

PH8151-Engineering physics - I

Two marks Question with Answers

UNIT-1

PROPERTIES OF MATTER

1. Define neutral surface and neutral axis?

In the middle of the beam along the thickness, there is a layer which neither elongated nor compressed due to bending of the beam. This layer is called the 'neutral surface' and the line at which the neutral layer intersects the plane of bending is called the 'neutral axis'.

2. What is the use of stress- strain diagram?

The elastic behaviour of solid material is studied by using this stress- strain diagram.

3. What are advantages of I shape girder?

- As the layer of the beam at the upper and bottom are subjected to maximum stress more material must be needed there to withstand the strain.
- As the stress around the neutral layer is small, material in these regions can be removed without loss efficiency. This would save economy.
- This type of cross- section provides a high bending moment and a lot of material is saved.
- I form of girders are made of steel as they have high young modulus.

4. What are types of moduli of elasticity?

- i. Young's modulus corresponding to linear strain.
- ii. Rigidity modulus corresponding to shearing strain.
- iii. Bulk modulus corresponding to volume strain.

5. Define bulk modulus and mention its units?

Within the elastic limit of a body, the ratio of volume stress to volume strain is called bulk modulus of elasticity. It is denoted by the letter K

Bulk modulus (K) = Volume stress/ shearing strain

Units: SI unit of bulk modulus is Nm^{-1}

6. Define Hooke's law?

Within the limits, the strain produced in a body is directly proportional to the stress which causes it.

strain \propto stress (or) stress \propto strain

stress = (constant) strain

This constant is called 'modulus of elasticity'.

7. What is elasticity?

The property of the body to regain its original shape and size, after the removal of deforming force is called elasticity.

8. Difference between stream line motion and turbulent motion?

Sl. NO	Stream line motion	Turbulent motion
1.	Flow of liquid is orderly.	Flow of liquid is zigzag and random.
2.	At any point along a straight line parallel to the axis of the tube. Velocity is constant.	Velocity varies along the straight line parallel to the axis of the tube.
3.	Velocity is proportional to the pressure.	Velocity is proportional to the square root of pressure.
4.	Velocity will always be less than critical velocity.	Velocity will always be greater than critical velocity.

9. What are elastic bodies?

The bodies which regain its original shape and size after the removal of deforming force are called elastic bodies.

10. Define strain and its units?

The change in dimension or shape of a body due to the deforming force results in strain. It is defined as the ratio of change in dimension to the original dimension. It has no units.

$$\text{Strain} = \text{Change in dimension} / \text{Original dimension}$$

11. What are types of strain?

1. Linear strain
2. Shearing strain
3. Volume strain

12. Define stress and its units?

The restoring force acting per unit area of the body is called the stress. This restoring force is equal and opposite to the applied force F . therefore, stress is also defined as the deforming force per unit area of the body.

$$\text{Stress} = \text{deforming force} / \text{area} = F/A$$

$$\text{SI unit of stress} = \text{newton (N) / meter}^2 (\text{m}^2) = \text{N/m}^2 \quad (\text{or}) \quad \text{Nm}^{-2}.$$

13. What are types of moduli of elasticity?

1. Young's modulus corresponding to linear strain.
2. Rigidity modulus corresponding to shearing strain.
3. Bulk modulus corresponding to volume strain.

14. Define young's modulus of elasticity and mention its unit?

With in the elastic limit, the ratio of linear stress to linear strain is called young's modulus of elasticity. It is denoted by Y and SI units of stress is Nm^{-2} and strain has no unit. Therefore, SI unit of young's modulus is Nm^{-2} .

15. What are effects of change in temperature in elastic bodies?

- A change in the temperature affects the elastic properties of a material. Arise in temperature usually decreases the elasticity of the material. A carbon filament which elastic at normal temperature becomes plastic at high temperature.
- Similarly, decrease in temperature increase the elastic property. Lead is not a very good elastic material. But at low temperature, it becomes an elastic material.

- However, in some cases like the invar steel, the elasticity is not affected by any change in temperature.

16. Define bending moment of a beam.

The moment of the couple due to the static reactions which balances the external couple due to the applied load is called bending moment.

17. What is uniform bending?

The beam is loaded uniformly on its both ends, the bent beam forms an arc of a circle. The radius of curvature of the bent beam is constant for given load. This type of bending is called uniform bending.

18. Define rigidity modulus and mention its units?

With I the elastic limit, the ratio of the tangential stress to shearing strain is called rigidity modulus. It is denoted by 'n' and SI unit of rigidity modulus is Nm^{-2} .

19. What is I shape girder?

A girder is a metallic beam supported at its two ends by pillars or on opposite walls. It should be so designed that it should not bend too much or break under its own weight. The cross section of beam is in the form of letter I.

20. What is poisson's ratio?

When a tensile stress is applied to a wire, the wire undergoes not only an extension of length in the direction of the force but also a contraction in its thickness. The ratio of decrease in thickness to the original thickness in lateral direction is known as lateral contraction. The ratio of lateral contraction to linear elongation is called poisson's ratio.

$$\text{Poisson's ratio} = \text{lateral contraction} / \text{linear elongation}.$$

21. What is cantilever?

A cantilever is a beam fixed horizontally at one end and loaded at the other end.

22. Define torsional stress?

The shear stress set up in the shaft when equal and opposite torques are applied to the ends of a shaft about its axis, is called torsional stress.

23. What are the uses of torsional pendulum?

It is used to determine

- Rigidity modulus of the wire
- Moment of inertia of the disc
- Moment of inertia of the irregular body.

24. What is a torsional pendulum?

A circular metallic disc suspended using a thin wire that executes torsional oscillation is called torsional pendulum.

25. What are the effects of hammering and annealing on elasticity of a material? (or) how do hammering and annealing affect elasticity the material?

When solid materials are to annealing, larger crystal grains are formed which results in the reduction of its elastic property.

On hammering and rolling metals are made into thin sheets by breaking up the grains into fine which increases the elastic properties.

26. When a wire is bent back and forth, it becomes hot. Why?

When a wire is bent back and forth, heat is generated due to the area of the elastic hysteresis loop and frictional force. Hence it becomes hot.

27. For a free particle moving within a one dimensional potential box, the ground state energy cannot be zero why?

$$E_n = \frac{n^2 h^2}{8ml^2}$$

For a free particle moving within a one dimensional potential box, As energy is proportional to n^2 the ground state energy cannot be zero since $n=1$ is the ground state.

28. State wien's displacement law?

Wien's law states that the wavelength corresponding to the maximum energy is inversely proportional to absolute temperature 'T'

i.e., $\lambda_{max} T = constant$

this law holds good for shorter wavelengths.

29. Why diamond is an insulator and graphite is a conductor?

In diamond structure, each carbon is attached to four other carbon atoms and so it shows large resistance. On the other hand, in graphite structure each carbon is attached to three other carbon atoms and the fourth one is left free. This is responsible for the increase in electrical and thermal conductivity. So graphite conducts and diamond insulates.

30. List any four factors affecting elastic modulus and tensile strength?

- Effect of stress
- Effect of temperature
- Effect of impurities
- Effect of annealing, hammering and rolling
- Effect of crystalline nature

31. What are the changes that occur in solid deformation?

Plastic deformation refers to any changes in the shape or size of an object. The cause of this is due to an applied force or a change in temperature.

32. Define tensile strength?

It is defined as the maximum value of tensile stress withstand by the material before fracture,

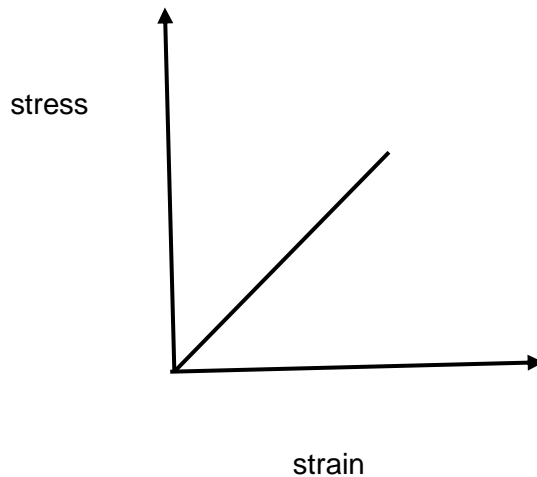
$$\text{Tensile strength} = \text{maximum tensile load} / \text{original cross-section area.}$$

33. How does plastic deformation occur in solids? (or) what are the changes that occur in solid deformation?

Plastic deformation refers to any change in the shape or size of an object. The cause of this is due to an applied force or a change in temperature.

34. How will you identify a brittle material from the stress- strain diagram?

A typical stress- strain curve for a brittle material will be linear. They do not show any plastic deformation.



35. An artificial denture with ultimate strength of 10^7 Nm^{-2} breaks when the jaws exerted a normal force of just 2 N while eating. Estimate the area in which the force acted on the denture?

Given data:

$$\text{Ultimate strength of pressure (p)} = 10^7 \text{ Nm}^{-2}$$

$$\text{Force (F)} = 2 \text{ N}$$

$$\text{Area} = ?$$

We know,

$$\text{Pressure} = \text{Force/Area}$$

$$= \frac{2}{10^{-7}} = 2 \times 10^{-7} \text{ m}^2$$