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B.E DEGREE EXAMINATIONS: DEC 2014

(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. Proof resilience is the mechanical property of the material which indicates their capacity to bear
   a) Static tensile load
   b) Static compressive load
   c) Shocks
   d) Torsion

2. The work done in producing strain on a material per unit volume is called
   a) Resilience
   b) Ductility
   c) Elasticity
   d) Plasticity

3. The bending moment at the free end of a cantilever beam carrying any type of load is
   a) Zero
   b) minimum
   c) maximum
   d) equal to the load

4. The example for indeterminate beam is
   a) Doubly over hanging beam
   b) Cantilever beam
   c) Propped cantilever.
   d) Single over hanging beam.

5. Torsional rigidity of a shaft is equal to
   a) Product of modulus of rigidity and polar moment of inertia
   b) Sum of modulus of rigidity and polar moment of inertia
   c) Difference of modulus of rigidity and polar moment of inertia
   d) Ratio of modulus of rigidity and polar moment of inertia

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) shear and torsion

7. A fixed beam is a beam whose end supports are such that the end slopes are

   a) maximum   b) minimum

   c) zero   d) none of the above

8. If the compressive member is not vertical, it is called as

   a) Strut   b) Column

   c) Stanchion   d) All the above.

9. The circumferential strain in case of thin cylindrical shell, when subjected to internal pressure (p) is

   a) more than diametral strain   b) less than diametral strain

   c) equal to diametral strain   d) none of the above

10. A cylindrical vessel is said to be thin if the ratio of its internal diameter to the wall thickness is

    a) less than 20   b) equal to 20

    c) more than 20   d) none of the above

PART B (10 x 2 = 20 Marks)

11. Define modulus of resilience.

12. Differentiate lateral strain and linear strain.

13. Classify the beams, depending upon type of supports.

14. How to draw SFD for a fixed beam?

15. Write the assumptions for finding out the shear stress in a circular shaft, subjected to torsion.

16. Give the classifications of helical springs.

17. What is a Macaulay's method? Where it is used?

18. Define slope of a beam.

19. Distinguish between cylindrical shell and spherical shell.

20. Define principal planes and principal stresses.

PART C (5 x 14 = 70 Marks)

21. a)   A Steel rod 21 mm diameter is passed through a brass tube 25 mm internal diameter and 30 mm external diameter. The tube is 80 cm long and is closed by thin rigid washers and fastened by nuts, screwed to the rod. The nuts are tightened until the compressive force in the tube is 5 kN. Calculate the stresses in the rod and in the tube. Take E for steel = 200 GPa, E for brass = 80 GPa.

(OR)

    b)   A load of 100 N falls through a height of 2 cm onto a collar rigidly attached to the

lower end of a vertical bar 1.5 m long and of 1.5 cm^2 cross-sectional area. The upper end of the vertical bar is fixed. Determine: (i) maximum instantaneous stress induced in the vertical bar, (ii) maximum instantaneous elongation, and (iii) strain energy stored in the vertical rod. Take E = 2 x 10^5 N/mm^2.

22. a) A simply supported beam of length 5 m carries a uniformly increasing load of 800 N/m run at one end to 1600 N/m run at the other end. Draw the S.F and B.M. diagrams for the beam. Also calculate the position and magnitude of maximum bending stress.

(OR)

 b) A cantilever 1.5 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25 m from the free end. Draw the shear force and bending moment diagrams of the cantilever.

23. a) A solid cylindrical shaft is to transmit 300KW at 100 rpm
 (i) If the shear stress is not to exceed 80MN/m^2,Find its diameter
 (ii) What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameter? The length, the material and maximum shear stress being same.

(OR)

 b) Two close-coiled concentric helical springs of the same length, are wound out of the same wire, circular in cross-section and supports a compressive load 'P'. The inner spring consists of 20 turns of mean diameter 16 cm and the outer spring has 18 turns of mean diameter 20 cm. Calculate the maximum stress produced in each spring if the diameter of the wire=1 cm and P=1000N.

24. a) A beam 3m long, simply supported at its ends, is carrying a point load W at the centre. If the slope at the ends of the beam should not exceed 1^0, find the deflection at the centre of the beam.

(OR)

 b) By double integration method, derive the expression $Y_c = 5Wl^4 / 384EI$ for a simply supported beam with a uniform distributed load.

25. a) A cylindrical shell 3m long which is closed at the ends has an internal diameter

of 1m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also change in dimensions of the shell if it is subjected to an internal pressure of 1.5MN/m2.Take E = 200GN/m2, and 1/m=0.3.

(OR)

b)   At a certain point in a strained material, the stresses on two planes, at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by a shear stress of a magnitude of 10 N/mm^2. Find graphically or otherwise, the location of principal planes and evaluate the principal stresses.

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