

1108  
B.E. (Mechanical Engineering)  
Fourth Semester  
MEC-402: Machines of Materials – II

Time allowed: 3 Hours

Max. Marks: 50

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

x-x-x

- Q1. (a) Differentiate between Proof Resilience and Modulus of Resilience.
- (b) Describe maximum distortion energy criterion of failure in brief.
- (C) Differentiate between prismatic and Non Prismatic beams.
- (d) Write generalised Euler's Formula Discuss its limitations.
- (e) State and prove flexibility coefficients reciprocity.

(2x5 = 10 Marks)

Part- A

Q2. The state of a strain at point A on the bracket as shown in the figure 1(a) below is measured using a strain rosette shown in figure 1(b). Due to loadings, the readings from the gauges give  $\epsilon_a = 60 \times 10^{-6}$ ,  $\epsilon_b = 135 \times 10^{-6}$ ,  $\epsilon_c = 264 \times 10^{-6}$ . Determine the in plane principal strains at the point 'A' and the directions in which they act.

(10 Marks)

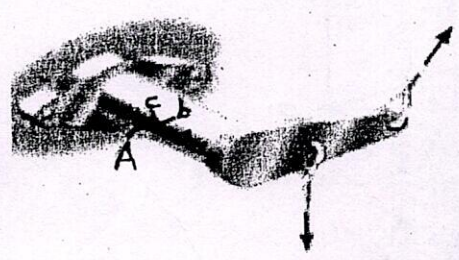


Figure: 1(a)

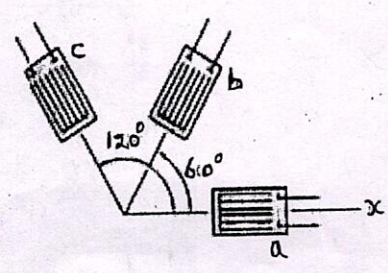


Figure: 1(b)

Q3. (a) Consider a state of stress in a thin walled cylindrical pressure vessel and construct the three principal circles of stresses. Relate the result to the yielding criterion. (4 Marks)

(b) The solid cast iron shaft shown in figure 2 below is subjected to a torque of  $T = 400 \text{ lb-ft}$ . Determine the smallest radius so that it does not fail according to maximum normal stress theory. A specimen of cast iron, tested in tension has an ultimate stress = 20 ksi. (6 Marks)

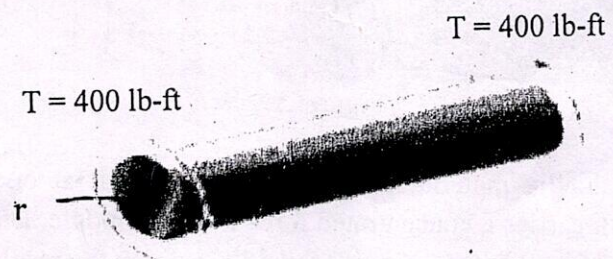
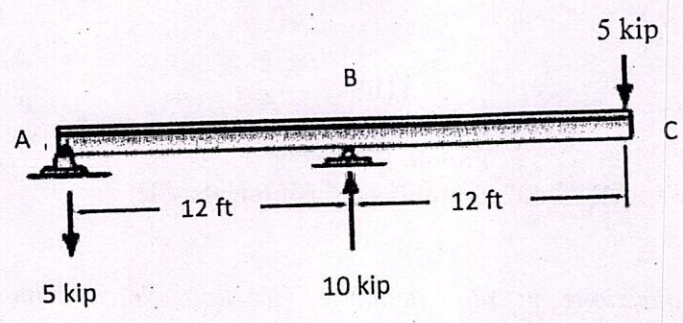


Figure: 2



Q4. Using moment area method, determine the slope and deflection at C shown in figure 3 below. Take  $E = 29 \times 10^3$  ksi and  $I = 125$  inch<sup>4</sup>. (10 Marks)



**Part-B**

Q5. (a) Differentiate between column and strut. (2 Marks)

(b) A steel strut 1 meter long is 30 mm in diameter. It is subjected to an axial thrust of 18 kN. In addition, a lateral load  $W$  acts at the centre of the strut. If the strut fails at a maximum stress of  $350$  MN/m<sup>2</sup>, determine the magnitude of lateral load  $W$ . Taking  $E = 210$  GN/m<sup>2</sup>. (8 Marks)

Q6. (a) State and Prove Castigliano's Second Theorem. (4 Marks)

(b) Determine the vertical deflection of point B in a pin jointed steel truss shown in the figure 4 below due to the elastic deformation of the members. Taking  $E = 30 \times 10^6$  psi. (6 Marks)

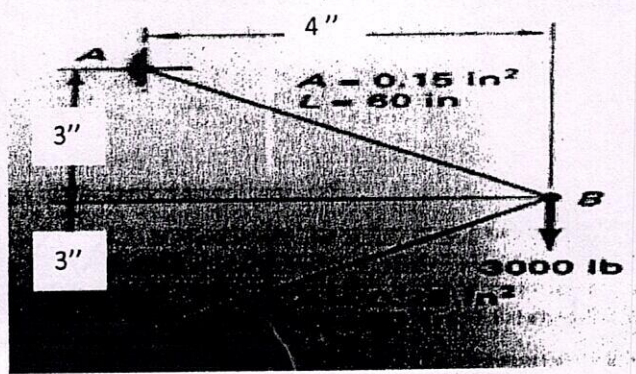


Figure: 4

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

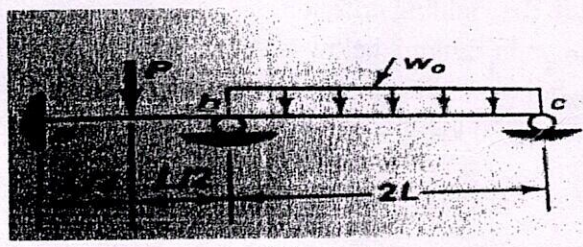


Figure: 5

(b) A Prismatic beam of ductile material having length 'L' fixed at one end (left end) and simply supported at other end (right end), carries a concentrated force  $P$  in the middle. Determine the plastic limit load using (i) Equilibrium method (ii) Virtual Displacement Method. Compare the results. (5 Marks)

x-x-x