**SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY:: PUTTUR**
**(AUTONOMOUS)**
Siddharth Nagar, Narayanavanam Road – 517583

**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code:** Mechanics of Solids (18CE0111) **Course & Branch**: B.Tech – CE

**Year & Semester:** II-B.Tech & II-Semester **Regulation:** R18

## UNIT 1

## THIN & THICK CYLINDERS

1. A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2.5 N/mm$^2$, Determine (i) change in diameter (ii) change in length and (iii) change in volume. Take E= 2x 10 5 N/mm$^2$ Poisson's ratio 0.25. [10M]

2. A cylindrical shell 100 mm long 200mm internal diameter having thickness of a metal as 10 mm is filled with a fluid at atmospheric pressure. If an additional 200 mm$^3$ pumped into the cylinder, Find i) the pressure exerted by the fluid on the cylinder and ii) the hoop stress induced . Take E = 2 X 10 $^5$ N/ mm$^2$ and Poisson's ratio is 0.3 [10M]

3. A copper cylinder, 90 cm long, 40 cm external diameter and wall thickness 6 mm has its both ends closed by rigid blank flanges. It is initially full of oil at atmospheric pressure. Calculate additional volume of oil which must be pumped into it in order to raise the oil pressure to 5 N/mm 2 above atmospheric pressure. For copper assume E= 1.0 x 10 5 N/mm 2 and Poisson's ratio 1/3. Take bulk modulus of oil as K= 2.6 x 10 3 N/mm$^2$. [10M]

4. A closed cylindrical vessel made of steel plates 4 mm thick with plane and, carries fluid under a pressure of 3 N/ mm$^2$. The dia, of cylinder is 30 cm and length is 80 cm , calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder. Take E = 2 X 10 $^5$ N/ mm$^2$ and Poisson's ratio is 0.286 [10M]

5. Derive an expression for hoop and radial stresses across thickness of the thick cylinder [10M]

6. Calculate the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 8 N/mm 2 , if maximum hoop stress in the section is not exceed to 35N/mm$^2$ . [10M]

7. Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm 2. Also sketch the radial pressure and hoop stress distribution across the section. [10M]

8. A compound cylinder is made by shrinking a cylinder of external diameter 300 mm and internal diameter of 250 mm over another cylinder of external diameter 250 mm and internal diameter 200 mm. The radial pressure at the junction after shrinking is 8 N/mm$^2$ . Find the final stresses set up across the section, when the compound cylinder is subjected to an internal fluid pressure of 84.5 N/mm$^2$ . [10M]

9. A steel cylinder of 300 mm external diameter is to be shrunk to another steel cylinder of 150 mm internal diameter. After shrinking, the diameter at the junction is 250 mm and radial pressure at the common junction is 28 $N/mm^2$ . Find the original difference in radii at the junction. Take E = 2 x 10 5 $N/mm^2$. [10M]

10. A thick spherical shell of 200 mm internal diameter is subjected to an internal fluid pressure of 7 $N/mm^2$ . If the permissible tensile stress in the shell material is 8 $N/mm^2$, Find thickness of the shell. [10M]

## UNIT-II

## DIRECT AND BENDING STRESS

1. A masonry dam of rectangular section, 20 m high and 10 m wide, has water upto a height of 16 mon its one side find:
   - i) Pressure force due to water on one meter length of the dam
   - ii) Position of centre of pressure
   - iii) The position at which the resultant cuts the base and Maximum and minimum intensities at the base of the dam. Take weight density of masonry is19.62 kN/$m^3$ and of water 9.81 kN/$m^3$ [10M]

2. Derive kernel of section for Rectangular, Circular and Hallow Circular sections [10M]

3. a) Derive the equation for resultant stresses when a column of rectangular section is subjected to a load which is eccentric to both axes [7M]

   b) A short column of rectangular cross-section 80 mm by 60 mm carries a load of 40 KN at a point 20 mm from the longer side and 35 mm from the shorter side. Determine the maximum compressive and tensile stresses in the section. [5M]

4. Determine the maximum and minimum stresses at the base of a hollow circular chimney of height 20m with external diameter 4m. The chimney is subjected to a horizontal wind pressure of intensity 1 KN/$m^2$. The specific weight of the material of chimney is 22 KN/$m^3$ [10M]

5. Find the position of centroid $I_{XX}$ and $I_{YY}$ for an unequal angle section 125mm X 75mm X 10mm [10M]

## UNSYMMETRICAL BENDING

6. A cantilever of length 2m carries a point load of 2KN at the free end. The c/s of cantilever is an unequal of dimensions 150X50X15 $mm^3$. The small leg of angle 50 mm is horizontal. The load passes through the centroid of the c/s. Determine a) position of neutral axis b) the magnitude of maximum stress setup at the fixed section of the cantilever [10M]

7. A 45 mm X 45 mm X 5 mm angle is used as a SSB over a span of 2.4m. It carries a load of 300 N along the vertical axis passing through the centroid of the section. Determine the resulting bending stress on the outer corners of the section, along the middle section of the beam [10M]

8. Determine the centroidal moment of inertia of the equal section 30 X 30X 10 $mm^3$ [10M]

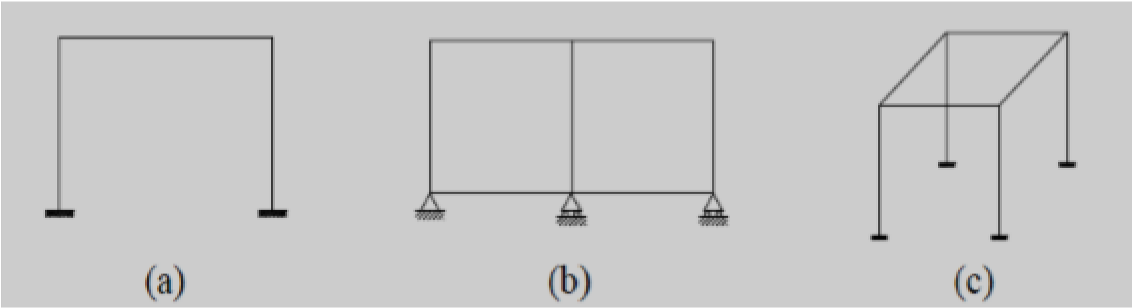
9. a) What is unsymmetrical bending [ 2M]

   b) Determine the prinicipal moment of inertia of unequal angle section 200X 150 X 10 X $mm^3$ [10M]

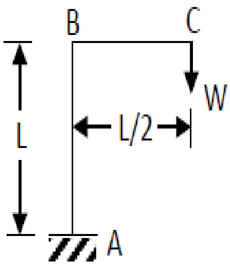
10. A wooden beam of c/s 100 mm X 150 mm is used as shown in fig to support a sloping tiled roof. It has an effective span of 4m and carries a uniformly distributed load 3 KN/M acting vertically download. Determine the maximum stresses developed in the beam [ 10M]

**UNIT-III**
**INTROUDUCTION**

1) Determine the number of indeterminacy for the three frames shown in figure below.

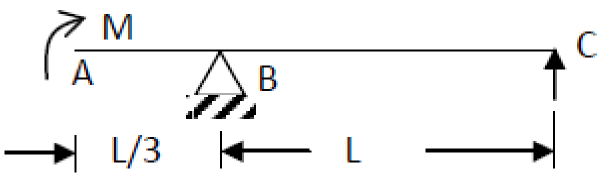



2. A vertical load W is applied to the rigid cantilever frame shown in figure below. Assuming EI to be constant throughout the frame determine the horizontal and vertical displacements of the point C. Neglect axial deformation. [ **10M]**

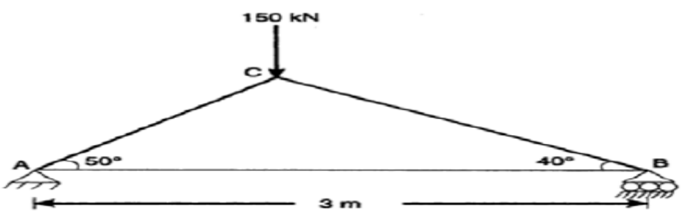



3. Calculate the central deflection and slope at ends of a simply supported beam carrying a U.D.L. **w** per unit length over the whole span. [**10M]**

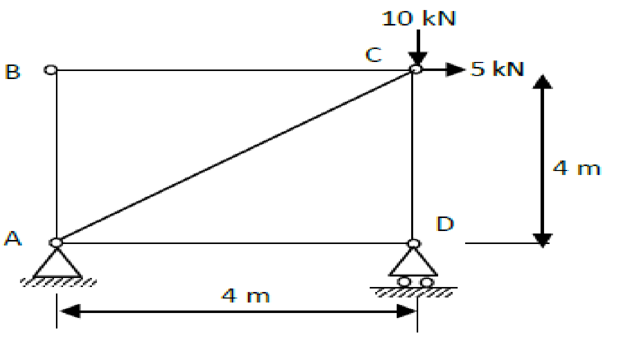
4. Using Castigliano's theorem, determine the deflection and rotation of the overhanging end A of the beam loaded as shown in figure below. [**10M]**



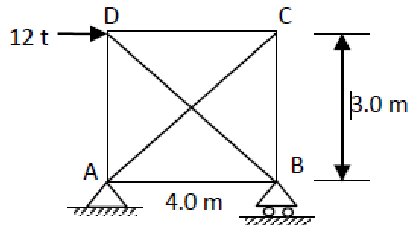

5. Determine the horizontal and vertical deflection components of joint C of the truss shown in figure below by energy method. Take E = 200 GPa and cross sectional area of each member is 1500 x $10^{-6}$ $m^2$. [**10M]**



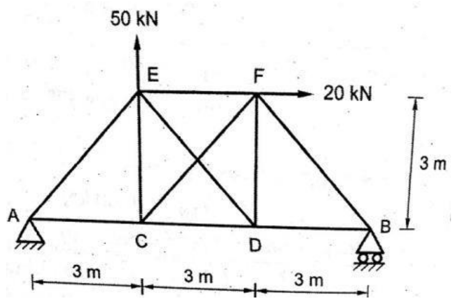
6. Find horizontal and vertical deflection of joint C of truss ABCD loaded as shown in figure below. Assume that, all members have the same axial rigidity. **[10M]**



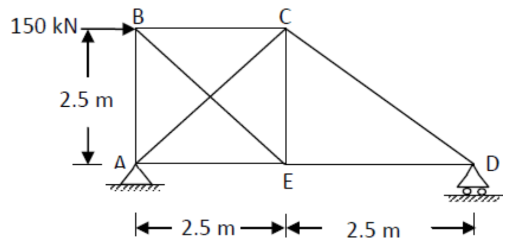

7. A pin jointed framed structure is loaded as shown in figure below. Calculate the forces in all members. Take area for horizontal members as 20 $cm^2$, vertical members as 30 $cm^2$, inclined members as 50 $cm^2$ and E = 2000 t/$cm^2$. **[10M]**



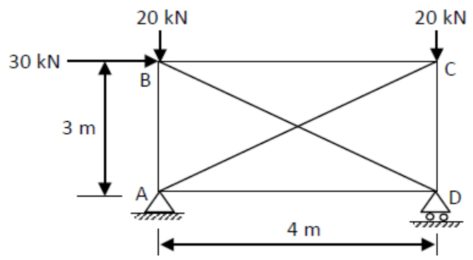

8.Analyze the truss shown in figure below. Assume that the cross sectional area of all members are same. **[10M]**




9. Determine the force in the members AC of a pin-jointed truss shown in figure below. Assume cross-sectional area of each member to be 15 x $10^{-4}$ $m^2$. **[10M]**




10.Determine the stresses in all the members of the frame shown in figure below, in which the cross sectional area of vertical members are 30 $cm^2$ each and those of all other members are 22 $cm^2$. Take E = 200 GPa. **[10M]**



## UNIT-IV

## ANALYSIS OF FIXED BEAMS & CONTINUOUS BEAMS

**1.** A fixed beam of length 6 m carries two point loads of 30 kN each at a distance of 2 m from both ends. Determine the fixed end moments and draw BMD. **[10M]**

**2.** A Fixed beam of span 6 m is subjected a UDL of 5 kN/m on the left half of the span and a point load of 15 kN at the middle of the right half of the span. Draw the SFD and BMD **[10M]**

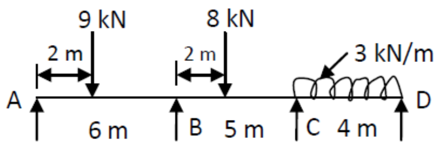
**3.** Calculate the fixed end moments and the reactions at the supports for a fixed beam AB of length 6 m. The beam carries point loads of 160 KN and 120 KN at a distance of 2 m and 4 m from the left end A. Draw SFD & BMD. **[10M]**

**4.** Derive an expression to find BM and SF of fixed beam carrying an eccentric load. **[10M]**

**5.** Determine the fixed end moments for the fixed beam with applied clockwise moment ‘M’ of distance ‘a’ from left end. The total length of beam is ‘L’. Sketch the bending moment and shear force diagram. **[10M]**

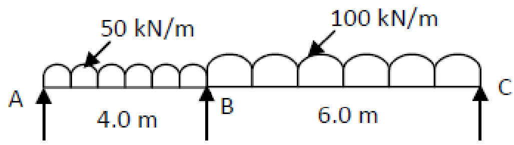
**6.** A continuous beam ABC of constant moment of Inertia carries a load of 10 kN in mid span AB and a central clockwise moment of 30 kN-min span BC. Span AB = 10 m and span BC = 15 m. Find the support moments and plot the shear froce and bending moment diagram. **[10M]**

**7.** Analyze the continuous beam ABCD shown in the figure below using theorem of three moments. Draw SFD and BMD. **[10M]**

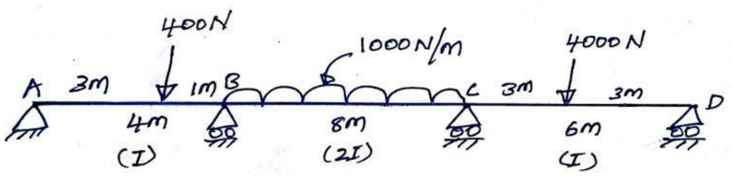



**8.** A continuous beam ABC of uniform section with span AB and BC as 4 m each, is fixed at A and simply supported at B and C. The beam is carrying a uniformly distributed load of 6 kN/m run throughout its length. Find the support moments and the reactions using theorem of three moments. Also draw SFD and BMD. **[10M]**

**9.** Analyze the beam and draw BMD and SFD **[10M]**



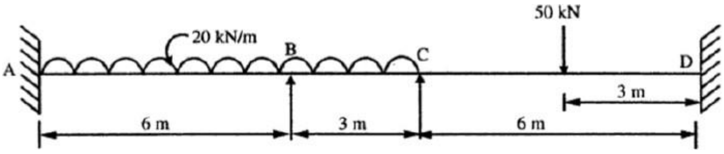

**10.** A continuous beam ABCD 18 m long is loaded as shown in figure below. During loading support ‘B’ sinks by 10 mm Find support moments and plot shear force and bending moment diagrams for the beam.Take E= 20 kN/mm$^2$ , I = 8 X10$^6$ mm$^4$ **[10M]**



## UNIT-V

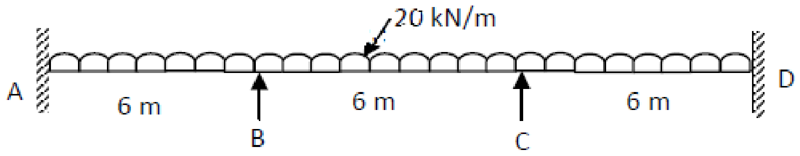
## SLOPE DEFLECTION METHOD& MOMENT DISTRIBUTION METHOD

1. Analyze the continuous beam as shown in figure below by slope deflection method. Support B sinks by 10 mm. Take E = 200 GPa and I = 16 x $10^7$ $mm^4$. Draw the bending moment diagram.

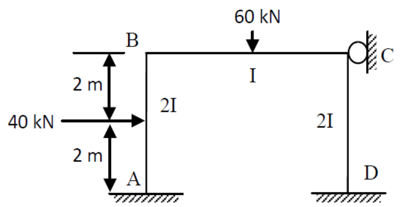



**10M**

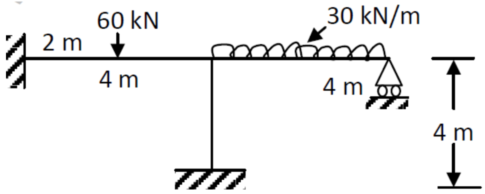
2. Analyze the continuous beam shown in figure below by slope deflection method and sketch SFD and BMD. EI is constant. **10M**



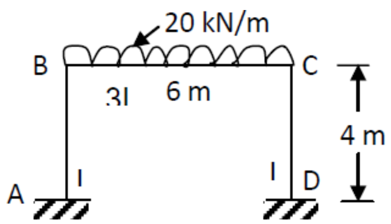

3. Analyze the portal frame shown in figure below, by slope deflection method. The relative moment of inertia value for each member is indicated in the figure below. Sketch the bending moment diagram **10M**



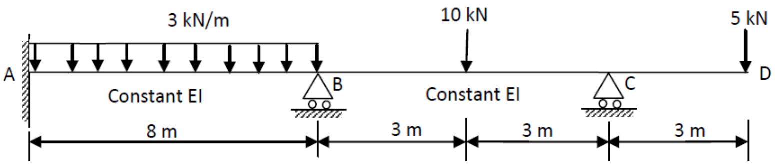

4. Analyze the frame shown in figure by slope deflection method. Draw BMD flexural rigidity is same for all members **10M**



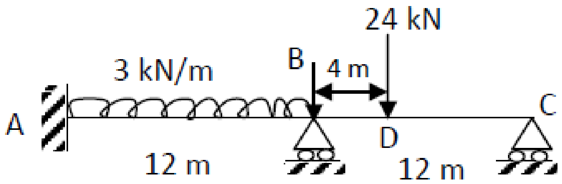

5. Analyze the frame shown in figure by slope deflection method. Draw BMD flexural rigidity is same for all members **10M**



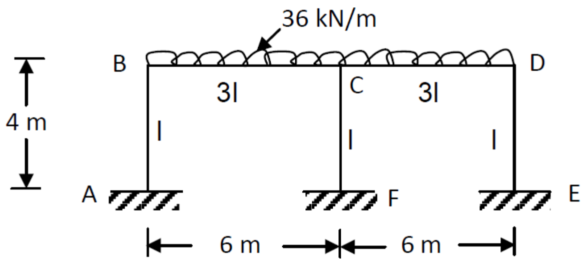
6.Analyze the continuous beam shown in figure below, using moment distribution method. Draw shear force and bending moment diagram for the continuous beam. **10M**



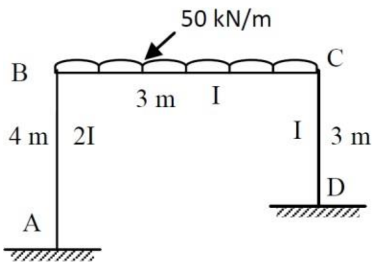

7.Analyze the continuous beam shown in figure below by using moment distribution method. The support B sinks 30 mm, values of E and I are 200 GPa and 0.2 x $10^9$ $m^4$ respectively uniform throughout. Draw S.F and B.M diagrams. **10M**



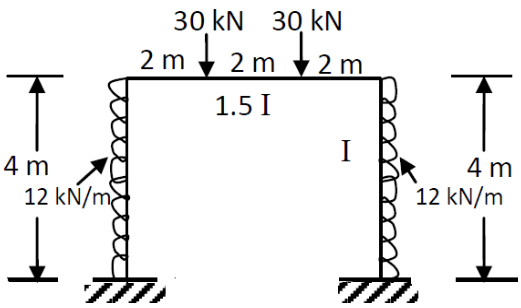

8.Analyze the rigid jointed frame shown in figure by moment distribution method and draw BMD **10M**




9.Analyze the portal frame shown in figure using moment distribution method **10M**




10.Analyze the portal frame shown in figure using moment distribution method **10M**



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**QUESTION BANK ( OBJECTIVE)**

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## UNIT-I
## THIN &; THICK CYLINDERS

1) A cylindrical vessel is said to be thin if the ratio of its internal diameter to the wall thickness is
A) **< 20** B) > 20 C) =20 D) None [ ]

2) A cylindrical vessel is said to be thick if the ratio of its internal diameter to the wall thickness is
A) < 20 **B) > 20** C) =20 D) None [ ]

3) The hoop stress in a thin cylindrical shell is [ ]
A) PD/2t B) PD/4t C) 6PD/t D) 4PD/t

4) The longitudinal stress in a thin cylindrical shell is [ ]
A) PD/2t B) PD/4t C) 6PD/t D) 4PD/t

5) Circumferential and hoop stress in thin spherical shell are [ ]
A) Equal B) Not Equal C) Greater D) Lesser

6) The maximum shear stress in a thin cylindrical shell is [ ]
A) F/A B) A/F C) FA D) None

7) A cast iron pipe 1m diameter is required to withstand a 200m head of water. If the tensile stress is 20Mpa, then the thickness is [ ]
A) 25mm B) 50mm C) 75mm D) 100mm

8) For the analysis of thick cylinders, the theory applicable is [ ]
A) Lame's theory B) Rankine's theory C) Poisson's theory D) None

9) The variation of the hoop stress across the thickness of a thick cylinder is
A) Linear B) Parabolic C) Uniform D) hyperbolic [ ]

10) A thin cylindrical shell of internal dia D, and thickness t, is subjected to internal pressure p. The change in diameter is given [ ]
A) Pd2/4tE (2-µ) B) Pd2/4tE (1-2µ) C) Pd2/2tE (2-µ) D) Pd2/2tE (1-2µ)

11) The ratio of circumferential stress to longitudinal stress in z thin cylinder subjected to an internal Hydrostatic pressure is [ ]
A) 1/2 B) 1 C) 2 D) 4

12) A thick cylinder is subjected to an internal pressure of 60Mpa. If the hoop stress on the outer surface is 150Mpa, then the hoop stress on the internal surface is [ ]

A) 105Mpa B) 180 Mpa C) 210 Mpa D) 135Mpa

13) A thin cylindrical steel pressure vessel of diameter 6cm and wall thickness 333 is subjected to an internal fluid pressure if intensity p. If the ultimate strength of steel is 3600Kg/cm$^2$, the bursting pressure will be [ ]

A) 18Kg/cm$^2$ B) 36Kg/cm$^2$ C) 180Kg/cm$^2$ D) 360Kg/cm$^2$

14) A thin cylindrical shell is subjected to internal pressure p. The poission's ratio of the material of shell is 0.3. Due to internal pressure the shell is subjected to circumferential strain and axial strain. The ratio of circumferential to axial strain is [ ]

A) 0.425 B) 2.25 C) 0.225 D) 4.25

15) For the same internal dia, wall thickness, material and internal pressure, the ratio of maximum stress, induced in a thin spherical vessel will be [ ]

A) 2 B) ½ C) 4 D) ¼

16) A thin cylinder contains fluid at a pressure of 500N/m 2 , the internal diameter of the shell is 0.6m and the tensile stress in the material is to be limited to 9000 N/mm 2 . The shell must have a minimum thickness is [ ]

A) 9 mm B) 11 mm C) 17mm D) 21mm

17) In a thick cylinder pressurized from inside, the hoop stress is maximum at [ ]

A) Centre of wall thickness B) outer radius C) Inner radius D) Both B & C

18) A thick cylinder with internal diameter d and outside dia 2d is subjected to internal pressure p. Then the maximum hoop stress in the cylinder is [ ]

A) P B) 0 C) 1 D) 2p

19) The commonly used technique of strengthening thin pressure vessel is [ ]

A) Wire winding B) Shrink Fitting C) Multi-layered construction D) None

20) A thick cylinder under external fluid pressure' p 0′ will have maximum stress at the

A) Outer radius B) Inner radius C) Mean radius D) None [ ]

21) A thick cylinder under internal fluid pressure' pi will have maximum stress at the

A) Outer radius B) Inner radius C) Mean radius D) None [ ]

22) A thick cylinder under pi and po will have maximum stress at the [ ]

A) Outer radius B) Inner radius C) Mean radius D) None

23) Hoop shrinking in thick cylinders is done to achieve [ ]

A) Increased stresses B) Decreased stresses C) Uniform stresses D) None

24) Which stress is the least in a thin shell [ ]

A) Longitudinal stress B) Hoop stress C) Radial stress D) None

25) Among the cylindrical and spherical thin vessels of same material, diameter and pressure which has the lesser thickness [ ]

A) Cylindrical shell B) Spherical shell

C) Cylindrical shell with semi spherical head D) None

26) What is the ratio of hoop stresses in a spherical vs cylindrical shell of same diameter, thickness and under same pressure? [ ]

A) 4:1 B) 2:1 C) 1:2 D) 1:4

27) Stresses in a thin cylindrical shell under internal pressure is independent of [ ]

A) Diameter B) Thickness C) Length D) Diameter and thickness

28) Design of a thin shell under pressure is done on the basis of [ ]

A) Radial stress B) Longitudinal stress C) Hoop stress D) All the three stresses

29) Which is most predominant type of failure in a thin shell [ ]

A) Bearing failure B) Compression failure C) Crushing failure D) None

30) The maximum strain in a thick cylinder under pi will be [ ]

A) σ h/E +μσ l /E B) σ h/ E + μσ r/ E C) σ r/E +μσ l /E D) None

31) Stress in a beam due to simple bending is ____________ [ ]

A) Directly proportional B) Inversely proportional C) Curvilinearly related D) None

32) Which stress comes when there is an eccentric load applied? [ ]

A) Shear stress B) Bending stress C) Tensile stress D) Thermal stress

33) The bending stress is ____________ [ ]

A) Directly proportional to the distance of layer from the neutral layer
B) Inversely proportional to the distance of layer from the neutral layer
C) Directly proportional to the neutral layer
D) Does not depend on the distance of layer from the neutral layer

34) On bending of a beam, which is the layer which is neither elongated nor shortened? [ ]

A) Axis of load B) Neutral axis C) Center of gravity D) None

35) Which of these are types of normal stresses? [ ]

A) Tensile and compressive stresses B) Tensile and thermal stresses
C) Shear and bending D) Compressive and plane stresses

36) The stress which acts in a direction perpendicular to the area is called ______ [ ]

A) Shear stress B) Normal stress C) Thermal stress d) None

37) In a body loaded under plane stress conditions, what is the number of independent stress components? [ ]

A) 1 B) 2 C) 3 D) 6

38) Which type of stress does in a reinforcement bar is taken by the concrete? [ ]

A) Tensile stress B) Compressive stress C) Shear stress d) Bending stress

39) A material has a Poisson's ratio of 0.5. If uniform pressure of 300GPa is applied to that material, What will be the volumetric strain of it? [ ]

A) 0.50 B) 0.20 C) 0.25 D) Zero

40) A diagram which shows the variations of the axial load for all sections of the pan of a beam is called ____________ [ ]

A) BMD b) SFD c) Thrust diagram d) Stress diagram

**Key:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1)A | 2)B | 3)A | 4)B | 5)A | 6)A | 7)B | 8)A | 9)D | 10)A |
| 11) C | 12) C | 13) C | 14)D | 15)A | 16)C | 17)C | 18)C | 19)C | 20)B |
| 21) B | 22) B | 23) C | 24)C | 25)B | 26)C | 27)C | 28)C | 29)D | 30)B |
| 31)A | 32)B | 33)A | 34) B | 35)A | 36) B | 37)C | 38)B | 39)D | 40)D |

**UNIT-II**

## DIRECT AND BENDING STRESS AND UNSYMETRICAL BENDING

1) A solid shaft of diameter D transmits the torque equal to [ ]
A) $Td^3$ B) 3τD **C) τD /3** D) τD* 3

2) The torque transmitted by a hallow shaft of external diameter (D) and internal diameter(d) is equal to [ ]
A) $\tau[D^3 - d^3]$ B) $\tau[D^3 - d^3]$ **C) $\tau[D^4 - d^4]$** D) $\tau[D^4 - d^4]$

3) Polar moment of inertia of a hallow circular shaft is [ ]
A) $[D^3 - d^3]$ **B) $[D^4 - d^4]$** C) $[D^3 - d^3]$ D) $[D^4 - d^4]$

4) The torsional rigidity of a shaft is defined as the torque required to produce [ ]
A) Maximum twist in shaft B) Maximum shear stress in shaft
C) Minimum twist in shaft **D) A twist of one radian per unit length of shaft**

5) Polar modulus of shaft is [ ]
A) J*R **B) J/R** C) R/J D) 1/J

6) If a shaft is simultaneously subjected to a torque T and a bending moment M, the ratio of maximum shearing stress is given by [ ]
**A) 2M/T** B) M/T C) 2T/M D) T/M

7) If two shafts of the same length, one of which is hollow, transmit equal torque and have equal maximum stress, then they should have equal [ ]
A) Polar moment of inertia **B) Polar modulus of section** C) Diameter D) None

8) A shaft AB of equal length l, diameter d is subjected to torque T at section C such that AC=l/3, ends of the shaft are fixed. What is the resisting torque at A [ ]
A) T **B) 0.67T** C) 0.5T D) 0.33T

9) A shaft turns at 150rpm under a torque of 150Nm. Power transmitted is [ ]
A) 0.15Π kW B) 10Π kW **C) 0.75Π kW** D) 750Π kW

10) The outside diameter of a hallow shaft is twice its inside diameter. The ratio of its torque carrying capacity to that a solid shaft of the same material and the same outside dia is [ ]
**A) 15/16** B) 3/4 C) 1/2 D) 1/16

11) In a rectangular shaft is subjected to torsion, the maximum shear occurs at [ ]
A) Centre B) corners C) middle of smaller side **D) middle of larger side**

12) A solid shaft of diameter d carries a twisting moment that develops maximum shear stress τ. If the shaft is replaced by a hallow one of outside diameter d and inside diameter d/2, then the maximum shear stress will be [ ]
**A) 1.607τ** B) 1.143τ C) 1.330τ D) 2τ

13) If a shaft is rotating at N revolutions per second with an applied torque T kg-m, the power transmitted by the shaft is [ ]
A) 1 B) 0 **C) 2ΠNT x 9.81** D) 9.81

14) Unsymmetrical bending is the bending caused by loads that [ ]

A) Lie in a vertical plane B) Lie in a horizontal plane

**C) Do not lie in a plane containing the principal centroidal axis**

D) Lie in a plane containing the principal centroidal axis

14) In a channel section symmetrical about XX axis shear centre lies at [ ]

A) Centre of the vertical web B) Centre of top flange C) Centroid of the section **D) None**

15) In an I section, symmetrical about XX and YY axes, shear centre lies at [ ]

A) Centroid of top flange **B) Centroid of web** C) Centroid of bottom flange D)None

16) The theory of curved beam was postulated by [ ]

A) Rankine B) Mohr C) Castigliano **D) Winkler- Bach**

17) In curved beams the distribution of bending stress [ ]

A) linear B) Parabolic C) Uniform **D) Hyperbolic**

18) The nature of stress at the inside surface of a crane hook is [ ]

A) Shear **B) Tensile** C) Compressive D) None

19) In a closed ring when a small cut is made at the horizontal diameter the maximum stress will [ ]

A) Decrease **B) Increase** C) Remain same D) Become infinite

20) What is the expression of the bending equation? [ ]

**A) M/I = σ/y = E/R** B) M/R = σ/y = E/I C) M/y = σ/R = E/I D) M/I = σ/R = E/y

21) On bending of a beam, which is the layer which is neither elongated nor shortened? [ ]

A) Axis of load **B) Neutral axis** C) Center of gravity D) None

22) Which stress comes when there is an eccentric load applied? [ ]

A) Shear stress **B) Bending stress** C) Tensile stress D) Thermal stress

23) Stress in a beam due to simple bending is _____________ [ ]

**A) Directly proportional** B) Inversely proportional C) Curvilinearly related D) None

24) The maximum negative bending moment in fixed beam carrying udl occurs at ________ [ ]

A) Mid span B) 1/3 of the span **C) Supports** D) Half of the span

25) A fixed beam of the uniform section is carrying a point load at the centre, if the moment of inertia of the middle half portion is reduced to half its previous value, then the fixed end moments will [ ]

**A) Increase** B) Remains constant C) Decrease D) Change their direction

26. A propped cantilever beam carrying total load "W" distributed evenly over its entire length calculate the vertical force required in the prop. [ ]

A) 3/4 W B) W C) 5/8 W **D) 3/8 W**

27. A solid shaft of circular in section is subjected to torque which produces maximum shear stress in a shaft. Calculate the diameter of the shaft. [ ]

**A) $(16T/\pi f)^{3/2}$** B) $(16f/\pi T)^{1/2}$ C) $(16f/\pi)^{1/2}$ D) $(\pi T/16f)^{1/2}$

28 When two dissimilar shafts are connected together, then the shaft is __________ [ ]

A) Integrated shafts **B) Composite shafts** C) Differential shafts D) Combined shafts

29. __________ torque occurs along with maximum shear stress due to combined bending and torsion.

**A) Equipment** B) Coaxial C) Biaxial D) Lateral [ ]

30. When a shaft is subjected to pure twisting then the type of stress developed is ________ [ ]

A) Bending B) Axial **C) Shear** D) Normal

31. The torque which produces unit twist per unit length is ________ [ ]

**A) Torsional rugosity** B) Torsional rigidity C) Torsional viscosity D) Torsional mean radius

32. In simply supported beams, the _____ stress distribution is not uniform. [ ]

**A) Bending** B) Shearing C) Tensile D) Compressive

33. The maximum _________ stresses occur at top most fibre of a simply supported beam. [ ]

A) Tensile **B) Compressive** C) Shear D) Bending

34. The stress is directly proportional to _______ [ ]

A) E B) u **C) y** D) R

35. At the extreme fibre, bending stress is______ [ ]

A) Minimum B) Zero C) Constant **D) Maximum**

36. The curvature of a beam is equal to _____ [ ]

A) EI/M B) M/E **C) M/EI** D) E/MI

37. Skin stress is also called as ______ [ ]

A) Shear stress **B) Bending stress** C) Lateral stress D) Temperature stress

38_________ is the total Strain energy stored in a body. [ ]

A) modulus of resilience B) impact energy **C) resilience** D) proof resilience

39 In cantilever beams, there is _______ stress above neutral axis.

A) Compressive **B) Tensile** C) Temperature D) Shear

40 The strength of beams depend merely on________ [ ]

**A) Modulus section** B) Moment of inertia C) Flexural rigidity D) Moment of resistance

## UNIT –III
## INTRODUCTION

1. For the validity of principle of superposition, materials should behave in which manner? [ ]
   A) linear-elastic B) non-linear-elastic C) Non-linear- inelastic **D) Linear- inelastic**

2. If in planar system, X parts/members are there with Y no. of forces, then condition for statically determinacy is:- [ ]
   A) Y < 3X B) Y > 3X **C) Y = 3X** D) none

3. If Y > 3X (X and Y are from the above question) then, the system is:- [ ]
   **A) Statically indeterminate** B) Statically determinate
   C) Can't say D) Depends on other conditions

4. If in a planar system, only 2 reaction forces are acting, then the system is:- [ ]
   **A) Essentially unstable** B) Essentially stable C) Can't say D) None

5. If all the reactions acting on a planar system are concurrent in nature, then the system is:- [ ]
   A) Can't say B) Essentially stable **C) Essentially unstable** D) none

6. If 4 reactions are acting on a beam, then the system is:- [ ]
   A) Unstable & indeterminate B) Stable & indeterminate C) Stable & determinate **D) Can't say**

7. If a system has more equations of equilibrium than no. of forces, then the system is:- [ ]
   A) Improperly constrained **B) Partially constrained** C) Stable D) Solvable

8. How many cases out of the following are improperly constrained? [ ]
   Parallel forces, concurrent forces, perpendicular forces, only moment
   A) 1 **B) 2** C) 3 D) 4

9. If a structure has total 10 joints, then what should be the minimum no. of joints in which equilibrium equations should be concurrently satisfied for stability? [ ]
   A) 7 B) 8 C) 9 **D) 10**

10. If a structure has 2j – r no. of members, then it will be:- [ ]
    A) stable B) unstable **C) depends upon structure** D) depends upon magnitude of load

11. Which of the following material is not used in making trusses? [ ]
    A) Wooden struts B) Metal bars C) Channel **D) Concrete**

12. The space between adjacent bents in a roof truss is called:- [ ]
    A) Purlins **B) Bay** C) Knee D) Braces

13. In a bridge truss, what is the sequence of load transmission? [ ]
    **A) Stringers to floor beams to side trusses** B) Floor beams to stringers to side trusses
    C) Side trusses to stringers to floor beam D) Side trusses to floor beams to stringers

14. What is the function of portal in bridge trusses? [ ]
A) To resist lateral forces
B) To resist horizontal forces
**C) To provide additional stability**
D) To allow thermal expansion

15. Pratt, Howe and warren trusses are used for typically hoe much span length? [ ]
A) 100 ft B) 150 ft **C) 200 ft** D) 250 ft

16. In a truss it is assumes that the members are joined by:- [ ]
A) Rough pins **B) Smooth pins** C) Either of them D) Neither of them

17. There is no bending stresses in truss due to:- [ ]
**A) Assumptions made** B) Design C) Materials used D) Neither of them

18. How many equilibrium equations do we need to solve generally on each joint of a truss? [ ]
A) 1 **B) 2** C) 3 D) 4

19. If a member of a truss is in compression, then what will be the direction of force that it will apply to the joints? [ ]
**A) Outward** B) Inward C) Depends on case D) No force will be there

20. If a member of a truss is in tension, then what will be the direction of force that it will apply to the joints? [ ]
A) Outward **B) Inward** C) Depends on case D) No force will be there

21. What should be ideally the first step to approach to a problem using method of joints? [ ]
A) Draw fbd of each joint
B) Draw fbd of overall truss
**C) Identify zero force members**
D) Determine external reaction forces

22. Which of the following are 0 force members? [ ]
**a) FG, HI, HJ** b) HI, HJ, AE c) HI, HJ, HE d) HI, HJ, FH

23. What should be the angle (in degrees) in the given system (part of a bigger system) if both of the members have to be a zero force member? [ ]
a) 22.5 b) 45 c) 67.5 **d) 90**

24. What will the magnitude of force (in N) transmitted by FI? [ ]
**a) 0** b) 1 c) 2 d) 3

25. What will the magnitude of force (in N) transmitted by IC? [ ]
**a) 0** b) 1 c) 2 d) 3

26. What is total no. of zero force members in the above given system? [ ]
a) 7 b) 8 **c) 9** d) 10

27. What is the exceptional case when resistance to normal force is considered to be more important than resistance to bending and shear force in beams? [ ]
a) Expansive axial force
**b) Compressive axial forc**e
c) Bending moment at both ends
d) Bending moment at one end

28. What will be the starting value of SFD? [ ]
a) 10 **b) -10** c) 5 d) -5

29. What will be the shape of SFD in the entire beam? [ ]
a) Straight line **b) Straight line with point of discontinuities**
c) Curve d) Curve with point of discontinuities

30. How many points of discontinuities will be there in the SFD? [ ]
a) 1 b) 2 **c) 3** d) 4

31. What will be the shape of BMD in the entire beam? [ ]
a) Straight line b) Straight line with point of discontinuities
c) Curve **d) Straight line with varying slope**

32. How many times would slope of BMD change? [ ]
a) 1 b) 2 **c) 3** d) 4

33. What will be the starting value of SFD? [ ]
**a) 25** b) -25 c) 15 d) -15

34. What will be the shape of SFD in the entire beam? [ ]
a) Straight line **b) Straight line with points of discontinuities**
c) Curve d) Straight line with points of discontinuities parallel to x axis

35. How many points of discontinuities will be there in the SFD? [ ]
a) 1 **b) 2** c) 3 d) 4

36. What will be the starting value of BMD? [ ]
a) 20 b) -20 c) 10 **d) -10**

37. What will be the shape of BMD in the entire beam? [ ]
a) Straight line b) Straight line with point of discontinuities
c) Curve **d) Combination of curve and straight line**

38. How many times would slope of BMD change? [ ]
a) 1 b) 2 c) 3 **d) infinite**

39. If, in the above question R= 4 then the truss are:- [ ]
a) Statically determinate **b) Statically indeterminate**
c) Stable d) Unstable

40. . A surface structure has:- [ ]
**a) Small thickness** b) Large thickness
c) Moderate thickness d) Arbit thickness

**Key:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1)D | 2)C | 3)A | 4)A | 5)C | 6)D | 7)B | 8)B | 9)D | 10)C |
| 11) D | 12) B | 13) A | 14)C | 15)C | 16)B | 17)A | 18)B | 19)A | 20)B |
| 21) C | 22) A | 23) D | 24)A | 25)A | 26)C | 27)B | 28)B | 29)B | 30)C |
| 31)D | 32)C | 33)A | 34)B | 35)B | 36)D | 37)D | 38)D | 39)B | 40)D |

## UNIT-IV

## ANALYSIS OF FIXED BEAMS & CONTINUOUS BEAMS

1. Rotation at the fixed end [ ]
   A) L/2 B) L/4 C) Zero D) none

2. Net moment at the support [ ]
   A) Zero B) double C) half D) none

3. Bending Moment is________to shear force [ ]
   A) Directly proportional B) Indirectly proportional
   C) Equal D) all the above

4. Degree of freedom for fixed end condition beam [ ]
   A) Zero B) 1 C) 2 D) 3

5. A fixed beam is subjected to UDL over its entire span. The joints of contra-flexure will occur on either side of the center at a distance of__________from the center. [ ]
   A) $l/\sqrt{3}$ B) $l/3$ C) $l/2\sqrt{3}$ D) $l/4\sqrt{3}$

6. A beam is a structural member predominantly subjected to [ ]
   A) Transverse loads B) axial forces C) twisting moment D) none of the above

7. The moment distribution method is best suited for [ ]
   A) Indeterminate pin jointed truss B) Rigid frames
   C) Space frames D) Trussed beam

8. In slope deflection method, the unknown rotations at various joints are determined by considering [ ]
   A) The equilibrium of the joint B) The rigidity of the joint
   C) The equilibrium of the structure D) None

9. While using three moments equation, a fixed end of a continuous beam is replaced by an Additional span of [ ]
   A) Zero length B) Infinite length C) Zero moment of inertia D) None of the above

10. Maximum deflection of a [ ]
    A) Cantilever beam carrying a concentrated load W at its free end is WL3/3EI
    B) Simply supported beam carrying a concentrated load W at mid-span is WL3/48EI
    C) Cantilever beam, carrying a uniformly distributed load over span is WL3/8EI
    D) All the above

11. The shear force on a simply supported beam is proportional to [ `]
    A) Displacement of the neutral axis B) Sum of the forces

C) Sum of the transverse forces D) Algebraic sum of the transverse forces of the section

12. In a loaded beam, the point of contra-flexure occurs at a section where [ ]
A) Bending moment is minimum B) Bending moment is zero or changes sign
C) Bending moment is maximum D) Shearing force is maximum

13. The shape of the bending moment diagram over the length of a beam, carrying a uniformly increasing load, is always [ ]
A) Linear B) Parabolic C) Cubical D) Circular

14. The shape of the bending moment diagram over the length of a beam, carrying a uniformly distributed load is always [ ]
A) Linear B)Parabolic C) Cubical D) Circular

15. Shear force for a cantilever carrying a uniformly distributed load over its length, is
B) Triangle B) Rectangle C)Parabola D) Cubic parabola [ ]

16. For a beam having fixed ends, the unknown element of the reactions, is [ ]
A) Horizontal components at either end B) Vertical components at either end
C) Horizontal component at one end and vertical component at the other
D) Horizontal and vertical components at both the ends

17. If the shear force along a section of a beam is zero, the bending moment at the section is
A) Zero B) Maximum C) Minimum D) Average of maximum-minimum [ ]

18. The moment diagram for a cantilever carrying a concentrated load at its free end, will be
A) Triangle B)Rectangle C)ParabolaD) Cubiparabola

19. The bending moment is maximum on a section where shearing force [ ]
A) Is maximum B) Is minimum C) Is equal D) Changes sign

20. For a simply supported beam with a central load, the bending moment is [ ]
A) Least at the centre B) Least at the supports
C) Maximum at the supports D) Maximum at the centre

20In a continuous bending moment curve the point where it changes sign, is called
A) Point of inflexion B) Point of contra flexure [ ]
C) Point of virtual hinge D) All the above

21) The max deflection of a simply supported beam of length L with a central load W, is A)$WL^2/48EI$ B)$W^2L/24EI$ C)WL3/48EI D)$WL^2/8EI$ [ ]

22) A simply supported beam carries two equal concentrated loads W at distances L/3 from either support. The maximum bending moment [ ]
A) WL/3 B)WL/4 C)5WL/4 D)3WL/12

23) A cantilever of length is subjected to a bending moment at its free end. If EI is the flexural rigidity of the section, the deflection of the free end, is [ ]
A)ML/EI B)ML/2EI C)$ML^2/2EI$ D)$ML^2/3EI$

24) In a fixed beam, at the fixed ends [ ]
A) Slope is zero and deflection is maximum

B) Slope is maximum and deflection is zero
C) Both Slope and deflection are maximum
C) Slope and deflection are zero

25) A beam fixed at both ends carries a UDL of 20KN/m over the entire span of 6 m. The bending moment at the centre of the beam is [ ]
A) 10KN-m B) 30KN-m C) 60KN-m D) 90KN-m

26) A beam ABC is simply supported at B and C and AB being the overhanging portion with UDL the maximum number of contra-flexure points in the beam will be equal to
A) 0 B)1 C) 2 D)3 [ ]

27. The rate of change of bending moment represents [ ]
A) Shear force B) Horizontal Force C) Bending moment D) none

28The units of bending moment are [ ]
A) KN-m B) KN-$m^2$ C) KN/m D) KN/$m^2$

29 A fixed beam AB 6 m long carries a vertical load 90 KN at 2m from A. The fixed end moments at A and B are [ ]
A) 40 KN-m, 80 KN-m B) 40 KN-m,120 KN-m
C) 80 KN-m,40 KN-m D) 120 KN-m,80 KN-m

30. In a fixed beam is subjected to UDL throughout the span, the point of contra flexure will occur at [ ]
A) L/2 B) At two fixed supports C) 0.21 L from each of the supports
D) 0.667 L from each of the supports

31. The point of contra flexure in a fixed beam carrying UDL will occur at a distance ------- from the ends [ ]
A) $L/\sqrt{3}$ B) $L/\sqrt{2}$ C) $L/3\sqrt{2}$ D) $L/2\sqrt{3}$

33. A beam having more than two supports then it is called [ ]
A) Fixed B) Continuous C) Cantilever D) Simply Supported

34. Fixed beam is more [ ]
A) Stable B) Stronger C) Stiffer D) All

35. At the point of contra flexure the moment is [ ]
A) Maximum B) Minimum C) Zero D) Negative

36. At the maximum deflection the slope is [ ]
A) Maximum B) Minimum C) Zero D) Negative

37. A simply supported beam of span L carries a uniformly distributed load W. The maximum bending moment M is [ ]
A) $\frac{WL}{2}$ B) $\frac{WL}{4}$ C) $\frac{WL}{8}$ D) $\frac{WL}{12}$

38. A simply supported beam of span L carries a concentrated load W at its mid span. The maximum bending moment M is [ ]
A) $\frac{WL}{2}$ B) $\frac{WL}{4}$ C) $\frac{WL}{8}$ D) $\frac{WL}{12}$

39. For a simply supported beam with a central load, the bending moment is [ ]
A) Least at the center. B) Least at the supports. C) Maximum at the supports. D) Maximum at the center

40. The deflection of any rectangular beam simply supported is [ ]
A) Directly proportional to its weight B) Inversely proportional to its weight
C) Inversely proportional to the cube of its depth D) All the above

**Key:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1)C | 2)A | 3)B | 4)A | 5)B | 6)A | 7)B | 8)A | 9)A | 10)D |
| 11) D | 12) B | 13) C | 14)B | 15)B | 16)D | 17)B | 18)A | 19)D | 20)D |
| 21) D | 22) C | 23) A | 24)D | 25)D | 26)B | 27)B | 28)A | 29)A | 30)C |
| 31)C | 32)A | 33)B | 34)D | 35)C | 36)C | 37)C | 38)B | 39)D | 40)D |

## UNIT- V

## SLOPE DEFLECTION METHOD& MOMENT DISTRIBUTION METHOD

1. The number of independent equations to be satisfied for static equilibrium of a plane structure is [ ]
   A) 1 B) 2 C) 3 D) 6
2. In the slope deflection equations, the deformations are considered to be caused by [ ]
   i. Bending moment
   ii. Shear force
   iii. Axial force

   The correct answer is
   A) Only (i) B) (i) and (ii) C) (ii) and (iii) D) (i), (ii) and (iii)
3. The fixed end moment for continuous beam subjected to UDL [ ]
   A) $\frac{wl^2}{12}$ B) $\frac{wl^3}{12}$ C) $\frac{Wl}{8}$ D) $\frac{wab^2}{l^2}$
4. The fixed end moment for continuous beam subjected to central point load [ ]
   A) $\frac{wl^2}{12}$ B) $\frac{wl^3}{12}$ C) $\frac{Wl}{8}$ D) $\frac{wab^2}{l^2}$
5. The fixed end moment for continuous beam subjected to eccentrically point load
   A) $\frac{wl^2}{12}$ B) $\frac{wl^3}{12}$ C) $\frac{Wl}{8}$ D) $\frac{wab^2}{l^2}$ [ ]
6. Slope deflection equation MAB = [ ]
   A) FAB+$\frac{2EI}{l}(2\theta_A+\theta_B)$ B) FAB - $\frac{2EI}{l}(2\theta_A+\theta_B)$
   C) FBA+$\frac{2EI}{l}(2\theta_B+\theta_A)$ D) FBA+$\frac{2EI}{l}(2\theta_A+\theta_B)$
7. A continuous beam AB subjected to UDL of 20 kN/m then fixed end moment FAB is
   A) 40 kN-m B) 120 kN-m C) 60 kN-m D) 180 kN-m [ ]
8. A continuous beam AB subjected to central point load of 60 kN then fixed end moment FAB is [ ]
   A) 40 kN-m B) 45 kN-m C) 60 kN-m D) 80 kN-m
9. Frames may sway due to [ ]
   A) Horizontal force & unsymmetry B) horizontal force only
   C) unsymmetry of columns D) all the above
10. A beam subjected to UDL then bending moment diagram is in_________shape
    A) Triangle B) rectangle C) parabola D) cubic [ ]
11. A beam subjected to point then bending moment diagram is in_________shape
    A) Triangle B) rectangle C) parabola D) cubic [ ]
12. A beam subjected to UVL then bending moment diagram is in_________shape
    A) Triangle B) rectangle C) parabola D) cubic [ ]
13. The develop method for slope deflection method is [ ]
    A) Flexibility method B) Kani's method
    C) Stiffness matrix method D) moment distribution method

14. In the displacement method of structural analysis, the basic unknowns are [ ]

A) Displacements B) force

C) Displacements and forces D) none of the above

15. In the slope deflection equations, the deformations are considered to be caused by

i) B.M. ii) S.F.iii) axial force

The correct answer is: [ ]

A) Only I B)i and ii C) ii and iii D)all three

16. Bending moment at any section in a conjugate beam gives in the actual beam

A) Slope B) curvature C) deflection D) B.M. [ ]

17. The statically indeterminate structures can be solved by [ ]

A) Using equations of statics alone B) Equations of compatibility alone

C) Ignoring all deformations and assuming the structure is rigid

D)Using the equations of statics and necessary number of equations of compatibility

18. A beam is completely analysed, [ ]

A) Support reactions are determined B) Shear and moment diagrams are found

C) The moment of inertia is uniform throughout the length

D) All of the above

19. A bending moment may be defined as [ ]

A) Arithmetic sum of the moments of all the forces on either side of section

B) Arithmetic sum of the forces on either side of section

C) Algebraic sum of the moments of all the forces on either side of section

D) None of these

20. At either end of a plane frame, maximum number of possible transverse shear forces, are

A) One B) two C) threeD) four

21.In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always [ ]

A) Zero B) less than 1 C) 1 D) greater than 1

22.The carryover factor in a prismatic member whose far end is fixed is [ ]

A) 0 B) ½ C) ¾ D) 1

23.Carry over factor = [ ]

A) $\frac{M}{\theta_A}$ B) $\frac{\theta_A}{M}$ C) $\frac{M'}{M}$ D) $\frac{M}{M^I}$

24. Stiffness K= [ ]

A) $\frac{M}{\theta_A}$ B) $\frac{\theta_A}{M}$ C) $\frac{M'}{M}$ D) $\frac{M}{M^I}$

25. Distribution factor = [ ]

A) B) $\frac{\sum K}{K}$ C) $\frac{M}{\sum K}$ D) $\frac{K}{\sum K}$

26.If the far end is fixed then stiffness K= [ ]

A) $\frac{4EI}{L}$ B) $\frac{3EI}{L}$ C) $\frac{2EI}{L}$ D) $\frac{EI}{L}$

27.Which of the following methods of structural analysis is a displacement method [ ]

A) Moment distribution method B) column analogy method

C) Three moment equation D) none of the above

28.In the displacement method of structural analysis, the basic unknowns are [ ]

A) Displacements B) force

C) Displacements and forces D) none of the above

29.The moment distribution method is best suited for (**Observers-2013**) [ ]

A) Indeterminate pin jointed truss B) Rigid frames

C) Space frames D) Trussed beam

30.Bending moment at any section in a conjugate beam gives in the actual beam: [ ]

B) Slope B) curvature C) deflection D) B.M.

31.The statically indeterminate structures can be solved by: [ ]

C) Using equations of statics alone B) Equations of compatibility alone

C) Ignoring all deformations and assuming the structure is rigid

D) Using the equations of statics and necessary number of equations of compatibility

32.The simultaneous equations of slope deflection method can be solved by iteration in: [ ]

D) Moment distribution method B) Consistent deformation method

C) Conjugate beam method D)Williot mohr method

33.The carryover factor in a prismatic member whose far end is hinged is (**AEE-2008)** [ ]

A) 0B) 1/2 C) 3/4 D) 1

34.The moment required to rotate the near end of a prismatic beam through a unit angle without translation, the far end being simply supported, is given by(**AEE-1996, 2004,2006,TSPSC-GENCO-15**

E) 3EI/L B) 4EI/L C)2EI/L D)EI/L [ ]

35.The moment required to rotate the near end of a prismatic beam through a unit angle without translation, the far end being fixed, is given by ( **TSPSC-AEE-15,A** [ ]

A)EI/L B) 2EI/L C) 3EI/L D)4EI/L

Where EI is flexural rigidity and L is the span of the beam.

36.If M is the external moment which rotates the near end of a prismatic beam without translation (the far end being fixed), then the moment induced at the far end is (**AEE-2006)** [ ]

F) M/2 in the same direction as M B) M/2 in the opposite direction as M

C) M in opposite direction D) 0

37If one end of a prismatic beam AB with fixed ends is given a transverse displacement Δ without any rotation, then the transverse reactions at A or B due to displacement is: (**AEE-2012)**

[ ] B) $6EI\Delta/l^2$ B) $6EI\Delta/l^3$ C) $12EI\Delta/l^2$ D) $12EI\Delta/l^3$

38.Moment-distribution method was suggested by [ ]

G) Hardy Cross B) G.A. Maney C) Gasper Kani D) None of these

39.A simply supported beam of span L carries a uniformly distributed load W. The maximum bending moment M is [ ]

A) $\frac{WL}{2}$ B) $\frac{WL}{4}$ C) $\frac{WL}{8}$ D) $\frac{WL}{12}$

40 A simply supported beam of span L carries a concentrated load W at its mid span. The maximum bending moment M is [ ]

A) $\frac{WL}{2}$ B) $\frac{WL}{4}$ C) $\frac{WL}{8}$ D) $\frac{WL}{12}$

**Key:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1)C | 2)A | 3)A | 4)B | 5)D | 6)A | 7) C | 8)B | 9)D | 10)C |
| 11) A | 12)D | 13)C | 14)A | 15)B | 16)A | 17)A | 18)D | 19)A | 20)A |
| 21)C | 22)B | 23)C | 24)A | 25)B | 26)A | 27)A | 28)A | 29)B | 30)C |
| 31) A | 32)A | 33)A | 34)A | 35)D | 36)B | 37)A | 38)A | 39)C | 40)B |