



Register Number:

B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Third Semester

AERONAUTICAL ENGINEERING

U13AET302: Mechanics of Solids

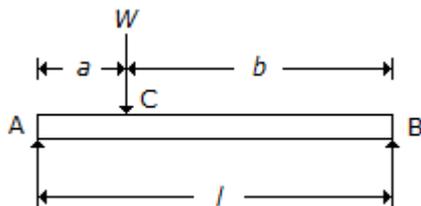
Time: Three Hours

Maximum Marks: 100

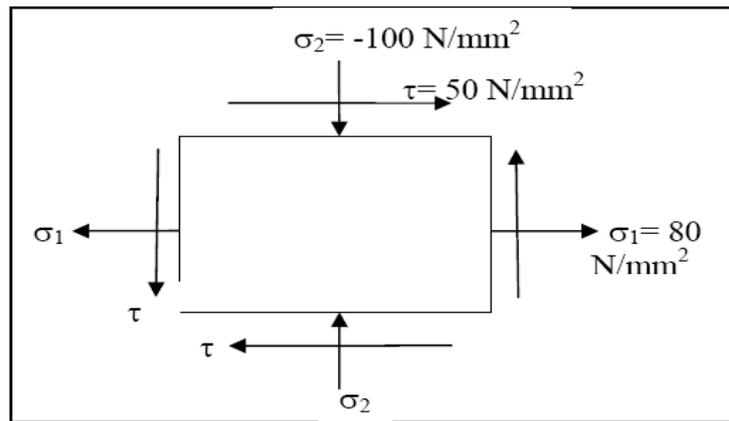
Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

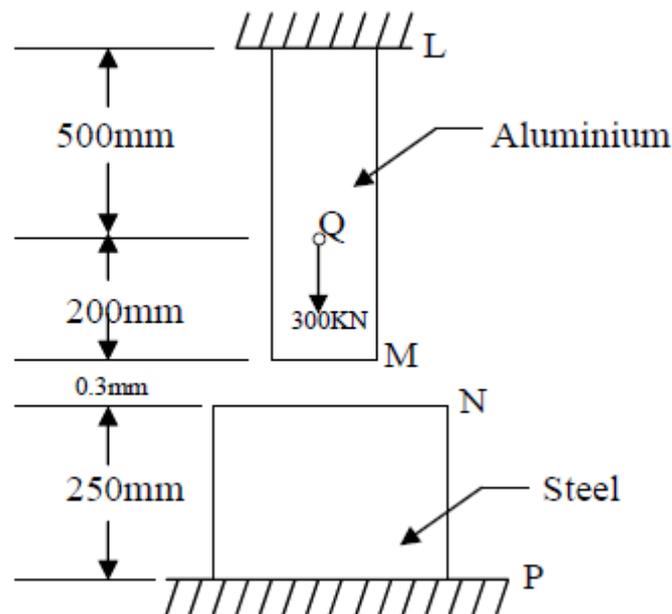
- The deformation per unit length is called
 - tensile stress
 - compressive stress
 - shear stress
 - strain
- The neutral axis of the cross-section a beam is that axis at which the bending stress is _____
- For a beam, as shown in the below figure, when the load W is applied in the centre of the beam, the maximum deflection is



- $\frac{Wl^3}{48 EI}$
 - $\frac{5 Wl^3}{384 EI}$
 - $\frac{Wl^3}{192 EI}$
 - $\frac{Wl^3}{384 EI}$
- In a simple bending of beams, the stress in the beam varies _____
 - Two closely coiled helical springs 'A' and 'B' are equal in all respects, but the number of turns of spring 'A' is half that of spring 'B'. The ratio of deflections in spring 'A' to spring 'B' is
 - 1/8
 - 1/4
 - 1/2
 - 2



22. a) A 700mm length of aluminium alloy bar is suspended from the ceiling so as to provide a clearance of 0.3mm between it and a 250mm length of steel bar as shown in fig. $A_{AL}=1250\text{mm}^2$, $E_{AL}=70\text{GN/m}^2$, $A_S=2500\text{mm}^2$ and $E_S=210\text{GN/m}^2$. Determine the stress in the aluminium and in the steel bar due to a 300kN load applied 500mm from ceiling.



(OR)

- b) (i) Explain in detail the Stress-Strain diagram for steel and aluminum alloy (10)
(ii) Determine the Poisson's ratio and bulk modulus of a material, for which Young's modulus is $1.2 \times 10^5 \text{ N/mm}^2$ and modulus of rigidity is $0.48 \times 10^5 \text{ N/mm}^2$. (4)
23. a) A cantilever 14m span carries load of 6kN, 4kN, 6kN and 4kN at 2m, 4m, 7m, and 14m respectively from the fixed end. It also has a uniformly distributed load of 2kN/m run for the length between 4m and 8m from the fixed end. Draw the shear

force and bending moment diagrams.

(OR)

- b) A beam AB 10m long has supports at its ends A and B. It carries a point load of 2.5 kN at 3 m from A and a point load of 2.5 kN at 7m from A and UDL of 0.5 kN/m between the point loads. Draw shear force and bending moment diagram. And also find Maximum bending moment.

24. a) (i) A close coiled helical spring having 100mm mean diameter is made of 20 turns of 10mm diameter steel rod. The spring carries an axial load of 100N. Find the shearing stress developed in the spring and extension suffered by the spring. Take shear modulus $G=84\text{GN/m}^2$. (4)
- (ii) The stiffness of a close-coiled helical spring is 1.5N/mm of compression under a maximum load of 60N. The maximum shearing stress produced in the wire of the spring is 125N/mm^2 . The solid length of spring is given as 5cm. Find: (i) diameter of wire (ii) mean diameter of the coils and (iii) number of coils required. Take $C=4.5 \times 10^4 \text{N/mm}^2$. (10)

(OR)

- b) A shaft is required to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40N/mm^2 and twist 1° per meter length. Determine the diameter required if
- i) The shaft is solid
- ii) The shaft is hollow with external diameter twice the internal diameter.
- Take modulus of rigidity= 80kN/mm^2 .

25. a) A simply supported beam of 8m length carries two point loads of 64kN and 48kN at 1m and 4m respectively from the left hand end. Find the deflection under each load and the maximum deflection. $E=210 \text{ GPa}$ and $I=180 \times 10^6 \text{ mm}^4$. Use Macaulay's Method

(OR)

- b) Find the Euler's crippling load for a hollow cylindrical steel column of 38mm external diameter and 2.5mm thick. Take length of the column as 2.3m and hinged at its both ends. Take $E=205\text{GPa}$. Also determine crippling load by Rankine's formula using constants as 335MPa and 1/7500.
