Exam.Code:0940
Sub. Code: 7047

1019

B.E. (Mechanical Engineering)
Fourth Semester
MEC-402: Mechanics 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) Describe Tresca Failure Criterion in brief.
(b) State first and second moment area theorems.
(C) Briefly describe lateral stability of beams.
(d) State and prove Castigliano's First Theorem.
(e) State and prove Stiffness coefficients reciprocity. (2×5 = 10 Marks)

Part-A

Q2. (a) The principal stresses at a point across two perpendicular planes are 75 MN/m^2 (tensile) and 35 MN/m^2 (tensile). Using Mohr's circle method, find the normal, tangential stresses and resultant stresses and its obliquity on a plane 20^0 with the major principal plane. (6 Marks)

(b) What do you mean by Strain Rosettes? Describe various types of stain Rosettes. (4 Marks)

Q3. (a) In a steel member, at a point the major principal stress is 180 MN/m^2 tensile and the minor principal stress is compressive. If the tensile yield point of the steel is 225 MN/m^2, find the value of minor principal stress at which yielding will commence using distortion energy criterion of failure. (4 Marks)

(b) A bent rectangular bar is subjected to an inclined force of 3000 N, as shown in figure 1 below. The cross section of the bar is 12 × 12 mm. Determine the state of stress at point A caused by the applied force and also finds the maximum principal stress. (6 Marks)

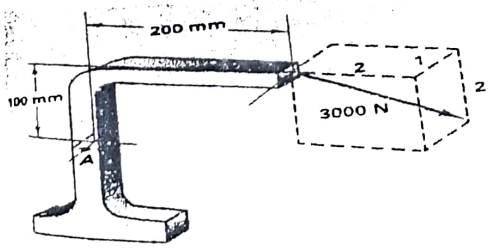


Figure: 1

Q4. (a) Derive an expression for moment curvature relation. (3 Marks)

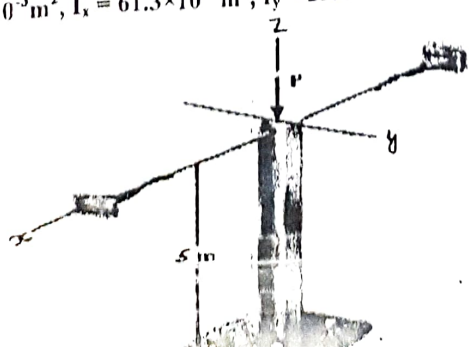
(b) A beam AB of span 8 meters is simply supported at the ends. It carries a uniformly distributed load of 30 KN/m over its entire length and a concentrated load of 60 KN at 3 meters from support 'A' (left Support). Determine the maximum deflection in the beam and the location where the deflection occurs. (7 Marks)

Take: E= 200×10^6 KN/m^2 and I= 80×10^{-4} m^4

Part-B

Q5. (a) Define criteria for stability of equilibrium in columns. Discuss various types of equilibrium. (3 Marks)

(b) The aluminium column is fixed at its bottom and is braced at its top by cables so as to prevent movement at the top along X axis as shown in the figure 2 below. If it is assumed to be fixed at its base, determine the largest allowable load P that can be applied. Use factor of safety for buckling = 3.0, Take E = 70 GPa, σ_y = 215 MPa, A = 7.5×10^{-3}m^2, I_x = 61.3×10^{-6} m^4, I_y = 23.2×10^{-6} m^4. (7 Marks)



Q6. (a) Consider an elastic beam fixed at both ends and subjected to a uniformly increasing load to one end as shown in the figure 3 below. Determine the reaction R_A and moment M_A at end 'A' using Castigliano's second theorem. Take EI for beam is constant. (5 Marks)

Figure: 3

(b) A man weighing 80 kg jumps on a diving board as shown in figure 4 below from a height of 0.6 meter. What maximum bending stresses will this cause in the board? The diving board is 50 × 300 mm in cross section. Take E = 12 GPa. Use virtual force method to determine deflection characteristics of the board. (5 Marks)

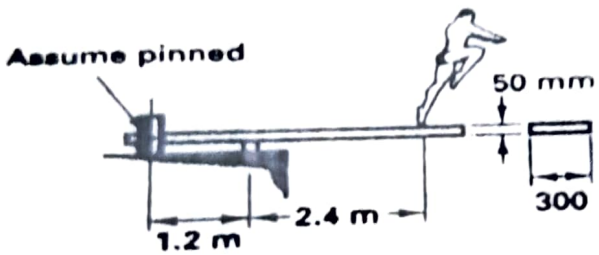


Figure: 4

Q7. (a) A two span continuous elastic beam on simple supports carries a uniform distributed load as shown in the figure 5 below. Using flexibility coefficients method determine the reactions at a, b and c. Also plot the elastic curve. (5 Marks)

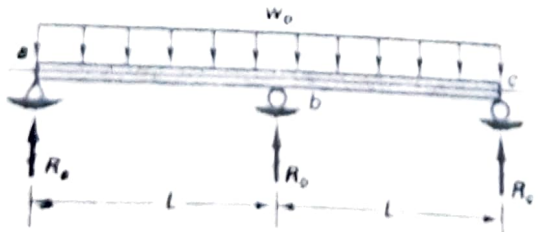


Figure: 5

(b) Determine the ultimate plastic moment for the governing factored load for the prismatic continuous beam of ductile material as shown in figure 6 below. (5 Marks)

Figure: 6