

AAIM MUHAMMED SALEGH COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

ME2254 STRENGTH OF MATERIALS
IV SEMESTER
TWO MARKS QUESTIONS AND ANSWERS

UNIT – I

STRESS STRAIN DEFORMATION OF SOLIDS

1. Define Hooke's law.
Hooke's law states that stress is proportional to strain within its elastic limit.
2. Define stress.
Stress is load divided by area.
3. Define strain.
Strain is the ratio of change in dimension over original dimension.
4. What are the types of stresses?
 1. Axial Stress.
 2. Bending stress.
 3. Shear stress.
5. What are differ types of strains
 1. Linear strain.
 2. Lateral strain.
 3. Volumetric strain.
 4. Shear strain.
6. What is difference between rigid and deformable bodies?
Rigid bodies will take more compressive load than the tensile load (Ex: brick stone, etc).
Deformable bodies can take both tensile and compressive load (Ex: Steel, copper, etc).
7. Define volumetric strain.
It is the change in volume over original volume.
8. What is relationship between Young's modulus, bulk modulus, and modulus of rigidity?
$$\text{Bulk Modulus } K = \frac{mE}{3(m - 2)}$$
$$\text{Modulus of Rigidity } C = \frac{mE}{2(m + 1)}$$
9. Define resilience (Or) Strain energy
It is the strain energy stored in the body.

10. Define proof resilience.

It is the maximum strain energy stored in the body.

11. Define Modulus of resilience.

It is the ratio of proof resilience over volume of the body.

12. Define Poisson ratio.

It is the ratio of lateral strain over linear strain.

13. Define Thermal stress.

It is stress or load induced due to change in temperature. This causes a material to expand or shrink.

14. Define Bulk Modulus.

It is the ratio of stress over volumetric strain.

15. What is the effect of change in temperature in the composite bar?

In the composite bar a material with lower co-efficient of expansion will be under tensile stress whereas the material with higher co-efficient expansion will be under compressive stress.

UNIT – II

BEAMS - LOADS AND STRESSES

1. What are the different types of loads

1. Point load 2. Uniformly distributed load (udl) 3. Uniformly varying load (uvl).

2. What are the different types of beams?

1. Cantilever beam 2. Simply supported beam 3. Fixed Beam 4. Over hanging beam 5. Continuous beam.

3. Define Shear force and bending moment.

Shear is total load acting at a point (upward load – downward load). Bending moment at a point is product of load and distance (anticlockwise moment – clockwise moment).

4. What are the assumptions in the theory of simple bending?

1. Beam is straight.
2. Each layer expand and contract independently.
3. Load acts normal to the axis of the beam.
4. Beam material is homogeneous.
5. Young's modulus is same for tension and compression.

5. Define point of contra flexure.

It is a point where the bending moment changes its sign from +ve to –ve or –ve to +ve. At that point bending moment is Zero.

6. Define flexural rigidity.

It is the product of moment of inertia and young's modulus (EI).

7. Define section modulus.

It is the ratio of moment of inertia over the neutral axis ($Z=I/y$). It is denoted by

“Z”. It is also known as strength of the section.

8. Where will be the maximum bending moment in simply supported beam?

Bending moment is maximum where shear force is zero.

9. Where will be the maximum bending stress in the beam?

The bending stress is the maximum at the ends of the section. And Zero at neutral axis.

10. Where will be the maximum Shear stress in a beam?

The maximum shear stress is the maximum at neutral axis and zero at the ends.

UNIT – III

TORSION AND SPRING

1. Define Torsion.

It is the angle of twist due to the load.

2. Define torsional rigidity.

It is a product of modulus of rigidity and polar moment of inertia (GI_p).

3. How does the shear stress vary across a solid shaft?

The stress is zero at the centre (neutral axis) and maximum at the perimeter.

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

Hollow shaft will carry more torque because polar inertia will be more for hollow shaft to solid shaft for the weight and length.

5. What are the types of spring?

Springs are following types.

1. Semi elliptical Leaf spring.
2. Quarter elliptical Leaf spring.
3. Closed coil helical spring
4. Open coil helical spring

6. What is the difference between closed coil and open coil spring

Closed Coil	Open coil
Angle of helix is less than 10°	Angle of helix greater than 20°
It is used for tensile load	It is used for both tensile and compressive load
Eg: Brake, accelerator	Eg :Shock absorber, ballpoint pen

7. Define Wahl's factor.

The effect of direct shear and change in coil curvature a stress factor is defined, which is known as Wahl's factor.

K = Wahl's factor, if we take into account the Wahl's factor then the formula for the shear stress becomes

$$\tau_{\max} = \frac{16.T.k}{\pi d^3}$$

8. What are the conditions to design a circular shaft?

1. The stress should be within the limit of the torque.
2. Angle of twist should be within the torque.

9. Define torsional energy or torsional resilience.

It is the strain energy stored due to angular twist. It is the product of Average torque and twist.

10. Define stiffness.

It is a ratio of load over change in length.

11. Express the strength of solid shaft

$$T = \pi \sigma d^3/16$$

12. How shafts are coupled?

Shafts are coupled by key or bolts.

UNIT – IV

BEAM DEFLECTION

1. What are the assumptions of double integration method?

1. The equation is based on the bending moment.
2. The effect of shear force is very small and thus neglected.
3. Beams are uniform
4. Inertia is uniform.
5. Material is homogenous.

2. Define Mohr theorems or moment area theorems.

Slope Theorem

It is the ratio of area of bending moment diagram over the flexural rigidity is called Mohr first theorem, to find the slope (A/EI).

Deflection Theorem

It is the product of slope and centroidal distance from a point, to find the deflection (Ax/EI).

3. What is a conjugate beam?

It is hypothetical beam; the load is derived from the bending moment diagram of the actual beam to find the slope and deflection. It is useful for varying I section along the span. The reaction at the support from the BM diagram load will give the slope.

4. What are the assumptions of Euler?

1. Column is straight.
2. Load is axial.
3. Self weight is neglected.
4. Column material is homogeneous.
5. Column fails due to buckling.
6. EI(flexural rigidity) is uniform

5. Define slenderness ratio.

It is the ratio of equal length of column over minimum radius of gyration.

6. What are the different types of ends and their equivalent length in the column?

1. Both ends hinged. ($l_e=L$)

2. Both ends fixed. ($l_e=L/2$)
3. One end hinged other end fixed. ($l_e=1.414L(\text{root } 2*L)$)
4. One end fixed other end free. ($l_e=2L$)

UNIT – V

ANALYSIS OF STRESSES IN TWO DIMENSIONS

1. Define Thin Cylinder or Sphere.

A Cylinder whose thickness is 20 times less than its diameter is known as thin cylinder.

2. What are the different types of stresses in cylinder?

1. Circumferential stress of Hoop stress.
2. Longitudinal Stress
3. Radial stress

3. Define Hoop Stress.

Hoop stress is the stress induced by fluid or gas inside the cylinder perpendicular to the length of the pipe. The thickness of the cylinder is decided based on hoop stress value because hoop stress is two times more than the longitudinal stress.

4. Define longitudinal stress

Longitudinal stress is the stress induced by the fluid or gas along the length of the Cylinder

5. How to increase the strength of a thin cylinder?

Winding the cylinder using thin wire.

6. Define Mohr's Circle.

It is the graphical representation to find stresses on a plane.

7. Define principal plane

It is a plane where shear force is zero is called principal plane.

8. Define Principal Stress.

The normal stress on the principal plane is called principal stress.

9. Define Oblique.

It is the angle between the resultant stress and normal stress.

10. In a Mohr's circle of stresses, what represents the maximum shear stress?

The radius of the Mohr's circle.