KUMARAGURU
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Register Number:………….

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(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)

1. Young's modulus E is represented the factor of proportionality between …………..

   a) Elasticity and rigidity   b) Stress and strain

   c) Area and force   d) Shear stress and Stress

2. The energy stored in a material, at the time of loading is called ……………

3. A simply supported beam of length (l) carries a point load (W) at the midpoint. The bending moment diagram will be a

   a) Triangle with maximum value at the left side support   b) Triangle with maximum value at the centre of the beam

   c) Parabola with maximum value at the centre of the beam   d) Parabola with maximum value at the right side support

4. Aircraft wing is an example for ……………. type of beam

5. Two springs of stiffness k1 & k2 respectively are connected in series, the stiffness of the composite spring (k) will be given by,

   a) k=k1+k2   b) k=k1k2

   c) k=(k1+k1)/k1+k2   d) k=(k1k2)/k1+k2

6. The polar moment of inertia for circular hollow shaft is ……………

7. Find the wrong option

   a) y - deflection   b) (d^2y/dx^2) - moment

   c) (dy/dx) - slope   d) (d^3y/dx^3) - shear load

8. A long vertical member, subjected to an axial compressive load is called as ……..

9. For biaxial stress the maximum shear stress occurs on plane inclined at following angle to the principal normal plane

    a) 45°   b) 135°

    c) 90°   d) 145°

10. The hoop stress in thin walled cylinder is …………… times greater than the longitudinal stress in the same thin walled cylinder under same pressure.

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Define :

    a) normal stress

    b) shear stress

12. Illustrate stress – strain diagram for steel and mark the important properties.

13. Explain the term 'Point of contra flexure' with neat sketch.

14. Find the smallest diameter of bolt that can be used in the clevis shown in Figure No1 if P = 400 kN. The shearing strength of the bolt is 300 MPa.

Figure 2.1

Figure No1

15. For same weight, which shaft will carry more torque, a solid one or a hollow one? Explain?

16. Explain:

    a) Flexural Rigidity

    b)Torsional Rigidity

17. What are the assumptions made in the derivation of simple bending equations?

18. Explain the types of column failure?

19. Define :

    a) Principal plane.

    b) Principal stress.

20. Give short notes on the types of stresses produced in thin cylindrical shells

PART C (5 x 14 = 70 Marks)

(Not more than 400 words)

Q.No. 21 is Compulsory

21.   Draw shear force and bending moment diagram for the beam given in Figure No 2
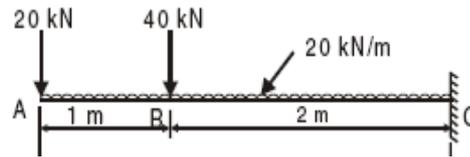

Figure No 2

22.   a)   Derive an equation relating Modulus of Elasticity (E) Rigidity modulus (G) and Bulk Modulus (K).

(OR)

      b)   A specimen of steel 20 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 80 kN and the load at elastic limit is 102 kN. The maximum load is 130 kN. The total extension at fracture is 56 mm and diameter at neck is 15 mm. Find
(i) The stress at elastic limit.
(ii) Young's modulus.
(iii) Percentage elongation.
(iv) Percentage reduction in area.
(v) Ultimate tensile stress.

23.   a)   A solid shaft is to transmit 300KW at 100 rpm if the shear stress is not to exceed $80N/mm^2$. Find the diameter of the shaft. If this shaft were to be replaced by hollow shaft of same material and length with an internal diameter of 0.6 times the external diameter, what percentage saving in weight is possible.

(OR)

      b)   A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 250 N.

          Determine:

            (i)   the deflection of the spring

            (ii)   maximum shear stress in the wire and

            (iii) Stiffness of the spring

           Take $C = 8 \times 10^4 N/mm^2$

24. a) A simply supported beam is loaded as shown in Figure No 3 is 200mm wide and 400mm deep. Find the slopes at the supports, deflections under loads and magnitude of the maximum deflection.
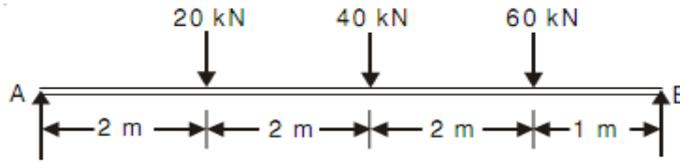
Take $E = 2 \times 10^4$ N/mm^2.Use Macaulay's method.

Figure No 3

(OR)

b) A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 250 KN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take $\sigma_C = 550$ N /mm^2 and. a = 1/1600 in Rankine's formula.

25. a) A cylinder 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. Also find the changes in dimensions of the shell, if it is subjected to an internal pressure of

1.5 MPa. Take E= 1.5MPa and Poisson's ratio=0.3.

(OR)

b) The state of stress at a point in a strained material is as shown in Figure No 4.
Determine:

(i) the direction of principal planes

(ii) the magnitude of principal stresses and

(iii) the magnitude of maximum shear stress.
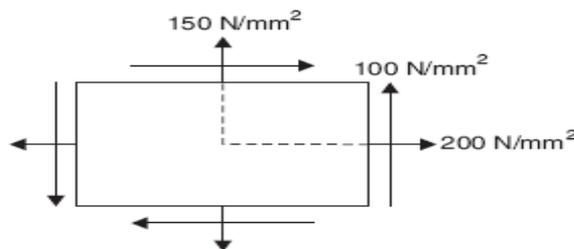
Indicate the direction of all the above by a sketch.

Figure No 4

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