KCG COLLEGE OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

CE 6306-STRENGTH OF MATERIALS (SEM: 3)

QUESTION BANK FOR UNIT 5

PART-A (2 Marks)

1. ***What are theories of failure for thick cylinders?***
   - Maximum Principal Stress theory
   - Maximum Shear Stress theory
   - Maximum Principal Strain theory
   - Maximum Distortion Energy Theory

2. ***Define Hoop stress.***
   This is the stress which is set up in resisting the bursting effect of the applied pressure and can be most conveniently treated by considering the equilibrium of half of the cylinder

3. ***Define "Thin Shell".***
   A thin shell is defined as a shell with a thickness which is small compared to its other dimensions and in which deformations are not large compared to thickness

4. ***Mention the types of stresses produced in thin cylindrical shells.***

   - Circumferential or hoop stress
   - The radial stress
   - Longitudinal stress

5. ***List out the modes of failure in thin cylindrical shell due to an internal pressure.***
   Such a component fails in since when subjected to an excessively high internal pressure. While it might fail by bursting along a path following the circumference of the cylinder. Under normal circumstance it fails by circumstances it fails by bursting along a path parallel to the axis. This suggests that the hoop stress is significantly higher than the axial stress.

6. ***What do you mean by principal plane?***
   The plane on which normal stress attains its maximum and minimum value.So these planes are also called as major principal plane and minor principal plane. The shear stress on principal plane is zero.

7. ***Define Torsion***
   When a pair of forces of equal magnitude but opposite directions acting on body, it tends to twist the body. It is known as twisting moment or torsion moment or simply as torque. Torque is equal to the product of the force applied and the distance between the point of application of the force and the axis of the shaft.

8. ***What are the assumptions made in Torsion equation***
   - The material of the shaft is homogeneous, perfectly elastic and obeys Hooke‟s law.
   - Twist is uniform along the length of the shaft
   - The stress does not exceed the limit of proportionality
   - The shaft circular in section remains circular after loading
   - Strain and deformations are small.

9. Define polar modulus

It is the ratio between polar moment of inertia and radius of the shaft.

£ = polar moment of inertia = J

Radius R

10. Why hollow circular shafts are preferred when compared to solid circular shafts?

The torque transmitted by the hollow shaft is greater than the solid shaft.

For same material, length and given torque, the weight of the hollow shaft will be less compared to solid shaft.

11. Write torsional equation

T/J=C_/L=q/R

T-Torque

J- Polar moment of inertia

C-Modulus of rigidity

L- Length

q- Shear stress

R- Radius

12. Write down the equation for maximum shear stress of a solid circular section in diameter 'D' when subjected to torque 'T' in a solid shaft.

T=_/16 * Fs*D3

T-torque

q Shear stress

D diameter

13. What is composite shaft?

Some times a shaft is made up of composite section i.e. one type of shaft is sleeved over other types of shaft. At the time of sleeving, the two shafts are joined together, that the composite shaft behaves like a single shaft.

14. What is a spring? State any two functions of springs

A spring is an elastic member, which deflects, or distorts under the action of load and regains its original shape after the load is removed.

Functions:

- To measure forces in spring balance, meters and engine indicators.
- To store energy.

15. What are the various types of springs?

- Helical springs
- Spiral springs
- Leaf springs
- Disc spring or Belleville springs

16. What is spring index (C)?

The ratio of mean or pitch diameter to the diameter of wire for the spring is called the spring index.

17. What is solid length?

The length of a spring under the maximum compression is called its solid length. It is

the product of total number of coils and the diameter of wire.
Ls = ntx d
Where, nt= total number of coils.

18. Define spring rate (stiffness).

The spring stiffness or spring constant is defined as the load required per unit deflection of the spring.
K= W/y
Where W -load
Y – Deflection

19. Define pitch.

Pitch of the spring is defined as the axial distance between the adjacent coils in uncompressed state. Mathematically Pitch=free length n-1

20. What are the differences between closed coil & open coil helical springs?

- The spring wires are coiled veryclosely, each turn is nearly at rightangles to the axis of helix
- The wires are coiled such that thereis a gap between the two consecutive turns.
- Helix angle is less than 10o Helix angle is large (>10o)

PART-B (16 Marks)

1. A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick plates is subjected to an internal pressure of 3 MPa. Calculate the change in volume of the vessel. Take E = 200 GPa and Poisson's ratio = 0.3 for the vessel material. **(April / May 2010)**

2. A spherical shell of 2 m diameter is made up of 10 mm thick plates. Calculate the change in diameter and volume of the shell, when it is subjected to an internal pressure of 1.6 MPa. Take E = 200 GPa and 1/m = 0.3. **(April / May 2010)**

3. A point in a strained material is subjected to two mutually perpendicular tensile stress of 200 MPa and 100 MPa. Determine the intensities of normal, shear and resultant stresses on a plane inclined at 30□ □ with the axis of the minor tensile stress**(April / May 2010)**

4. A point is subjected to a tensile stress of 250 MPa in the horizontal direction and another tensile stress of 100 MPa in the vertical direction. The point is also subjected to a simple shear stress of 25 MPa, such that when it is associated with the major tensile stress, it tends to rotate the element in the clockwise direction. What is the magnitude of the normal and shear stresses on a section inclined at an angle of 20□ □ with the major tensile stress?**(April / May 2010)**

5. A Cylindrical shell 3 meters long has 1 metre internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 15 kg/cm2. Take E = 2.0 × 106 kg/cm2 and Poisson's ratio = 0.3. **(Nov/Dec 2010)**

6. At a point in a strained material the principal stresses are 100 N/mm2 (tensile) and 60 N/mm2 (compressive). Determine normal stress, shear stress, resultant stress on a plane inclined at 50 degrees to the axis of the major principal stress. Also determine the maximum shear stress at the point. **(Nov/Dec 2010)**

7. A cylindrical shell 800 mm in diameter, 3 m long is having 10 mm metal thickness. If the shell is subjected to an internal pressure of 2.5N/mm2,
   (i) the change in diameter
   (ii) the change in length and
   (iii) the change in volume.
   Assume the modulus of elasticity and Poisson's ratio of the material of the shell as 200 kN/mm2 and 0.25 respectively. **(April / May 2011)**

8. The state of stress (in N/mm2) acting at a certain point of the strained material is shown in Fig. below. Compute (i) The magnitude and nature of principal stresses and (ii) The orientation of principal planes. **(April / May 2011)**