using the displacement method calculate the rotations at points b and c for the continuous beam of constant EI loaded as shown in the figure below. Also determine moments at points a & b. (5 Marks)



(b) Find the collapse load P_p for the beam shown, which has bending moment capacity M_p throughout.



(5 Marks)

X-X-X