



Max. Marks:30

Time: 1:30 Hour : min

This Question Paper Consists of 5 Questions & 2 Page

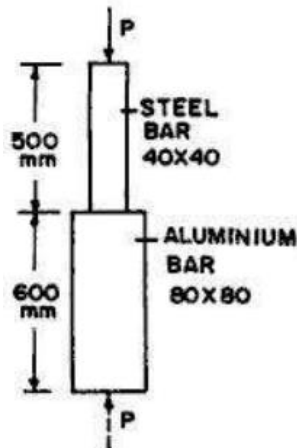
Marks Distribution & Mapping of Questions with Course Outcomes (COs)										
Q No	1	2	3	4	5	6	7	8	9	10
Marks	4,2	3,3	6	6	6					
CO No.	2	2,3	3	3	4					
Learning Level	2	2	3	3	3					

Note:

- Attempt all the questions.
- Write the answers in hard copy (on A4 or any other sheet available) using blue/black pen with their sign on top and bottom of each page. Also put page numbers on upper right corner of each page of the answer booklet.
- The time allowed for writing examination is 90 minutes. Extra 20 minutes are allowed for scanning and sending the answer booklet.
- Follow the instructions regarding submission of answer booklet as issued by examination section.

Q.1 A member formed by connecting a steel bar to an aluminium bar is shown in Fig. 1. Assuming that the bars are prevented from buckling sidewise, calculate the magnitude of force P, that will cause the total length of the member to decrease 0.20 mm. The values of elastic modulus for steel and aluminium are 210 kN/mm<sup>2</sup> and 70 kN/mm<sup>2</sup> respectively.

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b. What is meant by equivalent length of the column? What are its values for different end conditions of column?

2

Q.2 (a) A beam of span L, simply supported at the ends, is loaded with distributed load of intensity zero at the ends and w per unit length at the centre. Plot the S.F. and B.M. diagrams, indicating principal values.

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(b) A solid shaft is subjected to a torque of 12000 Nm. Find the necessary diameter of the shaft if the allowable shear stress is 60 N/mm<sup>2</sup>, and the allowable twist is 1° for every 20 diameters length of the shaft. Take  $G = 0.8 \times 10^5$  N/mm<sup>2</sup>.

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Q.3 A steel machine part is statically loaded and has yield strength of 320 MPa. For each of the following stress states, find the factor of safety using each of the three static failure theories.  $\sigma_x = 60$  MPa,  $\sigma_y = -30$  MPa,  $\sigma_z = -20$  MPa and  $\tau_{xy} = 40$  MPa

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Q.4 A cantilever beam of uniform section has a length AB = L, end B is free end and carries a point load W, while end A is fixed end. Find the slope and deflection at a point C, distant L/4 from the end A using moment area method.

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Q.5 A cylindrical tank of 750mm internal diameter, 12mm thickness and 1.5m length is completely filled with an oil of specific weight 7.85 kN/m<sup>3</sup> at atmospheric pressure. If the efficiency of longitudinal joints is 75% and that of circumferential joints is 45%, find the pressure head of oil in the tank. Also calculate the change in volume. Take permissible tensile stress of tank plate as 120 MPa and  $E = 200$  GPa, and  $\mu = 0.3$ .

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