

**UNIT II**

**TRANSFER OF LOADS AND STRESSES IN BEAMS**

Types of loads, supports, beams – concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment - Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force - Flitched Beams - Leaf Springs.

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**1. Define beam?**

Beam is a structural member which is supported at the ends and subjected to external loads acting transversely (i.e) perpendicular to the center line of the beam.

**2. What is meant by transverse loading on beam?**

If a load is acting on the beam which perpendicular to the central line of it then it is called transverse loading.

**3. What is Cantilever beam?**

A beam whose one end is free and the other end is fixed is called cantilever beam.

**4. What is simply supported beam?**

A beam supported or resting freely on the support at both ends.

**5. What is meant by overhanging beam?**

If one or both of the end portions are extended beyond the support then it is called over hanging beam.

**6. What is concentrated load?**

A load which is acting at a point is called concentrated (or) point load.

**7. What is uniformly distributed load.**

If a load which is spread over a part (or) entire length of the beam in such a manner that rate of loading 'w' is uniform throughout the length then it is called as uniformly distributed load (udl).

**8. Define point of contra flexure? In which beam it occurs?**

The point at which the bending moment changes sign (or) zero is in a beam is called as point of contra flexure. It normally occurs in overhanging beam.

**9. What do you mean by positive or sagging BM?**

BM is said to positive if moment on left side of beam is clockwise or right side of the beam is counter clockwise.

**10. What do you mean by negative or hogging BM?**

BM is said to negative if moment on left side of beam is counterclockwise or right side of the beam is clockwise.

**11. Define shear force and bending moment?**

SF at any section of a beam is defined as algebraic sum of all the forces acting on left (or) right of the section of the beam. BM at any section is defined as algebraic sum of the moments of all the forces acting on left (or) right of the section of the beam.

**12. When will bending moment is maximum?**

BM will be maximum when shear force change its sign (or) zero.

**13. What is maximum bending moment in a simply supported beam of span 'L' subjected to UDL of 'w' over entire span?**

Max BM,  $M_{\max} = wL^2/8$

**14. In a simply supported beam how will you locate point of maximum bending moment?**

The bending moment is maximum when SF is zero (or) changes sign. Write SF equation at that point and equating to zero we can find out the distances 'x' from one end, then find maximum bending moment at that point by taking all moment on right or left hand side of beam.

**15. What is shear force?**

The algebraic sum of the vertical forces at any section of the beam to the left or right of the section is called shear force.

**16. What is shear force and bending moment diagram?**

It shows the variation of the shear force and bending moment along the length of the beam.

**17. What are the types of beams?**

1. Cantilever beam
2. Simply supported beam
3. Fixed beam
4. Continuous beam
5. over hanging beam
6. Propped Cantilever beam.

**18. What are the types of loads?**

1. Concentrated load or point load
2. Uniformly distributed load
3. Uniformly varying load

**19. In which point the bending moment is maximum?**

When the shear force change of sign or the shear force is zero

**20. How do you relate intensity of loading, shearing force and bending moment?**

Relationship between Load and Shear force is

$$dF/dx = w$$

Relationship between Shear force and Moment

$$dM/dx = - F$$

Relationship between load, SF and BM is

$$w = dF/dx = - d^2M/dx^2$$

Where w = load, F = Shear force and M = bending moment

**21. A simply supported beam of span 5 m carries a uniformly distributed load of intensity of 4 kN/m over the entire span. Determine the maximum Bending Moment.**

**22. Draw the BMD for a cantilever of 1 m span carrying a clockwise moment couple of 1 kNm at its free-end.**

**23. What is maximum bending moment in a cantilever beam of span 'L' subjected to UVL of  $w$  kN/m maximum at support and zero at free end?**

**24. What is point of contra flexure? Whether point of contra flexure will occur in a cantilever beam?**

The point where BM is zero after changing its sign is known as point of contra flexure. In a cantilever beam it will not occur.

**25. Differentiate between 'Hogging' and 'Sagging' Bending Moments**

<b>Hogging BM</b>	<b>Sagging BM</b>
The convex side of the deflected beam is upward	The concave side of the deflected beam is upward
Ex: Cantilever beam	Ex: Simply supported beam
Considered as negative BM	Considered as positive BM