



B.E DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2009)

Third Semester

AERONAUTICAL ENGINEERING

MEC109: Strength Of Materials

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. A composite section contains 4 different materials. The stresses in all the different materials will be
 - a) Different
 - b) In the ratio of their areas.
 - c) Equal
 - d) Zero
2. The strain energy stored by the body within elastic limit, when loaded externally is called -----
 - a) Resilience
 - b) Strain Energy
 - c) Proof resilience
 - d) Modulus of Resilience
3. The bending moment at the free end of a cantilever beam carrying any type of load is
 - a) Zero
 - b) Maximum
 - c) Minimum
 - d) Equal to the load
4. In the theory of simple bending , the bending stress in the beam section varies
 - a) Linearly
 - b) Elliptically
 - c) Parabolically
 - d) Zig - Zag
5. The shafts are designed on the basis of
 - a) Rigidity
 - b) Strength
 - c) Stress
 - d) Both strength and Rigidity
6. When a closely coiled spring is subjected to an axial load, it is said to be under
 - a) Bending
 - b) Shear
 - c) Torsion
 - d) All of these
7. Maximum deflection in a beam supported freely at both ends due to a central load P at middle is
 - a) $PL^3 / 48EI$
 - b) $PL^3 / 16EI$
 - c) $PL^3 / 96EI$
 - d) $PL^2 / 48EI$

sectional area of 10 cm^2 while the remaining 2 m has a cross sectional area of 20 cm^2 . An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5 \text{ N/mm}^2$.

22. a) A 12 m span simply supported beam is carrying a uniformly distributed load of 2kN/m over a length of 6 m from the left end and point loads 6kN, 3kN and 4kN at distances of 7 m, 8 m and 9 m, respectively. Draw SF diagram and BM diagram for the beam and find the maximum bending moment.

(OR)

- b) A rectangular beam of width 200 mm and depth 300 mm is simply supported over a span of 5 m. Evaluate the load that the beam can carry per meter length, if the allowable bending stress in the beam is 100 N/mm^2 .

23. a) A solid and a hollow shaft have same weight and are made in same material. The inner diameter of hollow shaft is half of outer diameter. Show that for same shearing stress the hollow shaft will carry 1.44 times the torque carried by solid shaft. Is the greater torque capacity of hollow shaft an advantage?

(OR)

- b) A closely coiled helical spring made of 10mm diameter steel wire has 15 coils of 100mm mean diameter. The spring is subjected to an axial load of 100N.

Evaluate :

- (i) The maximum shear stress induced
- (ii) The deflection and
- (iii) Stiffness of the spring.

Take modulus of rigidity = $8.16 \times 10^4 \text{ N/mm}^2$.

24. a) A beam of span 4 m subjected to a point load of 20 kN at 1m from the left support and a UDL of 10kN/m over a length of 2 m from the right support.

Evaluate

- (a) Slope at the ends
- (b) Slope at centre
- (c) Maximum deflection using Macaulay method.

(OR)

- b) Evaluate the Euler's critical load for a cast iron hollow column of external diameter 200mm and 25mm thick and of length 6m hinged at both ends. Take $E = 0.8 \times 10^4 \text{ N/mm}^2$. Compare Euler's load with Rankine's critical load. Assume $f_c = 550 \text{ N/mm}^2$ and $\alpha = 1/1600$. Calculate the length of the column at which both critical loads are equal.

25. a) A cylindrical shell of 3m long and is having 1m internal diameter and 15mm thickness. Calculate the maximum intensity of shear stress induced and also the changes in the dimensions of the shell if it is subjected to an internal fluid pressure of 1.5 N/mm^2 .
Take $E_s = 2 \times 10^5 \text{ N/mm}^2$ and $\gamma = 0.3$ (Poisson's Ratio).

(OR)

- b) A point in a mass of material is subjected to a tensile stress of 60 N/mm^2 and a compressive stress of 40 N/mm^2 , acting on two mutually perpendicular planes, with a shear stress of 10 N/mm^2 on these planes. Evaluate the principal stresses and the maximum shear stress.
