CE8602 STRUCTURAL ANALYSIS - II

IMPORTANT 2 MARKS

UNIT 1 - INFLUENCE LINES FOR DETERMINATE BEAMS

1. **What is the use of influence line diagram (ILD)?**
   - Influence lines are very useful in the quick determination of reactions, shear force, bending moment or similar functions at a given section under any given system of moving loads.
   - Influence lines are useful in determining the load position to cause maximum value of a given function in a structure on which load positions can vary.

2. **State Muller Breslau's principle.**

   Muller–Breslau principle states that the influence line for a function (reaction, shear, or moment) is to the same scale as the deflected shape of the beam when the beam is acted upon by the function.
   - It is the quick method for establishing the shape of the influence line
   - Applicable for both determinate and indeterminate structures.

3. **What are influence lines?**

   An influence line is a graph showing, for any given frame or truss, the variation of any force or displacement quantity (such as shear force, bending moment, tension, deflection) for all positions of a moving unit load as it crosses the structure from one end to the other.

4. **Explain the use of Beggs deformeter.**

   It permits extremely accurate work in indirect model analysis. For best results the deformeter should be used in a room with controlled temperature and humidity so as to avoid disturbance of model deflections due to differential heating. Extended periods of use of this deformeter may cause considerable eye strain.

5. **What is meant by absolute maximum bending moment in a beam?**

   When a given load system moves from one end to the other end of a girder, depending upon the position of the load, there will be a maximum bending moment for every section. The maximum of these bending moments will usually occur near or at the midspan. The maximum of maximum bending moments is called the absolute maximum bending moment.

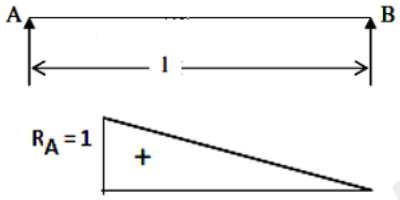
6. **Define similitude**

   Similitude means similarity between two objects namely the model and the Prototype with regard to their physical characteristics:
   - Geometric similitude is similarity of form
   - Kinematic similitude is similarity of motion
   - Dynamic and/or mechanical similitude is similarity of masses and/or forces.

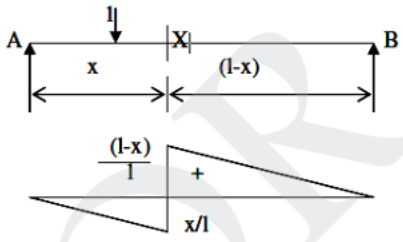
7. **What are the types of connections possible in the model of begg"s deformeter?**

- Hinged connection
- Fixed connection
- Floating connection

8. **Draw the ILD for reaction at the left support of a simply supported beam.**



9. **Sketch the influence line diagram for shear force at any section of a simply supported beam.**



Unit-3

ARCHES

1. **What is an arch? Explain.**

An arch is defined as a curved girder, having convexity upwards and supported at its ends.

- The supports must effectively arrest displacements in the vertical and horizontal directions.
- Only then there will be arch action.

2. **Write the types of arches based on the number of hinges.**

- Two hinged arch
- Three hinged arch
- Fixed arch
- Four hinged
- One hinged

3. **What are the types of arches according to their shapes ?**

- Curved arch
- Parabolic arch
- Elliptical arch
- Polygonal arch

4. **Write the difference between circular arch and parabolic arch.**

S.No	Circular arch	Parabolic arch
1	The calculation part is difficult in this circular type of arches.	The calculation part is easier in this parabolic type of arches.
2	The equation to find the height 'y' under the section is $y = \frac{4y_c}{L^2}(L - 2x)$	The equation to find the height 'y' under the section is $R^2 = x^2 + (R - y_c + y)^2$ Here R can be determined by $(2R_c - y_c)\, y_c = \left(\frac{L}{2}\right)^2$

5. **Give the equation for temperature effect in arches.**

Horizontal thrust, H = $\frac{l\alpha TEI}{\int_o^l y^2 dx}$

6. **Which theorem is utilized in solving the two hinged arch? State the theorem**

Eddy's theorem is utilized in solving the two hinged arch.

Eddy's theorem states that "The bending moment at any section of an arch is proportional to the vertical intercept between the linear arch (or theoretical arch) and the centre line of the actual arch".

7. **Difference between three hinged arch and two hinged arch?**

Sl.No.	Two hinged arches	Three hinged arches
1	Statically indeterminate to first degree	Statically determinate
2	Might develop temperature stresses	Increase in temperature causes increase in central rise. No stresses.
3	Structurally more efficient	Easy to analyse. But in construction, the central hinge may involve additional expenditure.
4	Will develop stresses due to sinking of supports	Since this is determinate, no stresses due to support sinking.

8. **Give the applications of two hinged arches.**
   - This is applicable to all shapes of arches.
   - Tunnel structures
   - Bridge Structures

9. **What is meant by Rib Shortening?**

As we can see that there is a normal thrusting force, which applies the compressing action to the rib/arch. If the magnitude is high it may result in the change in the length of the arch, due to corresponding strain, which can be found out by the Hooke's law. Final result will be the shortening of the arch. This effect is known as the Rib shortening.

UNIT – IV

PLASTIC ANALYSIS OF STRUCTURES

1. What is a plastic hinge?

When a section attains full plastic moment Mp, it acts as hinge which is called a plastic hinge. It is defined as the yielded zone due to bending at which large rotations can occur with a constant value of plastic moment Mp.

2. What is a mechanism?

When a system of loads is applied to an elastic body, it will deform and will show a resistance against deformation. Such a body is known as a *structure*. On the other hand if no resistance is set up against deformation in the body, then it is known as a *mechanism*..

3. What is difference between plastic hinge and mechanical hinge?

Plastic hinges modify the behavior of structures in the same way as mechanical hinges. The only difference is that plastic hinges permit rotation with a constant resisting moment equal to the plastic moment Mp. At mechanical hinges, the resisting moment is equal to zero

4. List out the assumptions made for plastic analysis. (assumptions made for pure bending)

The assumptions for plastic analysis are:

- Plane transverse sections remain plane and normal to the longitudinal axis before and after bending.
- Effect of shear is neglected.
- The material is homogeneous and isotropic both in the elastic and plastic state.
- Modulus of elasticity has the same value both in tension and compression.
- There is no resultant axial force in the beam.
- The cross-section of the beam is symmetrical about an axis through its centroid and parallel to the plane of bending.

5. Define shape factor.

Shape factor (S) is defined as the ratio of plastic moment of the section to the yield moment of the section.

$$Z = \frac{Mp}{M} = \frac{Zp.\sigma y}{Z.\sigma y} = \frac{Zp}{Z}$$

Where Mp = Plastic moment M = Yield moment
Zp = Plastic section modulus Z = Elastic section modulus

6. Define plastic modulus of a section Zp.

The plastic modulus of a section is the first moment of the area above and below the equal area axis. It is the resisting modulus of a fully plasticized section.

$$Zp = A/2\ (y1 + y2)$$

7. State upper bound theory.

Upper bound theorem states that "A load computed on the basis of an assumed mechanism will always be greater than or at least equal to the true ultimate load"

8. State lower bound theory.

Lower bound theorem states that "A load computed on the basis of an assumed equilibrium moment diagram in which the moments are not greater than Mp is less than or at best equal to the true ultimate load"

9.**What are meant by load factor and collapse load?**

Load factor:

Load factor is defined as the ratio of collapse load to working load.

$$\text{Load Factor } \lambda = \frac{Collapse\ Load}{Working\ load}$$

Collapse load:

The load that causes the (n + 1) the hinge to form a mechanism is called collapse load where n is the degree of statically indeterminacy. Once the structure becomes a mechanism.

10.**List out the shape factors for the following sections.**

- Rectangular section, S = 1.5
- Triangular section, S = 2.346
- Circular section, S = 1.697
- Diamond section, S = 2

11.Define Pure/simple Bending

Beam under constant bending moment with no shear force in it is said to be under pure/simple bending

UNIT-V

CABLE AND SPACE STRUCTURES

1. What are cable structures?

Long span structures subjected to tension and uses suspension cables for supports. Examples of cable structures are suspension bridges, cable stayed roof.

2. What is the true shape of cable structures?

Cable structures especially the cable of a suspension bridge is in the form of a catenary. Catenary is the shape assumed by a string / cable freely suspended between two points.

3. Briefly explain cable over a guide pulley.

Cable over a guide pulley has the following properties:

- Tension in the suspension cable = Tension in the anchor cable
- The supporting tower will be subjected to vertical pressure and bending due to net horizontal cable tension.

4. Briefly explain cable over saddle.

Cable over saddle has the following properties:

- Horizontal component of tension in the suspension cable = Horizontal component of tension in the anchor cable
- The supporting tower will be subjected to only vertical pressure due to cable tension

5. Define tension coefficient of a truss member.

The tension coefficient for a member of a truss is defined as the pull or tension in the member divided by its length, i. e. the force in the member per unit length.

6. Give some examples of beams curved in plan.

Curved beams are found in the following structures.

- Beams in a bridge negotiating a curve
- Ring beams supporting a water tank
- Beams supporting corner lintels
- Beams in ramps

7. What are the forces developed in beams curved in plan?

Beams curved in plan will have the following forces developed in them:

- Shear forces
- Bending Moment
- Torsional moments

8.Define a space frame and what is the nature of joint provided in the space trusses?

A space frame is a structure built up of hinged bars in space. It is three dimensional generalization of a truss.

Socket joint is provided in the space trusses.

9. What are the methods available for the analysis of space trusses?

Tension co-efficient method is available for the analysis of space trusses.

10. What is the need for cable structures?

- The main load bearing member.
- Flexible throughout.
- It can take only direct tension and cannot take any bending moment.

11.What is the nature of forces in the cables?

Cable structures have only tension and no compression or bending.

12.Differentiate Curved beam and beam curved in plan

Beam curved to plan is subjected to transverse loading and hence bending moment and shear force are induced at any section of the beam

But, A curved beam is subjected to ab addition of twisting moment also along with bending moment and shear force.

13.Give the application of three hinged stiffening girder

- It keeps the bridge decks remain horizontal
- It resists the shear force and bending moment due to live loads
- It convert the load applied over a deck slab as udl and transfer it to cable