Subject- Strength OF MATERIALS (22306)

SYLLABUS

Chapter No.	Name of chapter	Marks
1	Moment of Inertia	10
2	Simple Stress and Strain	12
3	Mechanical Properties and Elastic constant of metal	18
4	Shear force-Bending Moment and Shear Stress-Bending Stress	28
5	Torsion	16
6	Direct and Bending Stress	16
	Total Marks :-	100

BOARD THEORY PAPER PATTERN FOR SOM (22306)

Q.1		**Attempt any FIVE** **5*2=10**
	a)	Moment of Inertia
	b)	Mechanical Properties and Elastic constant of metal
	c)	Simple Stress and Strain
	d)	Shear force-Bending Moment and Shear Stress-Bending Stress
	e)	Direct and Bending Stress
	f)	Direct and Bending Stress
	g)	Direct and Bending Stress
Q.2		**Attempt any Three** **4*3=12**
	a)	Moment of Inertia
	b)	Simple Stress and Strain
	c)	Shear force-Bending Moment and Shear Stress-Bending Stress
	d)	Torsion
Q.3		**Attempt any Three** **4*3=12**
	a)	Mechanical Properties and Elastic constant of metal
	b)	Direct and Bending Stress
	c)	Shear force-Bending Moment and Shear Stress-Bending Stress

	d)	Direct and Bending Stress
Q.4		**Attempt any Three 4*3=12**
	a)	Moment of Inertia
	b)	Simple Stress and Strain
	c)	Mechanical Properties and Elastic constant of metal
	d)	Simple Stress and Strain
	e)	Mechanical Properties and Elastic constant of metal
Q.5		**Attempt any Two 6*2=12**
	a)	Shear force-Bending Moment and Shear Stress-Bending Stress
	b)	Torsion
	c)	Direct and Bending Stress
Q.6		**Attempt any Two 6*2=12**
	a)	Shear force-Bending Moment and Shear Stress-Bending Stress
	b)	Simple Stress and Strain
	c)	Torsion

CLASS TEST - I

PAPER PATTERN

COURSE: - Strength of Materials (22306)

PROGRAMME: - Mechanical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
2	Simple Stress and Strain	CO-306.02
3	Mechanical Properties and Elastic constant of metal	CO-306.03
4	Shear force-Bending Moment and Shear Stress-Bending Stress	CO-306.04

Q.1	Attempt any Four 3*2=6Marks	Course Outcome (CO)
a)	Simple Stress and Strain	CO-306.02
b)	Mechanical Properties and Elastic constant of metal	CO-306.03
c)	Shear force-Bending Moment and Shear Stress-Bending Stress	CO-306.04
d)	Simple Stress and Strain	CO-306.02
e)	Mechanical Properties and Elastic constant of metal	CO-306.03
f)	Shear force-Bending Moment and Shear Stress-Bending Stress	CO-306.04

Q.2	**Attempt any Three** **1*7=7 Marks**	
a)	Simple Stress and Strain	CO-306.02
b)	Simple Stress and Strain	CO-306.02
c)	Shear force-Bending Moment and Shear Stress-Bending Stress	CO-306.04
d)	Mechanical Properties and Elastic constant of metal	CO-306.03
e)	Mechanical Properties and Elastic constant of metal	CO-306.03
f)	Shear force-Bending Moment and Shear Stress-Bending Stress	CO-306.04

CLASS TEST - II

PAPER PATTERN

COURSE: - Strength of Materials (22306)

PROGRAMME: - Mechanical Engineering

Syllabus:

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Moment of Inertia**	**CO-306.01**
5	**Torsion**	**CO-306.05**
6	**Direct and Bending Stress**	**CO-306.06**

Q.1	Attempt any Four 4*2= 8Marks	Course Outcome (CO)
a)	Moment of Inertia	**CO-306.01**
b)	Torsion	**CO-306.05**
c)	Torsion	**CO-306.05**
d)	Direct and Bending Stress	**CO-306.06**
e)	Direct and Bending Stress	**CO-306.06**
Q.2	**Attempt any Three 3*4= 12Marks**	
a)	Moment of Inertia	**CO-306.01**
b)	Direct and Bending Stress	**CO-306.06**
c)	Direct and Bending Stress	**CO-306.06**
d)	Torsion	**CO-306.05**

e)	Moment of Inertia	**CO-306.01**
f)	Direct and Bending Stress	**CO-306.06**

COURSE OUTCOME (CO)

COURSE: - STRENGTH OF MATERIAL (22306)

PROGRAMME: - Mechanical Engineering

CO. NO	Course Outcome
CO-306.1	Compute Moment of Inertia of Symmetrical and unsymmetrical Section .
CO-306.2	Estimate Simple Stress in machine components
CO-306.3	Perform Test of Evolution of Mechanical Properties
CO-306.4	Compute Shear Stress and Bending Moments
CO-306.5	Estimate Stress in shaft under twisting Moments
CO-306.6	Estimate Stresses in Short member with eccentric load

1. Moment of Inertia

Position in Question Paper **Total Marks-10**

Q.1. a) 2-Marks.
Q.2. a) 4-Marks.
Q.3. d) 4-Marks.

Descriptive Question

1. Determine the MI of a triangular section having base 5 cm and 6 cm height about its base.
2. A triangular section has base 100 mm and 300 mm height determine moment of inertia about 1)MI about axis passing through base 2)MI about axis passing through apex
3. Find the moment of inertia of a hollow circular section having external diameter 100 mm and internal diameter 80mm about, 1) Axis passing through center 2) About tangent to the outer circle and parallel to xx axis.
4. Find the moment of inertia of a hollow rectangular section about its centre of gravity, if the external dimensions are 40 mm deep and 30 mm wide and internal dimension are 25 mm and 15 mm wide.
5. An isosceles triangular section ABC has base width 80 mm and height 60mm. Determine the moment of inertia of the section about the centre of gravity of the section and the base BC.
6. A hollow C.I. pipe with external diameter 100 mm and thickness of metal 10 mm is used as a strut. Calculate the moment of inertia and radius of gyration about its diameter.
7. A circular disc has M.I. about its any tangent is. Find the diameter of the disc.
8. An equilateral triangle has a side of 150 mm. find the moment of inertia about any of its sides.
9. Find MI of an equilateral triangle of side 2m about its base.
10. A semicircular lamina has a base diameter 140mm. Calculate the moment of inertia 1) about centroidal axis 2) about base.
11. Calculate Polar MI of a square section having 200mm as side.
12. Calculate polar moment of inertia for a circle having diameter 250 mm

MCQ Question

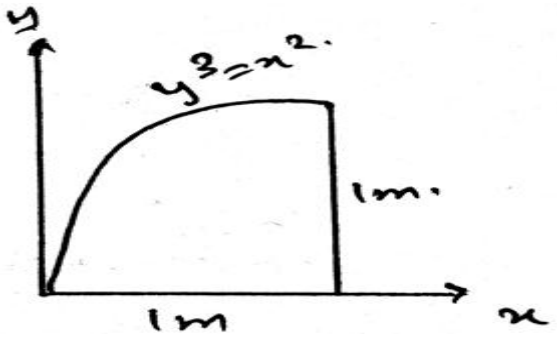
(Total number of Question=Marks*3=6*3=18)

Note: Correct answer is marked with **bold**

1. Whenever the distributed loading acts perpendicular to an area its intensity varies _____

a) Linearly **c)** Cubically
b) Non-Linearly d) Parabolically

2. Determine the moment of inertia of the area about the y-axis



a) 0.273m b) $11m^2$
c) $0.141m^2$ d) $0.811m^2$

3. The calculation of the moment of the body due to the loadings involve a quantity called _____

a) Moment b) Inertia
c) **Moment of Inertia** d) Rotation

4. Moment of Inertia is the integration of the square of the distance of the centroid and the del area along the whole area of the structure.

a) True b) False
c) May be true d) Can't say anything

5. There is perpendicular axis theorem for the area.

a) True b) **False**
c) May be true d) Can't say anything

6. What is parallel axis theorem and to whom it is applied?

a) **Theorem used to add the two mutually perpendicular moment of inertias for areas**
b) Theorem used to add the two mutually perpendicular moment of inertias for

volumes
c) Theorem used to add the two mutually perpendicular moment of inertias for linear distances
d) Theorem used to add the two mutually perpendicular moment of inertias for vectors

7. The parallel axis theorem gives the moment of inertia _____ to the surface of considerance.
a) Linear
b) Non-Linear
c) **Perpendicular**
d) Parallel

8. The parallel axis theorem can add any angle varied moment of inertias to give the perpendicular moment of inertia.
a) True
b) **False.**
c) May be true
d) Can't say anything

9. The parallel axis theorem uses the _____ of the distance.
a) Square root
b) **Square**
c) Cube root
d) Cube

10. The distance in the parallel axis theorem is multiplied by _____
a) **Area**
b) Volume
c) Linear distance
d) Area/Volume

11. one of the uses of the center of mass or centroid is as in the moment of inertia is that the net force acts at the _____ of the loading body.
a) **Centroid**
b) the center axis
c) The corner
d) the base

12. If the non-Uniform loading is of the type of parabola then for calculating the moment of inertia for areas?
a) The net load will not be formed as all the forces will be cancelled
b) The net force will act the center of the parabola
c) The net force will act on the base of the loading horizontally
d) **The net force will act at the centroid of the parabola**

13. If any external force also is applied on the structure and we are determining the moment of inertia then what should we consider?
a) The net force will act at the centroid of the structure only
b) The net load will not be formed as all the forces will be cancelled
c) The net force will act on the base of the loading horizontally
d) **The net force will not to be considered, there would be a net force of the distribution, rest will be the external forces**

14. The body is sometimes acted by two or three force members and we need to find the moment of inertia for the same. The difference between the two and the three force members is:
a) The former is collinear and the latter is parallel
b) The former is parallel and the latter is perpendicular
c) The former is perpendicular and the latter is collinear

d) **The former is acting on two points in the body while the latter is on three points**

15. The unit of moment of inertia of an area,

a) kg/m
b) kg/m^2
c) **m^4**
d) m^3

16. Moment of inertia of a squares of side b about an axis through its centre of gravity, is

a) $b^3/4$
b)$b^4/12$
c) $b^4 4/3$
d) $b^4/8$

17. Polar moment of inertia is

a) Same as moment of inertia
b) Applicable to masses whereas moment of inertia is applicable to area only
c) **The moment of inertia for an area relative to a linear or axis perpendicular to the plane of the area**
d) The moment of inertia for an area relative to a line or axis parallel to the centroidal axis

18. Centre of gravity of a thin hollow cone lies on the axis of symmetry at a height of

a) One-half of the total height above base
b) **One-third of the total height above base**
c) One-fourth of the total height above base
d) None of these

2. Simple Stress and Strain

Position in Question Paper **Total Marks-12**

Q.1. b) 2-Marks.
Q.1. c) 2-Marks.
Q.2. c) 4-Marks.
Q.3. b) 4-Marks.

Descriptive Question

1. A steel rod 500mm long and 20mm10mm in cross-section is subjected to axial pull of 300 KN.If modulus of elasticity is 2105 N/mm2 .Calculate the elongation of the rod. Also calculate strain induced in the bar.
2. A hollow cylinder 2 m long has an outside diameter of 50mm and inside diameter of 30mm. If the cylinder is carrying a load of 25 KN. FInd the stress in cylinder , also find deformation of the cylinder E=100 Gpa.
3. A load of 5KN is to be raised with the help of a steel wire. FInd the minimum diameter of wire if stress is not to exceed 100 MPa.
4. In an experiment a steel specimen of 13mm diameter was found to elongate 0.2mm in a 200 mm gauge length when it was subjected to a force of 26.8 KN. If specimen was tested within elastic range, Calculate Young's modulus for the steel.
5. A hollow cast iron column has internal diameter 200mm. What should be external diameter of the column, so that it could carry a load of 1600 KN without the stress exceeding 90 MPa.
6. A brass rod 1.5 m long and 20mm diameter was found to deform by 1.9mm under tensile load of 40KN. Calculate the modulus of elasticity.
7. A bar 500mm long and 22mm in diameter is elongated by 1.2mm under the effect of axial pull of 105 KN. Calculate stress-strain and modulus of elasticity..
8. A mild steel flat 75mm wide, 150mm thickness and 1.5 m long is subjected to pull of 45 KN. If elongation of flat is 0.6380mm. Find the young's modulus
9. An alloy bar 1m long and 200mm2 in cross section is subjected to compressive force of 20KN. If the modulus of elasticity is 100GPa. Find decrease in the length of bar.
10. A material has Young's Modulus of 2.1 10^5 N/mm2 and Poisson’s ratio 0.29. Calculatethe Bulk modulus and modulus of rigidity..
11. A material has Young's modulus of 1.8 10^5 N/mm2 and Bulk modulus1.2$10^5$ N/mm^2 .Find the Poisson’s ratio and Modulus of rigidity.

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1. Stress is
- a) External force
- c) Axial force
- **b) Internal resistive force**
- d) Radial force

2. Following are the basic types of stress except
- a) Tensile stress
- c) Shear stress
- b) Compressive stress
- **d) Volumetric stress**

3. When tensile stress is applied axially on a circular rod its
(i) diameter decreases, (ii)length increases (iii)volume decreases
Which of the above are true?
- a) Only i
- **c) i & ii**
- b) Only ii
- d) All of the above

4. When tensile stress is applied axially on a circular rod its
(i) diameter increases (ii)length decreases, (iii)volume decreases
Which of the above are true?
- a) Only i
- **c) i & ii**
- b) Only ii
- d) All of the above

5. Which of the following is not a basic type of strain?
- a) Compressive strain
- **c) Area strain**
- b) Shear strain
- d) Volume strain

6. Tensile Strain is
- **a) Increase in length / original length**
- b) Decrease in length / original length
- c) Change in volume / original volume
- d) All of the above

7. Volumetric Strain is
- a) Increase in length / original length
- b) Decrease in length / original length
- **c) Change in volume / original volume**
- d) All of the above

8. Hooke's law is applicable within
- **a) Elastic limit**
- c) Fracture point
- b) Plastic limit
- d) Ultimate strength

9. Young's Modulus of elasticity is
- **a) Tensile stress / Tensile strain**
- b) Shear stress / Shear strain

c) Tensile stress / Shear strain
d) Shear stress / Tensile strain

10. Modulus of rigidity is
a) Tensile stress / Tensile strain
b) Shear stress / Shear strain
c) Tensile stress / Shear strain
d) Shear stress / Tensile strain

11. Bulk modulus of elasticity is
a) Tensile stress / Tensile strain
b) Shear stress / Shear strain
c) Tensile stress / Shear strain
d) Normal stress on each face of cube / Volumetric strain

12. Factor of safety is
a) Tensile stress / Permissible stress
b) Compressive stress / Ultimate stress
c) Ultimate stress / Permissible stress
d) Ultimate stress / Shear stress

13. Poisson's ratio is
a) Lateral strain / Longitudinal strain
b) Shear strain / Lateral strain
c) Longitudinal strain / Lateral strain
d) Lateral strain / Volumetric strain

14. A rod, 120cm long and of diameter 3.0 cm is subjected to an axial pull of 18 kN. The stress in N/mm^2 is.
a) **22.57**
b) 23.47
c) 24.57
d) 25.47

15. The relationship between Young's modulus (E), Bulk modulus (K) and Poisson's ratio (μ) is given by
a) E=2K(1-2μ)
b) E=3K(1-2μ)
c) E=2K(1-2μ)
d) E=2K(1-3μ)

16. Which point on the stress strain curve occurs after the lower yield point?
a) **Yield plateau**
b) Upper yield point
c) Ultimate point
d) None of the mentioned

17. Which point on the stress strain curve occurs after yield plateau?
a) lower yield point
b) Upper yield point
c) **Ultimate point**
d) Breaking point

18. Which point on the stress strain curve occurs after the ultimate point?
a) Last point
b) **Breaking point**
c) Elastic limit
d) Material limit

19. A rigid body has Poisson's ratio equal to _____
a) 0
b) 1
c) less than 1
d) greater than one

20. The ratio of stress and strain is known as _____

a) Modulus of elasticity
c) Both a and b
b) Young's modulus
d) None of the above

21. Two parallel, equal and opposite forces acting tangentially to the surface of the body is called as _____
a. Complementary stress
c. Shear stress
b. Compressive stress
d. Tensile stress

22. What is the bulk modulus of a material, if a cube of 100 mm changes its volume to 4000 mm^3 when subjected to compressive force of 2.5 x 10^6 N?
a. 62.5 Gpa
c. 67.5 Gpa
b. 65 Gpa
d. 70 Gpa

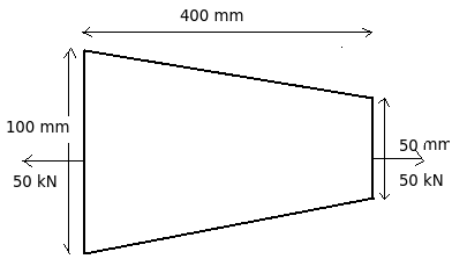
23. The relation between modulus of elasticity (E), modulus of rigidity (G) and bulk modulus (K) is given as _____
a. K+G / (3K+ G)
c. 3 KG / (9K+ G)
b. 3 KG / (3K+ G)
d. **9 KG / (3K+ G)**

24. The actual breaking stress in stress-strain diagram is the ratio of _____
a. load at breaking point and original cross-sectional area
b. **load at breaking point and reduced cross-sectional area**
c. maximum load and original cross-sectional area
d. yield load and original cross-sectional area

25. A rectangular bar has volume of 1.5 x 10^6 mm^3. What is the change in volume, if stresses in x, y and z direction are 100 Mpa, 150 Mpa and 160 Mpa respectively. (Assume K = 2 x 10^5 N/mm^2 & $\mu = 0.3$)
a. 1000 mm^3
c. 1500 mm^3
b. **1230 mm^3**
d. 2000 mm^3

26. Modulus of rigidity is the ratio of _____
a. Lateral strain and linear strain
b. Linear stress and lateral strain
c. **Shear stress and shear strain**
d. Shear strain and shear stress

27. In the diagram shown below, a tensile load of 50 kN is applied axially. What is the increase in length of the rectangular tapered plate of width 10 mm. (Assume E = 220 Gpa)



a. 0.10 mm
c. **0.126 mm**
b. 0.161 mm
d. 0.56 mm

28. When a rectangular bar is uniaxially loaded, the volumetric strain (e_v) is given as_____

a. σ_x / E(1- μ)
c. **σ_x / E(1- 2μ)**
b. σ_x / E(1+ μ)
d. σ_x / E(1+2μ)

29. What is the stress-strain curve?

a) It is the percentage of stress and stain
b) **It is the relationship between stress and strain**
c) It is the difference between stress and strain
d) None of the mentioned

30. Which point on the stress strain curve occurs after the proportionality limit?

a) Upper yield point
c) **Elastic limit**
b) Lower yield point
d) Ultimate point

3. Mechanical Properties and Elastic constant of Metal

Position in Question Paper **Total Marks-18**

Q.1. d) 2-Marks.
Q.2. b) 4-Marks.
Q.5. c) 6-Marks.
Q.6. b) 6-Marks.

Descriptive Question

1. A bar 30 mm x 30 mm is 4.5 m long is subjected to impact load of 300 N which falls on collar from a height of 400 mm. Find 1] Stress 2] Strain energy 3]Change in length. 4] mod. of resilience .
2. An unknown weight falls by 30 mm on to a collar rigidly fixed to lower end of vertical bar 4 m long & 1000 mm 2 in area. If instantaneous elongation is 3.66 mm. Determine – 1] The stress produced 2] Unknown weight.
3. An unknown weight falls through a height of 12mm on to a collar . Attached to the bottom of bar 2.5 m long & 100 mm 2 in area if maximum instantaneous elongation is 1.6 mm. Find 1] Stress 2]Unknown weight. E = 200 Gpa.
4. Calculate the strain energy stored in a bar 50mm diameter & 2.5 m long subjected to tensile load of 100kN take if
   1) load is gradually applied
   2) load is suddenly applied
5. A square steel rod 50 mm size & 3 m long is subjected to a pull of 100kN suddenly applied to it Calculate , i) Strain ii) Elongation iii) Modulus of resilience E = 210 Gpa.
6. A bar 1.5 m long10 mm diameter hangs vertically , it has a collar fixed at lower end .a load of 120 N falls on the collar from the height of 30 mm. Calculate strain energy absorbed.Youngs modulus for material is .
7. A steel bar 20 mm diameter is 7 m long & has collar attached to it .A load of 800N falls on it from a height of 60 mm. Find -
   1] Stress 2] Change in length. 3] Strain energy 4] modulus of resilience. Youngs modulus for material is .

8. A bar 30 mm x 30 mm is 4.5 m long is subjected to impact load of 300 N which falls on collar from a height of 400 mm. Find 1] Stress 2] Strain energy 3]Change in length. 4] mod. of resilience .

9. An unknown weight falls by 30 mm on to a collar rigidly fixed to lower end of vertical bar 4 m long & 1000 mm 2 in area. If instantaneous elongation is 3.66 mm. Determine – 1] The stress produced 2] Unknown weight.

MCQ Question

(Total number of Question=Marks*3=8*3=24)

Note: Correct answer is marked with **bold**

1. Time dependent permanent deformation is called _____.
- a) Plastic deformation
- b) Elastic deformation
- c) **Creep**
- d) Anelastic deformation

2. Figure-out the odd point in the following
- a) Proportinal limit
- b) Elastic limit
- c) Yeild point
- d) **Fracture point**

3. If a material is subjected to two incremental true strains namely ε1 and ε2, then the total true strain is
- a) ε1 * ε2
- b) ε1 - ε2
- c) **ε1 + ε2**
- d) ε1 / ε2

4. Engineering stress-strain curve and True stress-strain curve are equal up to
- a) Proportional limit
- b) Elastic limit
- c) **Yeild point**
- d) Tensile strength point

5. Value of Poisson's ratio for ionic solids in the range of
- a) 0.1
- **b) 0.2**
- c) 0.3
- d) 0.4

6. Hydrostatic stress results in the following
- a) Linear strain
- b) Shear strain
- c) Both linear and shear strains
- d) **None**

7. High elastic modulus in materials arises from
- a) **High strength of bonds**
- b) Weak bonds
- c) combination of bonds
- d) None

8. Change in elastic modulus for ordinary materials between 0K and melting point is
- a) 10-20% increase
- b) **10-20% decrease**
- c) 80-90% decrease
- d) 80-90% increase

9. Bauschinger effect
- a) Hysteresis loss during loading and unloading
- b) Anelastic deformation
- c) **Dependence of yield stress on path and direction**

d) None

10. Shape of true stress-strain curve for a material depends on
a) Strain
b) Strain rate
c) Temperature
d) **All**

11. Toughness of a material is equal to area under _____ part of the stress-strain curve.
a) Elastic
b) Plastic
c) **Both**
d) None

12. True stress-strain curve need to be corrected after
a) Elastic limit
b) Yield limit
c) **Tensile strength**
d) no need to correct

13. Following condition represents onset of necking
a) **εu = n**
b) εu = 1-n
c) εu = 1+n
d) εu = ln (1+n)

14. As compared with conventional stress-strain curve, the true stress-strain curve is
a) Above and right
b) Below and right
c) **Above and left**
d) Below and left

15. According to distortion-energy criterion, yielding occurs when
a) Distortion energy reaches a critical value
b) Second invariant of the stress deviator exceeded some critical value
c) Octahedral shear stress reaches a critical value
d) **All**

16. von Mises and Tresca criteria give different yield stress for
a) Uni-axial stress
b) Balanced bi-axial stress
c) **Pure shear stress**
d) All

17. Plastic deformation results from the following
a) Slip
b) Twinning
c) **Both**
d) None

18. Time dependent recoverable deformation under load is called _____ deformation.
a) Elastic
b) **Anelastic**
c) Elastic after-effect
d) Visco-elastic

19. Resistance of a material against any external force is termed as _____
a) Stiffness
b) Malleability
c) **Strength**
d) Hardness

20. The property of a material to resist any elastic deformation is termed as _____
a) **Stiffness**
b) Hardness
c) Malleability
d) Strength

21. Resistance developed by surface of any material is known as _____
a) Strength
b) **Hardness**
c) Stiffness
d) Creep

22. Permanent deformation of material with respect to time due to constant load and variable temperature is termed as _____

a) Elasticity
b) Isotropy
c) Hardness
d) **Creep**

23. Property by virtue of which material can absorb strain energy without plastic deformation is called _____

a) Creep
b) Anisotropy
c) **Resilience**
d) Fatigue

24. In which of the following test specimen is in the form of the simply supported beam?

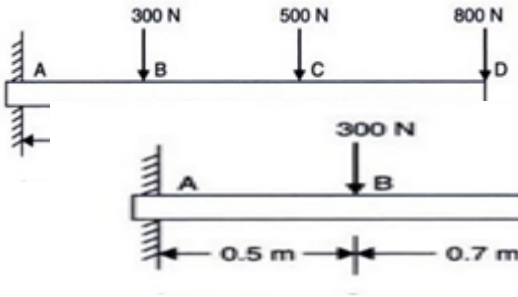
a) Izod test
b) Rockwell hardness test
c) **Charpy test**
d) Brinell test

4. Shear Force and Bending Moment

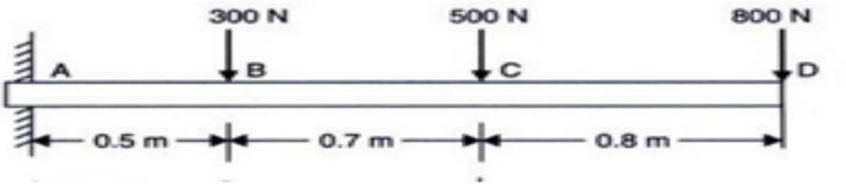
Position in Question Paper **Total Marks-28**

Q.1. e) 2-Marks.
Q.1. f) 2-Marks.
Q.2. d) 4-Marks.
Q.4. a) 4-Marks.
Q.4. c) 4-Marks.
Q.5. b) 6-Marks.
Q.6. a) 6-Marks.

Descriptive Question



nt diagram for loading shown below.



2. Draw bending moment and shear force diagram of a cantilever beam having AB 4 meters long having its fixed end at A and loaded with a uniformly distributed load of 1 kN/m upt 2 meters from A and with a concentrated load of 2 kN at 1 m from B.

3. Draw bending moment and shear force diagram of a cantilever beam having AB 4 meters long having its fixed end at A and loaded with a uniformly distributed load of 1 kN/m upto 2 meters from A and with a concentrated load of 2 kN at 1 m from B.

4. A cantilever beam ABCD is fixed at A and free at D ,such that AB=1 m, BC= 2m, CD= 3.5 m. It carries an udl of 150 kN/m from B and D along with a point load of 500 kN at point C. Draw shear force and bending moment diagram for this beam.

5. A cantilever 2.4 m long carries point loads of 20 kN and 50 kN at free end and 1.68 m from free end respectively. It also carries uniformly distributed load of 30 kN/m starting from 0.24 m to 1.2 m from free end. Draw SFD and BMD.

6. Draw shear force and bending moment diagram for a cantilever beam AB of 4 m long having its fixed end at A and loaded with uniformly distributed load of 2 kN/m over entire span and point load of 3 kN acting upward at the free end of cantilever. Find point of contra-flexure if any.

7. Draw SFD and BMD locating all important features for a cantilever of 6m length

and point loads of 15N at the center of the length of cantilever and 10N at the end of cantilever. There is udl of 5 KN/m. between the two point loads .

8. A simply supported beam of span 6 m carries two point loads of 30 kN each at 2 m and 4 m from left support. The beam also carries a U.D.L. of 20 kN/m between two point loads. Draw S.F.D. and B.M.D.

9. Draw S.F.D. and B.M.D. for a beam whose left support is hinge and right support is roller. The beam has following details :
(i) Span = 8 m
(ii) U.D.L. of 20 kN/m at 4 m from left support.
(iii) A point load of 120 kN at a distance of 6 m from LHS.

MCQ Question

(Total number of Question=Marks*3=28*3=84)

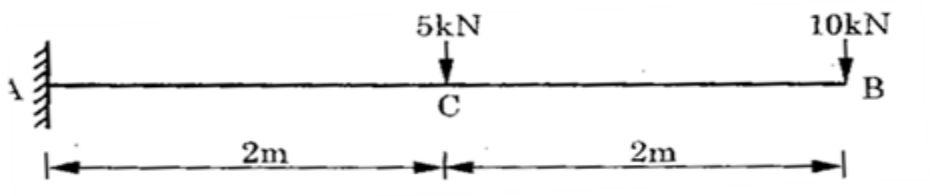
Note: Correct answer is marked with **bold.**

1. In a simply supported beam carrying a uniformly distributed load over the left half span, the point of contraflexure will occur in
(a) Left half span of the beam
(b) Right half span of the beam.
(c) Quarter Points of the beam
(d) **Does not exist**

2. A sudden increase or decrease in shear force diagram between any two points indicates that there is
(a) No loading between the two points
(b) **Point loads between the two points**
(c) U.D.L. between the two points
(d) None of these

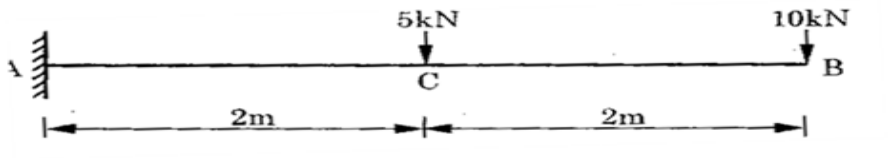
3. When the bending moment is parabolic curve between two points, it indicates that there is
(a) No loading between the two points
(b) Point loads between the two points
(c) **U.D.L. between the two points**
(d) Uniformly varying load between the two points

4. In bellow fig, max. S.F. will be



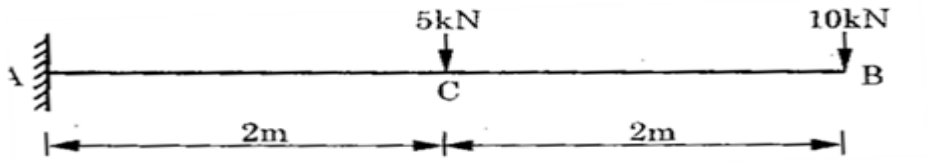
(a) 5 kN
(b) 10 kN
(c) **15 kN**
(d) 30 kN

5. In bellow Fig, max B.M. will be



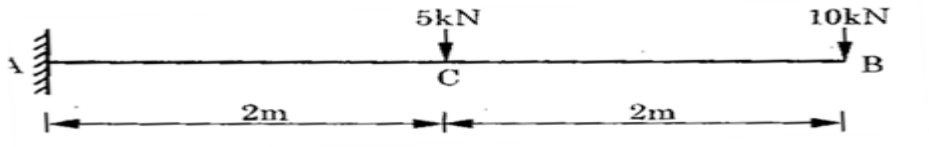
(a) 40 kN-m
(b) **50 kN-m**
(c) 60 kN-m
(d) 80 kN-m

6. In bellow Fig., slope of S.F.D. between B and C will be



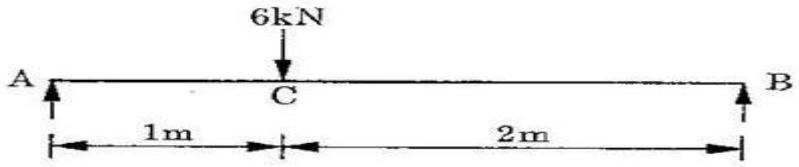
(a) **Zero**
(b) 10 kN
(c) 15 kN
(d) 20 kN

7. In bellow Fig. , slope of B.M.D. between B and C will be



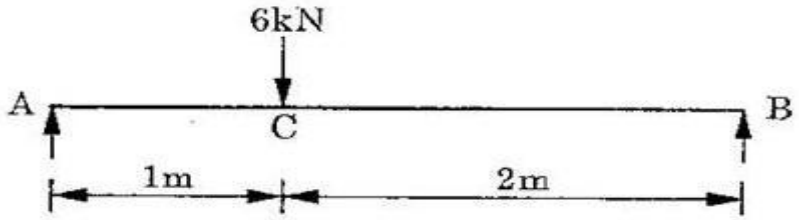
(a) Zero
(b) 5 kN
(c) **20 kN**
(d) 15 kN

8. In bellow Fig., at point B, the value of B.M will be



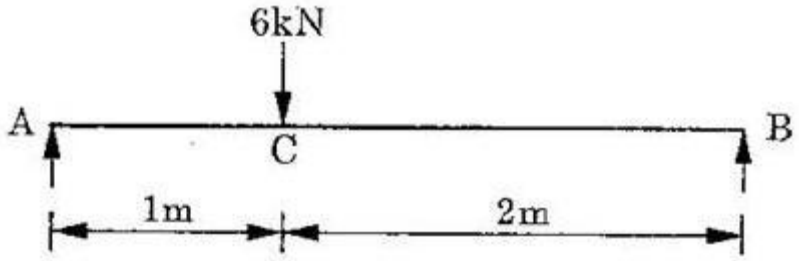
(a) 5 kN
(c) **Zero**
(b) 10 kN
(d) None of these

9. In bellow Fig , the reaction at support A will be



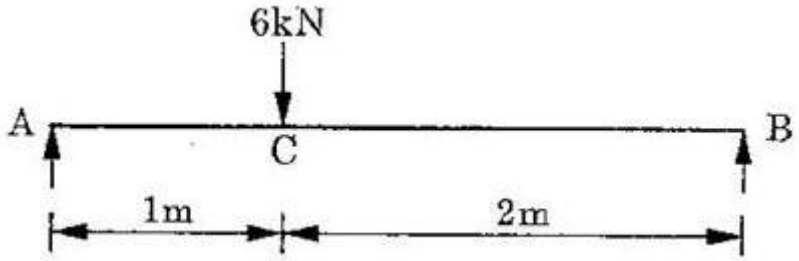
(a) 6 kN
(c) **4 kN**
(b) 2 kN
(d) None of these

10. In bellow Fig., the maximum B.M. will be at



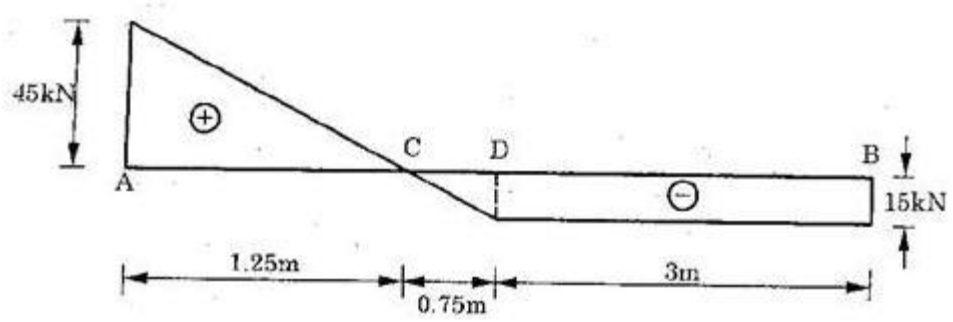
(a) Support A
(c) Centre of beam
(b) Support B
(d) **Under the load**

11. In bellow Fig, the maximum B.M. will be



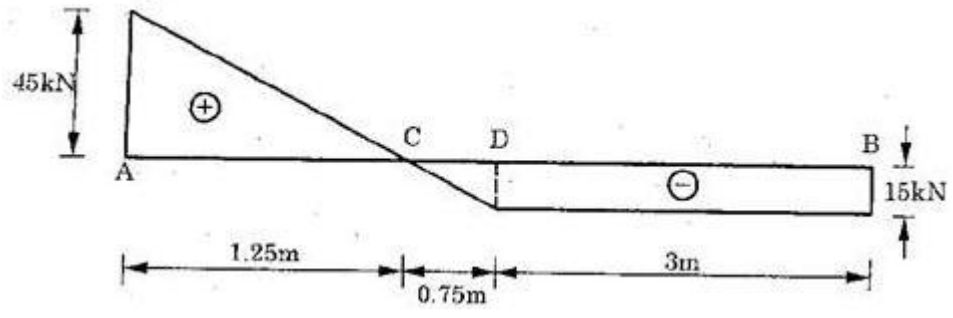
(a) 6 kN-m
(c) **2 kN-m**
(b) 4 kN-m
(d) 8 kN-m

12. In bellow Fig , the slope of B.M.D. will be more for



(a) **Portion AC**
(c) Will be equal
(b) Portion BC
(d) None of these

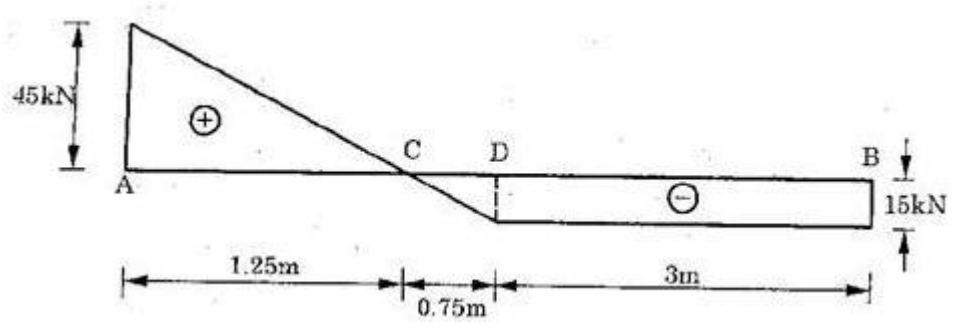
13. In bellow Fig, gives the S.F.D. for



(a) **Cantilever beam** (c) Overhanging beam

(b) Simply supported beam (d) Insufficient data

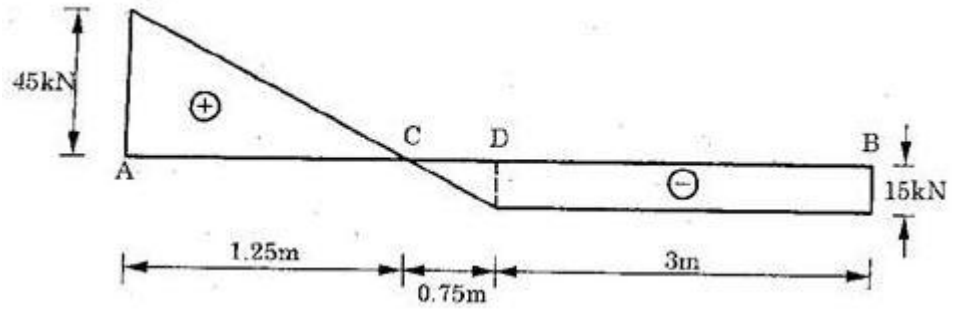
14. Corresponding to bellow Fig the loading on the portion AD of the beam will be



(a) Uniformly distributed load (c) **Point loads**

(b) Uniformly varying load (d) Cannot be said

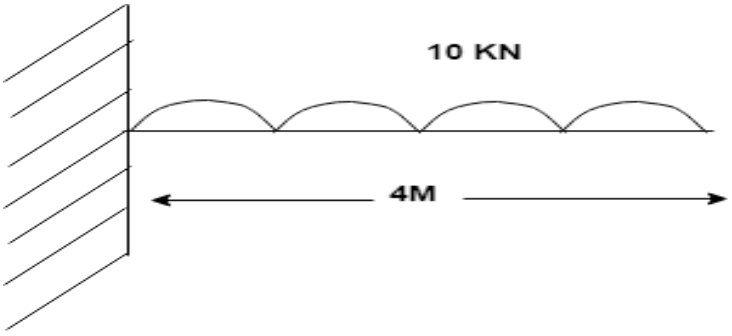
15. Corresponding to bellow Fig, the maximum bending moment will be at



(a) A (c) **C**

(b) B (d) D

16. Determine the moment at fixed end.



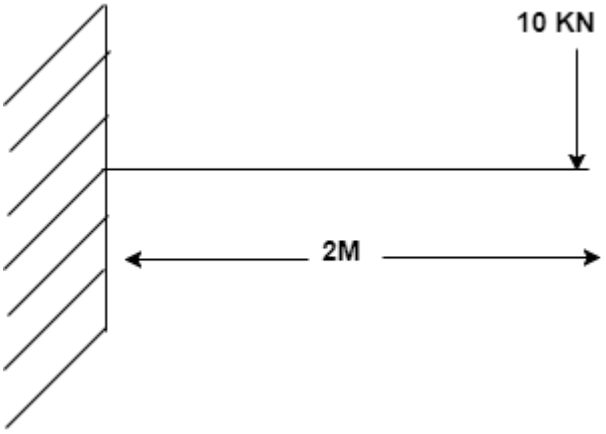
a) 40 kNm
c) 60 kNm
b) 50 kNm
d) **80 kNm**

17. Shear force is diagram is _____ representation of shear force plotted as ordinate.
a) Scalar
c) **Graphical**
b) Aerial
d) Statically

18. Hogging is_____
a) **Negative bending moment**
c) Positive bending moment
b) Positive shear force
d) Negative shear force

19. At the point of contraflexure, the value of bending moment is _____
a) **Zero**
c) Can't be determined
b) Maximum
d) Minimum

20. Shear force of following diagram



a) **Rectangle**
c) Circle
b) Square
d) Trapezoidal

21. SI units of bending moment is _____
a) kN
c) kNm
b) kN^2
d) km

22. What is the other name for a positive bending moment?
a) Hogging
c) **Inflation**
b) Sagging
d) Contraflexure

23. Shear force is unbalanced _____ to the left or right of the section.
a) Horizontal force
c) Inclined force
b) **Vertical force**
d) Conditional force

24. SI units of shear force is _____
a) kN/m
c) **kN**
b) kN-m
d) m/N

25. A beam is a structural member which is subjected to
a) Axial tension or compression

b) **Transverse loads and couples**
c) Twisting moment
d) No load, but its axis should be horizontal and x-section rectangular or circular

26. What is the bending moment at end supports of a simply supported beam?
a) Maximum
b) Minimum
c) **Zero**
d) Uniform

27. What is the maximum shear force, when a cantilever beam is loaded with udl throughout?
a) **w×l**
b) w
c) w/l
d) w+l

28. Sagging, the bending moment occurs at the _____ of the beam.
a) At supports
b) **Mid span**
c) Point of contraflexure
d) Point of emergence

29. What will be the variation in BMD for the diagram? [Assume l = 2m].

a) Rectangular
b) Trapezoidal
c) **Triangular**
d) Square

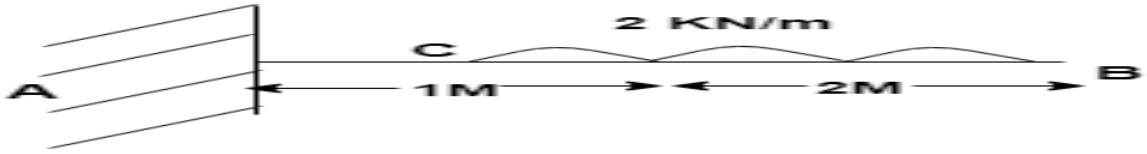
30. What is the maximum bending moment for simply supported beam carrying a point load "W" kN at its centre?
a) W kNm
b) W/m kNm
c) W×l kNm
d) **W×l/4 kNm**

31. How do point loads and udl be represented in SFD?
a) Simple lines and curved lines
b) Curved lines and inclined lines
c) **Simple lines and inclined lines**
d) can't represent any more

32. _____ curve is formed due to bending of overhanging beams.
a) **Elastic**
b) Plastic
c) Flexural
d) Axial

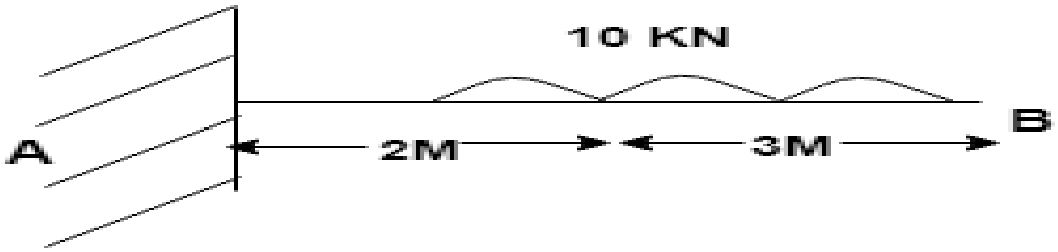
33. The relation between slope and maximum bending moment is _____
a) Directly proportion
b) **Inversely proportion**
c) Relative proportion
d) Mutual incidence

34. What is the SF at support B?



a) 5 kN
b) 3 kN
c) 2 kN
d) **0 kN**

35. Where do the maximum BM occurs for the below diagram.



a) -54 kNm
b) -92 kNm
c) **-105 kNm**
d) – 65 kNm

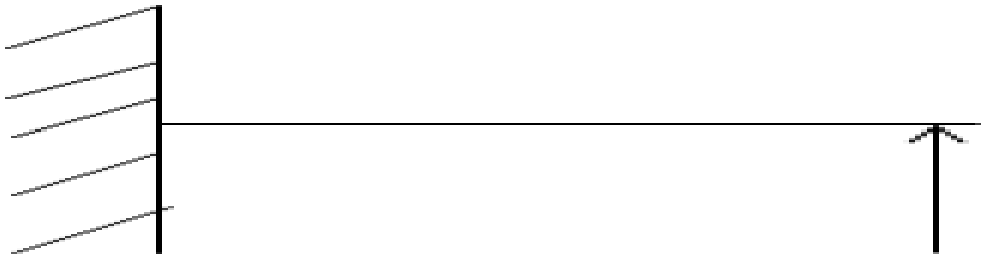
36. _____ is a horizontal structural member subjected to transverse loads perpendicular to its axis.

a) Strut
b) Column
c) **Beam**
d) Truss

37. Example for cantilever beam is _____

a) **Portico slabs**
b) Roof slab
c) Bridges
d) Railway sleepers

38. The diagram depicts _____ kind of beam.



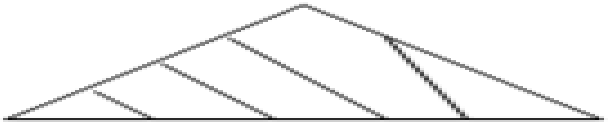
a) Cantilever
b) Continuous
c) Over hanging
d) **Propped cantilever**

39. Fixed beam is also known as _____

a) **Encastered beam**
b) Built on beam
c) Rigid beam
d) Tye beam

40. U.D.L stands for?
a) Uniformly diluted length
b) Uniformly developed loads
c) Uniaxial distributed load
d) Uniformly distributed loads

41. Given below diagram is _____ load.



a) Uniformly distributed load
b) **Uniformly varying load**
c) Uniformly decrees load
d) Point load

42. Moving train is an example of ____ load.
a) Point load
b) Cantered load
c) **Rolling load**
d) Uniformly varying load

43. Continuous beams are _____
a) Statically determinate beams
b) **Statically indeterminate beams**
c) Statically gravity beams
d) Framed beam

43. A beam which extends beyond it supports can be termed as _____
a) **Over hang beam**
b) Over span beam
c) Isolated beams
d) Tee beams

44. Units of U.D.L?
a) **KN/m**
b) KN-m
c) KN-m×m
d) KN

45. At the supports of a simply supported beam, bending moment will be
a) Maximum
b) Minimum
c) Zero
d) None

46. At the supports of a simply supported beam, shear forces will be
(a) Maximum
b) Minimum
(c) Zero
d) None

47. In case of a cantilever beam, bending moment at the free end will be
(a) Maximum
(b) Minimum
(c) Zero
(d) None

48. In case of a cantilever beam, bending moment at the fixed end will be
(a) Maximum
(b) Minimum
(c) Zero
(d) None

49. In case of a cantilever beam, shear force at the fixed end will be
(a) Maximum (b) Minimum
(c) Zero (d) None

50. In case of a cantilever beam having concentrated loads, bending moment variation will be
(a) Linear (b) Parabolic
(c) Cubic (d) None

51. In case of a cantilever beam having UDL, bending moment variation will be
(a) Linear **(b) Parabolic**
(c) Cubic (d) None

52. In case of a cantilever beam having concentrated loads, shear force variation will be
(a) Linear (b) Parabolic
(c) Cubic **(d) None**

53. In case of a cantilever beam having concentrated loads, shear force variation will be
(a) Linear (b) Parabolic
(c) Cubic **(d) None**

54. In case of a cantilever beam having UDL, shear force variation will be
(a) Linear (b) Parabolic
(c) Cubic (d) None

55. Relation between bending moment and shear force is
(a) $dM/dx = -V_x$ (b) $dM/dx = \pm V_x$
(c) $dM/dx = V_x$ (d) None

56. Relation between shear force and UDL is
(a) dV/dx=+ w **(b) dV/dx=– w**
(c) dV/dx=± w (d) None

57. Relation between shear force and Concentrated load is
(a) dV/dx= 0 (b) dV/dx=– W
(c) dV/dx=–W (d) None

58. Under sagging bending moment, the uppermost fiber of the beam is in
(a) Shear **(b) Compression**
(c) Tension (d) None

59. A beam is a simply supported beam when its movement is restricted in
(a) One way (b) Two ways
(c) Three ways (d) None

60. A beam is a hinged beam when its movement is restricted in
(a) One way **(b) Two ways**
(c) Three ways (d) None

61. A beam is a fixed beam when its movement is restricted in
(a) One way (b) Two ways
(c) Three ways (d) None

62. Movement of the free end of a cantilever is restricted in
(a) One way (b) Two ways
(c) Three ways (d) None

63. An overhanging beam can have
(a) One overhang (b) Three overhangs
(c) Five overhangs (d) None

64. An overhanging beam can have
(a) Zero overhang (b) Three overhangs
(c) Two overhangs (d) None

65. A continuous beam is one which has
(a) One support (b) Two supports
(c) Three supports (d) None

66. A fixed beam has
(a) One free end **(b) Two free ends**
(c) One end fixed (d) None

67. Variation of shear force due to UDL will be
(a) Linear (b) Parabolic
(c) Cubic (d) None

68. Variation of bending moment due to UDL will be
(a) Linear **(b) Parabolic**
(c) Cubic (d) None

69. Maximum bending moment in a S.S. beam having a concentrated load at the center will be
(a) WL (b) WL/2
(c) WL/4 (d) None

70. Maximum bending moment in a S.S. beam having a UDL over entire length will be
(a) wL2/2 (b) wL2/4
(c) wL2/8 (d) None

71 Maximum bending moment in a cantilever beam having a UDL over entire length will be
(a) wL2/2 (b) wL2/4
(c) wL2/8 (d) None

72. A simple support offers only _____ reaction normal to the axis of the beam.
a) Horizontal **b) Vertical**
c) Inclined d) Moment

73. To avoid _____ stresses in beams, one end of the beam is placed on the rollers.
a) Compressive b) Pyro
c) Temperature d) Tensile

74. _____ support develops support moment.
a) Hinged b) Simple
c) Fixed **d) Joint**

75. In a cantilever with uniformly distributed load, the variation of a bending moment is according to

a) Linear Law **b) Parabolic Law**
c) Cubic Law d) Horizontal Law

76. In which of the following beams, the supports are not situated at the ends

a) Cantilever beam **b) Overhanging beam**
c) Simply supported beam d) Fixed beam

77. The value of shear force at *A* for a simply supported beam *AB* of span 10 m with point load 25 kN at centre of span is

a) 2.5 kN **b) 12.5 kN**
c) 25 kN d) 50 kN

78. If I and δl are the length and change in length respectively, the strain is equal to

a) δl/l b) l/δl
c) l x δl d) l^2 x δl

79. A perfect frame should satisfy the following relation

a) m = 2j – 3 b) m = 2j – 2
c) m = 3j – 3 d) m = 3j – 4

80. The property of certain materials of returning. back completely to its original shape and size, after the removal of external forces, then it is said to be

a) Perfectly Plastic **b) Perfectly Elastic**
c) Partially Plastic d) Partially Elastic

81. The deflection at the free end of a cantilever of length (l) carrying a point load (W) at its' free end is given as

a) $Wl^3/2EI$ b) $Wl^2/2EI$
c) Wl/2EI **d) $Wl^3/3EI$**

82. Algebraic sum of the moments of the forces, to the right (or) left of the beam section is known as

a) Bending moment b) Uniformly distributed load
c) Shear force d) Point load

83. The difference between number of unknown reaction components and the number of available equilibrium equations is

a) degree of displacement b) degree of determinacy
c) degree of indeterminacy d) degree of freedom

84. A column of length is one end fixed and other pin jointed. Its equivalent length will be equal to

a) 0.707l b) 0.5l
b) l d) 2l

5. Torsion

Position in Question Paper **Total Marks-16**

Q.3. a) 4-Marks.
Q.3. c) 4-Marks.
Q.4. b) 4-Marks.
Q.4. d) 4-Marks.

Descriptive Question

1. Find the power transmitted by a shaft of 25mm diameter running at 400 rpm. Take allowable shear stress for shaft material as 65 Mpa.

2. A solid shaft of diameter 60 mm is running at 150 rpm. Find the power that can be transmitted by the shaft if permissible shear stress is 80 N/mm2 , Maximum torque is likely to exceed 30% more than mean torque. {i.e. Tmax=1.30 T avg}

3. Find the power that can be transmitted by a hollow shaft having external diameter 200mm and internal diameter 120 mm. The shaft is running at 110 rpm. Allowable shear stress for the material is 63 Mpa. Maximum torque is likely to exceed 20% more than mean torque.

4. A hollow shaft of external and internal diameters as 100mm and 40mm is transmitting power at 120 rpm. Find the power it can transmit if the shearing stress is not to exceed 50mpa.

5. Find the Power that a solid shaft of 100 mm diameter running at 500 rpm can transmit, if angle of twist is 1.5 degrees in a length of 2m. Take G=70 GPa.

6. A hollow shaft of external and internal diameters as 80mm and 40mm is required to transmit torque from one pulley to another. What is the value of torque transmitted, if the angle of twist is not to exceed 3 degrees in a length of 2 meters. Take modulus of rigidity as 80 Gpa.

7. What is the torque induced in a solid circular shaft of diameter 50 mm rotating at 100 rpm , if the permissible shear stress is not to exceed 75 Mpa.

8. A solid circular shaft of 30 mm diameter is subjected to a torque of 250 N-M causing an angle of twist 3.74 degrees in a length of 2m. Determine the modulus of rigidity of the material of the shaft.

9. A solid circular shaft of 100mm diameter transmits 120KW at 200 rpm. Find the maximum shear stress and angle of twist for a length of 6m.Take G=80 GPa.

10: A solid steel shaft has to transmit 100 KW at 160 r.p.m. Taking allowable shear stress as

70 MPa, find the suitable diameter of the shaft. the Maximum torque transmitted in each revolution exceeds the mean by 20%.

11: Select a suitable diameter for a solid circular shaft to transmit 200 HP at 180 rpm. The allowable shear stress is 90 Mpa and allowable angle of twist is for every 5m length of shaft . Take C/G = 82 GPa

12: A shaft is transmitting power of 50.5 kw at 120 rpm. if the shear stress is not to exceed 40 MPa,find the suitable diameter of the shaft.

13: A solid shaft is subjected to torque of 1.6 KN-m. Find the necessary diameter of the shaft, if the allowable shear stress is 60 Mpa. the allowable twist is 1 degree for every 2m length of shaft c=80 Gpa.

14: A shaft is transmitting 100 kW at 180 r.p.m if the allowable shear stress in the shaft material is 60 MPa, determine the suitable diameter for the shaft. The shaft is not to twist more than 1 degrees in a length of 3 meter. G=80 Gpa.

MCQ Question

(Total number of Question=Marks*3=8*3=24)

Note: Correct answer is marked with **bold**

1. The unit of Torque in SI units

(a) kg-m (b) kg-cm
(c) N-m (d) N/m^2

2. When a shaft is subjected to a twisting moment, every cross-section of the shaft will be under

(a) Tensile stress (b) Compressive stress
(c) Shear stress (d) All of these

3. The shear stress is minimum at

(a) Axis of the shaft (b) Outer surface of the shaft
(c) Anywhere inside the shaft (d) None of these

4. The shear stress varies from centre to the surface of the shaft with

(a) Uniform rate (b) Varying rate
(c) Remains same (d) None of these

5. The shaft are made of

(a) Mild steel (b) alloy steel
(c) Cooper alloys **(d) Any of these**

6.The shafts are designed on the basis of

(a) Rigidity (b) Strength
(c) Both of these (d) Either of these

7.The product of the tangential force acting on the shaft and radius of shaft known as

(a) Torsional rigidity (b) Flexural rigidity

(c) Bending moment **(d) Twisting moment**

8. The polar moment of inertia of a solid circular shaft of diameter (d) is

(a) $\frac{\pi d^3}{16}$ (b) $\frac{\pi d^3}{32}$

(c) $\frac{\pi d^4}{32}$ (d) $\frac{\pi d^4}{64}$

9.The polar moment of inertia of a hollow shaft of outer diameter (D) and inner diameter (d) is given by.

(a) $\frac{\pi}{16}(D^3 - d^3)$ **(b)** $\frac{\pi}{32}(D^4 - d^4)$

(c) $\frac{\pi}{64}(D^4 - d^4)$ (d) $\frac{\pi}{32}\left(\frac{(D^4 - d^4)}{d}\right)$

10. The torque transmitted by a solid shaft is

(a) $\frac{\pi}{4} fsd^3$ **(b)** $\frac{\pi}{16} fsd^3$

(c) $\frac{\pi}{32} fsd^3$ (d) $\frac{\pi}{64} fsd^3$

11. The torque transmitted by a hollow shaft of outer diameter (D) and inner diameter (d)

(a) $\frac{\pi}{4} fs\left(\frac{D^2 - d^2}{D}\right)$ (b) $\frac{\pi}{16} fs\left(\frac{D^3 - d^3}{D}\right)$

(c) $\frac{\pi}{16} fs\left(\frac{D^4 - d^4}{D}\right)$ (d) $\frac{\pi}{32} fs\left(\frac{D^4 - d^4}{D}\right)$

12. The criteria for the design of a shaft is the stress at

(a) The external surface (b) The axis

(c) Any inside layer (d) Any of these

13. The strength of a hollow shaft is …… for the same length, material and weight of a solid shaft**.**

(a) More **(b) Less**

(c) Equal (d) None of these

14. For the same material, length and given torque, a hollow shaft weighs…… a solid shaft.

(a) Less than **(b) More than**

(c) Equal to (d) None of these

15. Torsional sectional modulus is also known as _____
a) Polar modulus b) Sectional modulus
c) Torsion modulus d) Torsional rigidity

16. _____ is a measure of the strength of shaft in rotation.
a) Torsional modulus b) Sectional modulus
c) Polar modulus d) Torsional rigidity

17. The power transmitted by shaft SI system is given by _____
a) 2πNT/60 b) 3πNT/60
c) 2πNT/45 d) NT/60 W

18. _____ is a graph showing variations of discharge with time.
a) Rising limb graph b) Crest graph
c) Hydraulic graph d) Gauge graph

19. In the torsion equation, $TJ=\tau R=C.\theta l$ the term J/R is called
a) shear modulus b**)** section modulus
c) **polar modulus** d**)** none of these

20. When two shafts of same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal
a) polar moment of inertia b) **polar modulus**
c) diameter **d)** angle of twist

21. Torque transmitted by a solid shaft of diameter (d), when subjected to shear stress (***τ***) is equal to
a) π16×τ×d2 b) **π16×τ×d3**
c) π32×τ×d2 **d)** π32×τ×d3

22. When a machine member is subjected to torsion, the torsional shear stress set up in the member is
a) zero at both the centroidal axis and outer surface of the member
b) maximum at both the centroidal axis and outer surface of the member
c) **zero at the centroidal axis and maximum at the outer surface of the member**
d) maximum at the centroidal axis and zero at the outer surface of the member

23. Equivalent torque in a shaft subjected to axial load P, torque T and bending moment M is
(a) T_{eq} = (Pa2 + M2 + T2) (b) T_{eq} = $(Pa2 + M2 + T2)^{0.5}$
(c)T_{eq} = $(M2 + T2)^{0.5}$ (d) None

24. Equivalent bending moment in a shaft subjected to axial load P, torque T and bending moment M is

(a) $M_{eq} = 0.5\ [M + (M2 + T2)0.5]^{0.5}$ **(b) $M_{eq} = 0.5\ [M + (M2 + T2)^{0.5}]$**

(c) $M_{eq} = (M2 + T2)^{0.5}$ (d) None

6. Direct and Bending Stress

Position in Question Paper **Total Marks-16**

Q.4. e) 4-Marks.
Q.5. a) 6-Marks.
Q.6. c) 6-Marks.

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1. A rectangular mild steel flat 150mm. wide and 12.mm thick carry tensile load of 180kn at on eccentricity of 10mm in plane bisecting the thickness find max and min intensity of stress.
2. A rectangular column 300mm wide and 500mm deep carries load of 100 kn at the eccentricity of 30 mm in the plane bisecting thickness calculate max and min stresses.
3. A circular section 300mm dia carries 100kN at eccentricity of 30mm find max and min stress eccentricity.
4. A hollow circular section having external dia 300mm and internal dia 250mm carries a load of 100Kn at an eccentricity of 125mm calculate the max and min intensities of the stress in the section.
5. A hollow rectangular column section 600mm by 300mm outer dimensions and 500mm by 250mm internal dimension carries a load of 15Kn at an eccentricity of 100 mm in the plane bisecting thickness calculate the maximum and minimum intensities of stress in section.
6. A circular bar having 200mm diameter is subjected to a load of 300 Kn is acting an eccentricity of "e" mm from center if max. stress is limited to 12 N/. find the value of e.
7. A rectangular mild steel flat 150 mm wide and 120 mm thick carries a load of 180 Kn in a plane bisecting thickness if max stress is 14 N/, Find e.
8. A square column has co-centric circular cavity of 37.5 mm in diameter. If the maximum load of 220KN is applied at an eccentricity of 10mm with respect to xx axis and maximum compressive stress is limited to 80 MPa. Find the size of the square column.

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold**

1. If Z and I are the section modulus and moment of inertia of the section, the shear force F and bending moment M at a section are related by

(a) F=MyI
(b) F=MZ
(c) F=dMdx
(d) F=∫M dx

2. The section modulus of a rectangular section is proportional to
(a) area of the section
(b) square of the area of the section
(c) product of the area and depth
(d) product of the area and width

3. Stress may be expressed in Newtons
(a) per millimetre square (N/mm2)
(b) per centimetre square (N/cm2)
(c) per metre square (N/m2)
(d) All of the above

4. The centre of gravity of a trapezoidal dam section whose top width is a, bottom width is b and the vertical side is a, from its vertical face is
(a) a2+ab+b23a+b
(b) b2+bc+c23b+c
(c) a2+ab+c23a+c
(d) none of these

5. A rectangular bar of width b and height h is being used as a cantilever. The loading is in a plane parallel to the side b. The section modulus is
(a) bh312
(b) bh26
(c) b2h6
(d) none of these

6. The range within which a load can be applied on a rectangular column, to avoid any tensile stress, is
(a) one-half of the base
(b) one-fifth of the base
(c) one-fourth of the base
(d) one-fifth of the base

7. In rectangular columns (cross-section b x h), the core is a
(a) rectangle of lengths b/2 and h/2
(b) square of length b/2
(c) rhombus of length h/2
(d) **rhombus of diagonals b/3 and h/3**

8. A short masonry pillar is 60 cm x 60 cm in cross-section, the core of the pillar is a square whose side is
(a) 17.32 cm
(b) 14.14 cm
(c) 20.00 cm
(d) 22.36 cm

9. For keeping the stress wholly compressive the load may be applied on a circular column anywhere within a concentric circle of diameter
(a) d/2
(b) d/3
(c) d/4
(d) d/8

10. To ascertain the maximum permissible eccentricity of loads on circular columns, the rule generally followed, is

(a) middle half rule of columns **(b) middle fourth rule of columns**

(c) middle third rule of columns (d) none of these

11. A beam is said to be of uniform strength, if _____

a) B.M. is same throughout the beam

b) Shear stress is the same through the beam

c) Deflection is the same throughout the beam

d) Bending stress is the same at every section along its longitudinal axis

12. Stress in a beam due to simple bending is _____

a) Directly proportional b) Inversely proportional

c) Curvilinearly related d) None of the mentioned

13. Which stress comes when there is an eccentric load applied?

a) Shear stress **b) Bending stress**

c) Tensile stress d) Thermal stress

14. 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

15. 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 of the mentioned

16. 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

17. Consider a 250mmx15mmx10mm steel bar which is free to expand is heated from 15C to 40C. What will be developed?

a) Compressive stress b) Tensile stress

c) Shear stress **d) No stress**

18. The safe stress for a hollow steel column which carries an axial load of 2100 kN is 125 MN/m^2. if the external diameter of the column is 30cm, what will be the internal diameter?

a) 25 cm **b) 26.19cm**

c) 30.14 cm d) 27.9 cm

19. Flitched beam is also called

(a) Flitched bar **(b) Flitched shaft**

(c)Composite beam (d) Flitched cantilever

20. A flitched beam has

(a) Common neutral axis & both materials bend independently

(b) Common neutral axis & both materials has common R (Radius of curvature)

(c) Two neutral axis & both materials has common R (Radius of curvature)

(d) Two neutral axis & both materials bend independently

21. Middle quarter rule is valid for a

(a) Rectangular section

(b) Hexagonal section

(c) Circular section

(d) Any section

22. Middle third rule is valid for a

(a) **Rectangular section**

(b)Hexagonal section

(c) Circular section

(d) Any section

23. RCC beams are designed assuming

(a) Concrete can take no compressive load

(b) Concrete can take no compressive stress

(c) Concrete can take no tensile stress

(d) Concrete can take no tensile load

24. Bending stress is

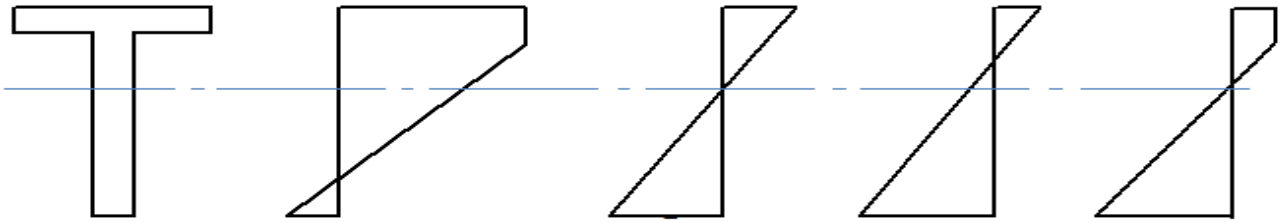
(a) Neither tensile nor compressive stress

(b) Tensile or compressive but cannot be added algebraically with direct tensile stress

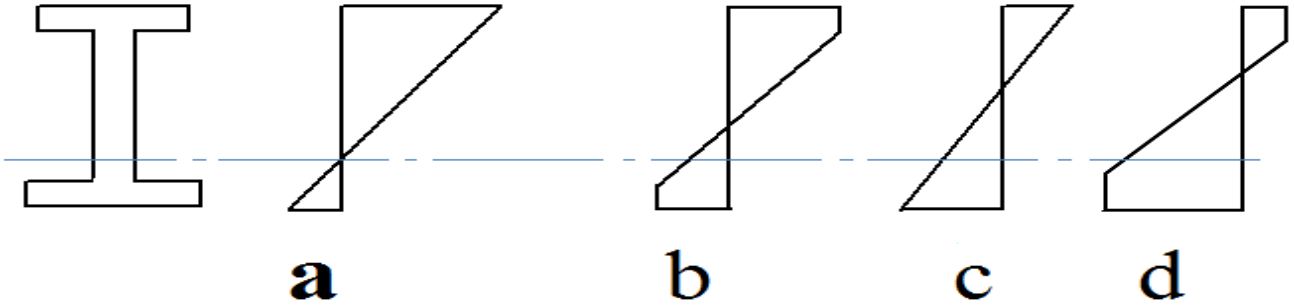
(c) Tensile or compressive and can also be added algebraically with direct tensile stress

(d) None of the above

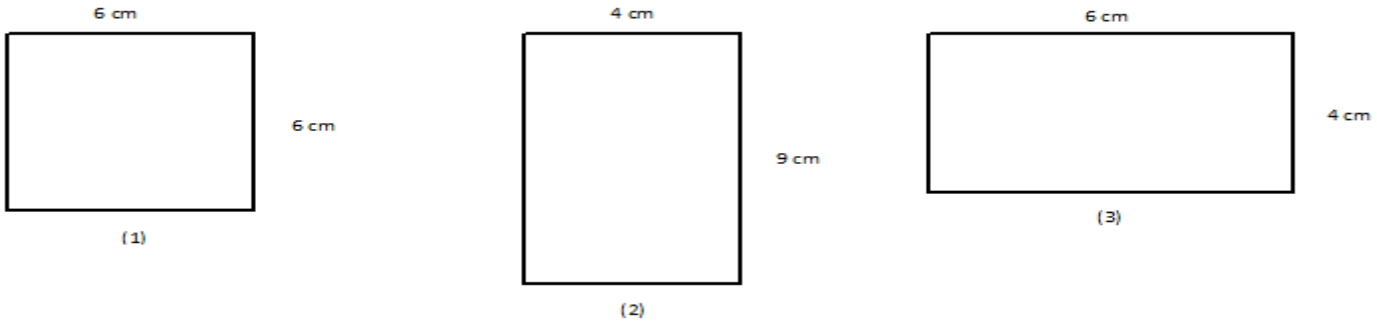
25. In a T-section beam, the bending stress distribution will be as shown



26. In a channel section beam, bending stress distribution will be



27. Three beams have cross section as shown below



They have same length, same weight and same material, then corresponding to maximum allowable stress

(a) All beams will have same moments of resistance
(b) Beam (1) will have maximum moments of resistance
(c) Beam (2) will have maximum moments of resistance
(d) Beam (3) will have maximum moments of resistance

28. Which of the machine component is designed under bending stress?

(a) Shaft
(b) **Arm of a lever**
(c) Key
(d) Belts and ropes

29. Neutral axis of a beam always coincides with

(a) Axis passing through bottom of beam
(b) Axis passing through height h/2 from bottom
(c)Axis passing through height h/3 from bottom
(d) Axis passing through centroid

30. For bending equation to be valid, radius of curvature of the beam after bending should be

(a) Equal to its transverse dimensions
(b) Infinity
(c) Very large compared to its transverse dimensions
(d) Double its transverse dimensions