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DEPARTMENT OF MECHANICAL ENGINEERING

SECOND YEAR (SY)

SCHEME: I **SEMESTER: III**

NAME OF SUBJECT: STRENGTH OF MATERIAL

Subject Code: 22306

UNIT WISE MULTIPLE CHOICE QUESTIONS BANK

Question Bank for Multiple Choice Questions

Program: Diploma in Mechanical engineering	**Program Code:- ME**
Scheme:-I	**Semester:- 3**
Course:- Strength of Materials	**Course Code:- 22306**

01 – Moment of Inertia	**Marks:-06**
Content of Chapter:- 1.1 Concept Moment of Inertia (MOI), Effect of MI in case of beam and column. 1.2 MOI about axes passing through Centroid, Parallel and perpendicular axis theorem, Polar MOI and Radius of Gyration. 1.3 MOI of Std basic shapes. 1.4 MOI of Composite plane fig.	

1. The unit of moment of inertia of an area,
   A. kg/m
   B. kg/m^2
   C. m^4
   D. m^3

Answer: - Option C

Explanation: - Moment of Inertia= A*h^2 (Product of Area & Square of its distance from axis), Area unit= m^2 & Square of its distance= m^2, so I= m^4

2. Moment of inertia of a squares of side b about an axis through its center of gravity, is
   A. $b^3/4$
   B. $b^4/12$
   C.$b^4 4/3$
   D. $b^4/8$

Answer: - Option B

Explanation: - Standard formula of moment of inertia of square= $b^4/12$

3. The moment of inertia of a circular cross-section of diameter d about an axis passing through its centroid can be expressed as …

A $\pi d^4/64$
B $\pi d^2/32$
C $\pi d^2/64$
D $\pi d^4/32$

Answer: - Option A

Explanation: - Standard formula of moment of inertia of Cirle= $\pi d^4/64$

4. Point, where the total volume of the body is assumed to be concentrated is
a) Center of area
b) Centroid of volume
c) Centroid of mass
d) All of the mentioned

Answer: - Option B
Explanation: - The centroid of the volume is the point where total volume is assumed to be concentrated.

5. What is MOI?
a) ml^2
b) mal
c) ar^2
d) None of the mentioned

Answer: - Option C
Explanation: - The formula of the moment of inertia is, MOI = ar^2 where
M = mass, a = area, l = length, r = distance.

6. What is the formula of radius of gyration?
a) $k^2 = I/A$
b) $k^2 = I^2/A$
c) $k^2 = I^2/A^2$
d) $k^2 = (I/A)^{1/2}$

Answer: - Option A
Explanation: - The radius of gyration of a body about an axis is a distance such that its square multiplied by the area gives moment of inertia of the area about the given axis. The formula of radius of gyration is given as $k^2 = I/A$.

7. What is the formula of theorem of parallel axis?
a)$I_{AD} = I_G + Ah$
b)$I_{AB} = Ah^2 + IG$
c) $I_{AB} = I_G - Ah^2$
d) $I_{AB} = I_G + I_{xx}$

Answer: - Option B
Explanation: - The theorem of parallel axis states that if the moment of inertia of a plane area about an axis in the plane of area theough the C.G. of the plane area be represented by IG, then the moment of the inertia of the given plane area about a parallel axis AB in the plane of area at a distance h from the C.G. is given by the formula
$I_{AB} = Ah^2 + I_G$.

8. What is the unit of radius of gyration?
a) m^4
b) m
c) N
d) m^2

Answer: - Option B
Explanation: - The radius of gyration = (length^4/length^2)1/2 = length
So its unit will be m.
9. What will be the the radius of gyration of a circular plate of diameter 10cm?
a) 1.5cm
b) 2.0cm
c) 2.5cm
d) 3cm

Answer: - Option C
Explanation: - The moment of inertia of a circle, I = πD^4/64 = 491.07 cm^4
The area of circle = 78.57 cm,
Radius of gyration = (I/A)$^{1/2}$ = 2.5 cm.

10. What is the moment of inertia of a rectangular section about an horizontal axis through C.G?
a) bd^3/6
b) bd^2/12
c) b^{2}d^2/12
d) bd^3/12

Answer: - Option D
Explanation: - The moment of inertia of a rectangular section about an horizontal axis through C.G is bd^3/12.

11. What is the moment of inertia of a rectangular section about an horizontal axis passing through base?
a) bd^3/12
b) bd^3/6
c) bd^3/3
d) bd^2/3

Answer: - Option C
Explanation: - The moment of inertia of a rectangular section about an horizontal axis passing through base is bd^3/3.

12. What is the moment of inertia of a triangular section about the base?
a) bh^2/12
b) bh^3/12
c) bh^3/6
d) bh^2/6

Answer: - Option B
Explanation: - The moment of inertia of a triangular section about the base is bh^3/12.

13. What is the moment of inertia of a triangular section about an axis passing through C.G. and parallel to the base?
a) bh^3/12
b) bh^3/24
c) bh^3/36
d) bh^3/6

Answer: - Option C
Explanation: - The moment of inertia of a triangular section about an axis passing through C.G. and parallel to the base is $bh^3/36$.

14. What will be the moment of inertia of a circle in cm4 of diameter is 10cm?
a) 340
b) 410
c) 460
d) 490

Answer: - Option D
Explanation: - The moment of inertia of a circle is = $\pi D^4/64 = 491.07\ cm^4$

15. What will be the moment of inertia of the given rectangle about an horizontal axis passing through the base?

a) 1500 mm^4
b) 1650 mm^4
c) 1666 mm^4
d) 1782 mm^4

Answer: - Option C
Explanation: - The moment of inertia of a rectangular section about an horizontal axis passing through base = $bd^3/3$
= 5x10x10x10/3
= 1666.66 mm^4.

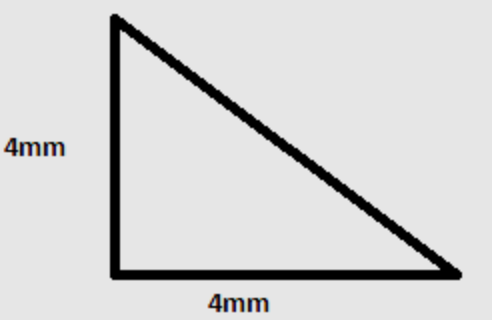
16. What will be the moment of inertia of the given rectangular section about an horizontal axis through C.G.?

a) 350 mm^4
b) 379mm^4
c) 416mm^4
d) 500mm^4

Answer: - Option C

Explanation: - The moment of inertia of a rectangular section about an horizontal axis through C.G = $bd^3/12$
= 5x10x10x10/12
= 416.67 mm^4.

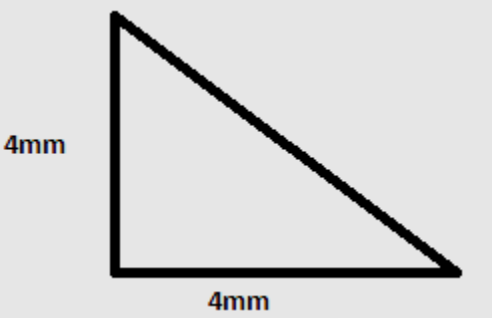
17. What will be the moment of inertia of the given triangle about the base?



a) 20.33 mm^4
b) 21.33 mm^4
c) 24.33 mm^4
d) 22.33 mm^4

Answer: - Option B
Explanation: - The moment of inertia of a triangular section about the base = $bh^3/12$.
= 4x4x4x4/12
= 21.33 mm^4.

18. What will be the moment of inertia of the given triangle about an axis passing through C.G and parallel to base?



a) 6.1 mm^4
b) 7.1 mm^4
c) 8.1 mm^4
d) 7.56 mm^4

Answer: - Option B
Explanation: - The moment of inertia of a triangular section about an axis passing through C.G. and parallel to the base = $bh^3/36$.
= 4x4x4x4/36
= 7.11 mm^4.

19. What will be the difference between MOI of two triangle sections is in 1st, MOI is taken about its base and in 2nd MOI is taken about its centroid?
a) $bh^3/12$
b) $bh^3/18$

c) $bh^3/36$
d) $bh^3/24$

Answer: - Option B
Explanation: - The moment of inertia of a triangular section about the base is $bh^3/12$
The moment of inertia of a triangular section about an axis passing through C.G. is $bh^3/36$
So the difference = $bh^3/12 – bh^3/36 = bh^3/18$.

20. The moment of inertia of a plane area with respect to an axis _____ to the plane is called a polar moment of inertia.
a) Parallel
b) Perpendicular
c) Equal
d) Opposite

Answer: - Option B
Explanation: - The moment of inertia of a plane area with respect to an axis perpendicular to the plane of the figure is called a polar moment of inertia with respect to a point, where the axis intersects a plane.

21. 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-forth of the total height above base
D. None of these
Answer: - Option B
Explanation: - One-third of the total height above base.

22. The term 'centroid' is
A. the same as center of gravity
B. the point of suspension
C. point of application of the resultant of all the forces tending to cause a body to rotate about a certain axis
D. None of these

Answer: - Option A
Explanation: -'centroid' is the same as center of gravity.

23. What is the moment of inertia of a triangular section about the base?
a) $bh^3/12$
b) $bh^3/24$
c) $bh^3/36$
d) $bh^3/6$

Answer: - Option A
Explanation: - The moment of inertia of a triangular section about the base is $bh^3/12$.

24. What is the moment of inertia of a triangular section about the Vertex?
a) $bh^3/12$
b) $bh^3/24$
c) $bh^3/36$
d) $bh^3/4$

Answer: - Option D
Explanation: - The moment of inertia of a triangular section about the Vertex is $bh^3/4$.

25. What is the formula of theorem of perpendicular axis?
a) $I_{zz} = I_{xx} + I_{yy}$
b) $I_{zz} = I_{xx} - I_{yy}$
c) $I_{zz} = I_{xx} * I_{yy}$
d) $I_{zz} = I_{xx}/I_{yy}$

Answer: - Option A
Explanation: - The perpendicular axis theorem states that the moment of inertia of a plane figure about an axis perpendicular to the figure and passing through the centroid is equal to the sum of moment of inertia of the given figure about two mutually perpendicular axes passing through the centroid. $I_{zz} = I_{xx} + I_{yy}$

.26. The unit of moment of inertia of an area,
A. kg/m
B. kg/m^2
C. m^4
D. m^3
Answer: - Option C
Explanation: - Moment of Inertia= $A*h^2$ (Product of Area & Square of its distance from axis), Area unit= m^2 & Square of its distance= m^2, so I= m^4

27. What will be the moment of inertia of a circle in cm4 of diameter is 20cm?
a) 7853.98
b) 6853.98
c) 5853.98
d) 4853.98

Answer: - Option A
Explanation: - The moment of inertia of a circle is = $\pi D^4/64$ = 7853.98cm^4

28. What will be the radius of gyration of a circular plate of diameter 5cm?
a) 1.56cm
b) 2.0cm
c) 2.5cm
d) 3cm

Answer: - Option C
Explanation: - The moment of inertia of a circle, I = $\pi D^4/64$ = 30.67 cm^4
The area of circle = 19.635 cm^2,
Radius of gyration = $(I/A)^{1/2}$ = 1.56 cm.

29. What will be the difference between MOI of two triangle sections is in 1st, MOI is taken about its centroid and in 2nd MOI is taken about its base?
a) $bh^3/12$
b) $bh^3/18$
c) $bh^3/36$
d) $bh^3/24$

Answer: - Option B
Explanation: - The moment of inertia of a triangular section about the base is $bh^3/12$
The moment of inertia of a triangular section about an axis passing through C.G. is $bh^3/36$
So the difference = $bh^3/36 - bh^3/12 = bh^3/18$.

30. The axis about which moment of area is taken is known as _____
a) Axis of area
b) Axis of moment
c) Axis of reference
d) Axis of rotation

Answer: - Option C
Explanation: - The axis of reference is the axis about which moment of area is taken. Most of the times it is either the standard x or y axis or the centeroidal axis.

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Question Bank for Multiple Choice Questions

Program: Diploma in Mechanical engineering	**Program Code:- ME**
Scheme:-I	**Semester:- 3**
Course:- Strength of Materials	**Course Code:- 22306**

02 – Simple stress and strains	**Marks:-10**

Content of Chapter:-

2.1 Equilibrium, Rigid body, Deformable body.
2.2 Axial Stresses- meaning, Resistance, Types of stresses; Axial (linear) Strain- concept,types
2.3 Hook's law, Young's Modulus, Axial deformation in abody and bodies in series.
2.4 Behavior of ductile and brittle materials subjected to axial tension,stress strain or load deformation curve ,limit of proportionality,yielding,permanent set,yield stress,ultimate stress.
2.5 Shear stress and strain, Modulous of rigidity, punchiung shear, shear connectors, single and double shear.
2.6 Temprature stress and strain in case of bodies having uniform cross-section, deformation fully prevented

1. A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar Will induce
   A.no stress
   B.shear stress
   C.tensile stress
   D.compressive stress

Answer: - Option A
Explanation: - There is no rigid support/prevented; bar is freely expanded so stress will not induce.

2. The deformation per unit length is called

   A. tensile stress

   B. compressive stress

   C. shear stress

   D. strain

   Answer: - Option D
   Explanation: - Definition of Strain= deformation per unit length

3. Whenever a material is loaded within elastic limit, stress is _____ strain.

A.equal to

B.directly proportional to

C.inversely proportional to

Answer: - Option B
Explanation: - According to Hooke's Law, stress is directly proportional to strain.

4 The ratio of change in volume to the original volume is called

A. linear strain

B. lateral strain

C. volumetric strain

D. Poisson's ratio

Answer: - Option D
Explanation: - volumetric strain= change in volume to the original volume

5. The unit of modulus of elasticity is same as those of

A. stress, strain and pressure

B. stress, force and modulus of rigidity

C. strain, force and pressure

D. stress, pressure and modulus of rigidity

Answer: - Option D
Explanation: - stress, pressure and modulus of rigidity is same as modulus of elasticity(N/mm^2)

6. When a bar of length *l*, width *b* and thickness *t* is subjected to a pull of *P*, its

A. length, width and thickness increases

B. length, width and thickness decreases

C. length increases, width and thickness decreases

D. length decreases, width and thickness increases

Answer: - Option C
Explanation: - Due to pull, length increases, width and thickness decreases.

7. The ratio of the largest load in a test to the original cross-sectional area of the test piece is called

A. elastic limit

B. yield stress

C. ultimate stress

D. breaking stress

Answer: - Option C
Explanation: - Ultimate stress =Max Load/Area

8. Which of the following statement is correct?
   A. The stress is the pressure per unit area.

   B. The strain is expressed in mm.

   C. Hook's law holds good up to the breaking point.

   D. Stress is directly proportional to strain within elastic limit.

Answer: - Option D
Explanation: - According to Hooke's Law, stress is directly proportional to strain.

9. The thermal or temperature stress is a function of
   A. increase in temperature

   B. modulus of elasticity

   C. coefficient of linear expansion

   D. all of these

Answer: - Option D
Explanation: - $\sigma T = E\alpha\Delta T$

10. A steel bar 2 m long, 20 mm wide and 10 mm thick is subjected to a pull of 2 kN. If the same bar is subjected to a push of 2 kN, the Poisson's ratio of the bar in tension will be _____ the Poisson's ratio for the bar in compression.
    A. equal to

    B. less than

    C. greater than

Answer: - Option A
Explanation: - Due to pull and push lateral and linear strain is same so Poisson's ratio of the bar in tension will be equal to the Poisson's ratio for the bar in compression.

11. The change in length due to a tensile or compressive force acting on a body is given by (where P = Tensile or compressive force acting on the body, l = Original length of the body, A = Cross-sectional area of the body, and E = Young's modulus for the material of the body)

A. $\frac{P.l.A}{E}$

B. $\frac{Pl}{AE}$

C. $\frac{E}{P.l.A}$

D. $\frac{AE}{Pl}$

Answer: - Option B
Explanation: - According to hooks law, σ= E × e , σ=P/A & e=Δl/L SO Put σ and e value to get change in length formula.

12. The property of a material by which it can be beaten or rolled into thin plates is called _____
a) Malleability
b) Plasticity
c) Ductility
d) Elasticity

Answer: - Option A
Explanation: - A material can be beaten into thin plates by its property of malleability.

13. A member which does not regain its original shape after removal of the load producing deformation is said _____
a) Plastic
b) Elastic
c) Rigid
d) None of the mentioned

Answer: - Option A
Explanation: - A plastic material does not regain its original shape after removal of load. An elastic material regains its original shape after removal of load.

14. The material in which large deformation is possible before absolute failure by rupture is called _____
a) Plastic
b) Elastic
c) Brittle
d) Ductile

Answer: - Option D
Explanation: The ductile material can be drawn into wires because it can resist large deformation before it fails.

15. What is a creep?
a) Gradual increase of plastic strain with time at constant load

b) Gradual increase of elastic strain with time at constant load
c) Gradual increase of plastic strain with time at varying load
d) Gradual increase of elastic strain with time at varying load

Answer: - Option A
Explanation: Creep is the property by virtue of which a metal specimen undergoes additional deformation with the passage of time under sustained loading within elastic limit. It is permanent in nature and cannot be recovered after removal of load, hence is plastic in nature.

16. The Unit of strain is?
a) LT^{-2}
b) N/m^2
c) N
d) Dimensionless

Answer: - Option D
Explanation: Strain is the ratio of change in dimension to original dimension. So it is dimensionless.

17. What is tensile strain?
a) The ratio of change in length to the original length
b) The ratio of original length to the change in length
c) The ratio of tensile force to the change in length
d) The ratio of change in length to the tensile force applied

Answer: - Option A
Explanation: The tensile stress is the ratio of tensile force to the change i length. It is the stress induced in a body when subjected to two equal and opposite pulls. The ratio of change in length to the original length is the tensile strain.

18. Find the strain of a brass rod of length 250mm which is subjected to a tensile load of 50kN when the extension of rod is equal to 0.3mm?
a) 0.025
b) 0.0012
c) 0.0046
d) 0.0014

Answer: - Option B
Explanation: Strain = dL/L = 0.3/250 = 0.0012.

19. The unit of force in S.I. units is ?
a) Kilogram
b) Newton
c) Watt
d) Dyne

Answer: - Option B
Explanation:: Force = mass x acceleration = kg x m/s^2 = N.

20. What is the unit for stress?
a) N/m^2
b) Nm^2
c) N/m

d) Nm

Answer: - Option A
Explanation:: Stress is basically forced upon the unit area. The dimension for force is N and the dimension of area is m^2. Therefore, the unit for stress is the dimension of force divided by that of area which is N/mm^2.

21. Which of the following relation is stated by Hooke's law?
a) Stress is directly proportional to strain
b) Stress is inversely proportional to strain
c) Stress is directly proportional to square of strain
d) Stress is inversely proportional to square of strain

Answer: - Option A
Explanation: According to Hooke's law, stress is directly proportional to strain and the ratio of stress to strain is denoted by Y or E and is called Young's Modulus oof elasticity.

22. Ductility is indicated by _____
a) Percentage elongation
b) Percentage of expansion
c) Poisson's ratio
d) Elasticity

Answer: - Option A
Explanation: Ductility is calculated by percentage elongation and reduction in cross-sectional area. It is the ability of a material to undergo plastic deformation and it is opposite to brittleness.

23. What term is used for the ratio of lateral strain to linear strain?
a) Bulk modulus
b) Elastic modulus
c) Shear strain
d) Poisson's ratio

Answer: - Option D
Explanation: Ratio of lateral strain to linear strain is known as Poisson's ratio. Modulus of elasticity is ratio of stress to strain. Bulk of modulus is mostly applied in liquids.

24. Which material has higher elasticity?
a) Rubber
b) Glass
c) Steel
d) Copper

Answer: Option C
Explanation: Decreasing order of elasticity is steel > copper > rubber > glass. Elasticity is inversely proportional to strain developed within the material. That's why steel is the most elastic of four.

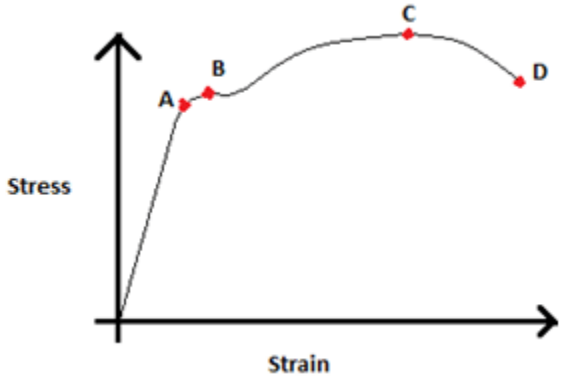
25. Yield strength represents resistance against _____
a) Fracture
b) Elastic deformation
c) Bending
d) Plastic deformation

Answer: Option D
Explanation: Yield strength represents materials' resistance against plastic deformation. Rigidity shows resistance against elastic deformation. Stiffness is a measure of resistance against bending.

26. Necking causes drop in load after an ultimate tensile point.
a) True
b) False

Answer: Option A
Explanation: Ductile metals show the drop in load after an ultimate tensile point. It is because of necking. It results in decrease in local cross section.

27. Which of the following options is correct?



a) A – yield point, B – elastic limit, C – fracture point, D – Ultimate tensile strength
b) A – yield point, B – proportional limit, C – Ultimate tensile strength, D – fracture point
c) A – proportional limit, B – yield point, C – Ultimate tensile strength, D – fracture point
d) A – yield point, B – proportional limit, C – fracture point, D – Ultimate tensile strength

Answer: Option C
Explanation: The point A refers to the point till which hooke's law can be followed, i.e: stress $\propto$ strain. It is also called the proportional limit. The point B refers to the point upto which if stress is applied the metal, on removal of stress, will regain its natural length. It is called yield point or elastic limit. The point C refers to the maximum tensile strength. And point D refers to the point where the material breaks or fractures.

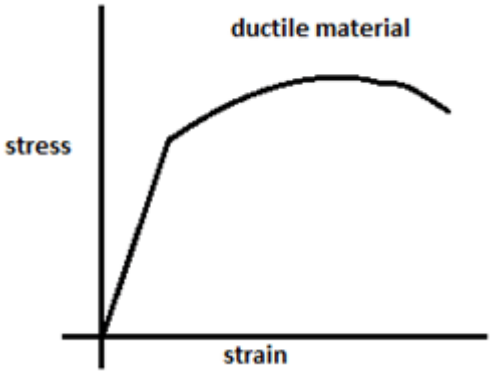
28. The stress corresponding to fracture point is called _____
a) ultimate stress
b) breaking stress
c) yield stress
d) plastic stress

Answer: Option B
Explanation: Breaking stress refers to the stress at which the material fractures. Ultimate stress is the maximum stress a material can handle before breaking. The material doesn't fracture at this stress. Yield stress refers to the stress after which plastic deformation begins.

29. Which of the following statements is correct for ductile materials?
a) Large deformation takes place between elastic limit and fracture point
b) have no proportional limit
c) Break immediately after proportional limit

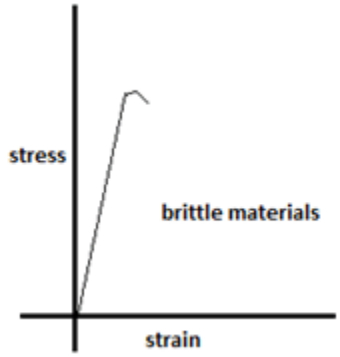
d) cannot be drawn into wires

Answer: Option A
Explanation: Ductile materials are those which can be drawn into wires as they deform by a significant amount between elastic limit and fracture point. The stress-strain curve of a ductile material looks like:



30. Which of the following statements is correct for brittle materials?
a) It breaks soon after elastic limit is crossed
b) It shows significant plastic deformation before breaking
c) It is used to make wires
d) Stress is never proportional to strain

Answer: Option A
Explanation: Brittle materials break soon after elastic limit. They show no significant plastic deformation and hence can't be used for making wires. Their stress-strain curve looks like:



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DEPARTMENT OF MECHANICAL ENGINEERING

Question Bank for Multiple Choice Questions

Program: Diploma in Mechanical engineering	**Program Code:- ME**
Scheme:-I	**Semester:- 3**
Course:- Strength of Materials	**Course Code:- 22306**

03 – Mechanical properties and elastic constants of metals	**Marks:-08**

Content of Chapter:-

3.1 Types of loads (actions) and related deformation, Flexure, torsion, shear.
3.2 Mechanical Properties: Elasticity, Plasticity, Ductility, Brittleness, Malleability, Fatigue, Creep, Toughness, Hardness.
3.3 Strength, Factor of Safety, Stiffness and flexibility.
3.4 Linear & lateral Strain, Poisson's ratio, changes in lateral dimensions.
3.5 Uni-Bi-Tri-axial stress systems, strain in each direction, bulk modulous, volumetric strain.
3.6 Relation between three moduli.
3.7 Stress due to gradual, Sudden and Impact load, corresponding deformation. Strain Energy, Resilience, Proof Resilience and Modulus of resilience.

1. Strain energy is the

   A.energy stored in a body when strained within elastic limits
   B.energy stored in a body when strained up to the breaking of a specimen
   C.maximum strain energy which can be stored in a body
   D.proof resilience per unit volume of a material
   Answer: - Option A
   Explanation: - Strain energy= energy stored in a body when strained within elastic limits.

2. Proof Resilience is the

   A.energy stored in a body when strained within elastic limits

   B.energy stored in a body when strained up to the breaking of the specimen

   C.maximum strain energy which can be stored in a body

   D.none of the above

   Answer: - Option C
   Explanation: - Proof Resilience= maximum strain energy which can be stored in a body

3. Which of the following statement is correct?

   A.The energy stored in a body, when strained within elastic limit is known as strain energy.

B. The maximum strain energy which can be stored in a body is termed as proof resilience.

C. The proof resilience per unit volume of a material is known as modulus of resilience.

D. all of the above

Answer: - Option D
Explanation: - All Definitions are correct.

4. The total strain energy stored in a body is termed as

A. resilience

B. Proof resilience

C. impact energy

D. modulus of resilience

Answer: - Option A
Explanation: - Resilience Definitions.

5. The Poisson's ratio for cast iron varies from

A. 0.33 to 0.37

B. 0.21 to 0.26

C. 0.31 to 0.34

D. 0.32 to 0.42

Answer: - Option B
Explanation: - Poisson's ratio for cast iron varies from 0.21 to 0.26,cork=0, rubber=0.45-0.5

6. The relation between Young's modulus (*E*), shear modulus (*C*) and bulk modulus (K) is given

A. $E = \frac{3K.C}{3K + C}$

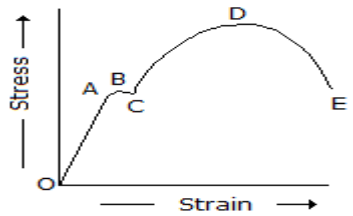
B. $E = \frac{6K.C}{3K + C}$

C. $E = \frac{9K.C}{3K + C}$

D. $E = \frac{12K.C}{3K + C}$

Answer: - Option C
Explanation: - E=3K (1-2μ)…….. (1) E=2G (1-μ)…….. (2) Where E=Elastic Modulus, K=Bulk Modulus, C=Modulus of Rigidity.

7. In the below figure, the stress corresponding to point *D* is



A.yield point stress

B.breaking stress

C.ultimate stress

D.elastic limit

Answer: - Option C
Explanation: - Ultimate stress =Max Load/Area

8. Which of the following statement is wrong?
   A. The deformation of the bar per unit length in the direction of the force is called linear strain.

   B. The Poisson's ratio is the ratio of lateral strain to the linear strain.

   C. The ratio of change in volume to the original volume is called volumetric strain.

   D. The bulk modulus is the ratio of linear stress to the linear strain.

Answer: - Option D
Explanation: - The bulk modulus (K) is the ratio of Direct stress to the volumetric strain.

9. The strain energy stored in a body, when the load is gradually applied, is (where σ = Stress in the material of the body, *V* = Volume of the body, and *E* = Modulus of elasticity of the material)

A. $\frac{\sigma E}{V}$

B. $\frac{\sigma V}{E}$

C. $\frac{\sigma^2 E}{2 V}$

D. $\frac{\sigma^2 V}{2 E}$

Answer: - Option D
Explanation: -. Strain energy stored in a body=1/2*Load*displacement=1/2*σ^2*volume/E.

10. A steel bar 2 m long, 20 mm wide and 10 mm thick is subjected to a pull of 2 kN. If the same bar is subjected to a push of 2 kN, the Poisson's ratio of the bar in tension will be _____ the Poisson's ratio for the bar in compression.

A. equal to

B. less than

C. greater than

Answer: - Option A
Explanation: -.

11. Which of the following statement is wrong?

A. The deformation of the bar per unit length in the direction of the force is called linear strain.

B. The Poisson's ratio is the ratio of lateral strain to the linear strain.

C. The ratio of change in volume to the original volume is called volumetric strain.

D. The bulk modulus is the ratio of linear stress to the linear strain.

Answer: - Option D
Explanation: - Bulk modulus is the ratio of linear stress to Volumetric strain.

12. The strain energy stored in a body, when the load is gradually applied, is (where σ = Stress in the material of the body, *V* = Volume of the body, and *E* = Modulus of elasticity of the material)

A. $\frac{\sigma E}{V}$

B. $\frac{\sigma V}{E}$

C. $\frac{\sigma^2 E}{2V}$

D. $\frac{\sigma^2 V}{2E}$

Answer: - Option D
Explanation: - Strain Energy=1/2*LOAD*DIPLACEMENT=σ^2*Vol^m/2E.

13. The slope of the stress-strain curve in the elastic deformation region is _____
a) Elastic modulus
b) Plastic modulus
c) Poisson's ratio
d) None of the mentioned

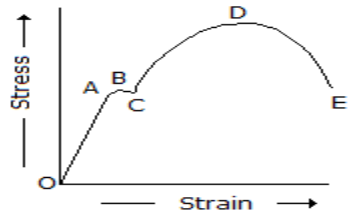
Answer: - Option A

Explanation: - The **elastic modulus** is the ratio of stress and strain. So on the stress strain curve, it is the slope. Elastic modulus= Direct stress/Linear strain.

14. Which point on the stress strain curve occurs after the proportionality limit?
a) Upper yield point
b) Lower yield point
c) Elastic limit
d) Ultimate point

Answer: - Option C
Explanation: - The curve will be stress strain proportional upto the proportionality limit. After these, the elastic limit will occur.

15.In the below figure, the stress corresponding to point *E* is



A.yield point stress

B.breaking stress

C.ultimate stress

D.elastic limit

Answer: - Option B
Explanation:- Breaking stress =Failure Load/Area

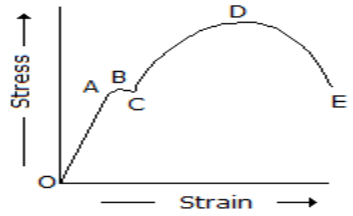
16. Which point on the stress strain curve occurs after yield point?
a) lower yield point
b) Upper yield point
c) Ultimate point
d) Breaking point

Answer: - Option C
Explanation:- After the yield point the curve will go up to its maximum limit of stress which is its ultimate point.

17. Where is the necking region?
a) The area between lower yield point and upper yield point
b) The area between the plastic limit and elastic limit
c) The area between the ultimate point and initial point
d) The area between the ultimate point and rupture

Answer: - Option D
Explanation:- Necking is a tensile strain deformation which is based in after the ultimate amount of stress occurs in the material.

18.In the below figure, the stress corresponding to point *A* is



A.yield point stress

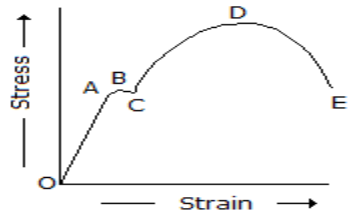
B.breaking stress

C.ultimate stress

D.elastic limit

Answer: - Option D
Explanation:- elastic limit

19.In the below figure, the stress corresponding to point *B* is



A.Upper yield point stress

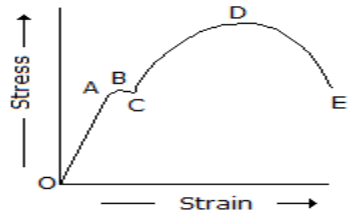
B.breaking stress

C.Lower yield point stress

D.elastic limit

Answer: - Option A
Explanation:- Upper yield point stress

20.In the below figure, the stress corresponding to point *C* is



A.Upper yield point stress

B.breaking stress

C.Lower yield point stress

D.elastic limit

Answer: - Option C
Explanation:- Lower yield point stress

21. The law which states that within elastic limits strain produced is proportional to the stress producing it is known as _____
a) Bernoulli's law
b) Hooke's law
c) Stress law
d) Poisson's law

Answer: - Option B
Explanation:-: Hooke's law states that strain is directly proportional to strain produced by the stress when a material is loaded within the elastic limit.

22. What is the factor of safety?
a) The ratio of stress to strain
b) The raio of permissible stress to the ultimate stress
c) The ratio of ultimate stress to the permissible (Working) stress
d) The ratio of longitudinal strain to stress

Answer: - Option C
Explanation:- Factor of safety is the ratio of ultimate stress to the permissible (Working) stress.

23. A circular rod of dia 30 mm and length 200mm is extended to 0.09mm length and 0.0045 diameters through a tensile force. What will be its Poissons ratio?
a) 0.30
b) 0.31
c) 0.32
d) 0.33

Answer: - Option D
Explanation:- Poissons ratio = lateral strain / longitudinal strain
= δD/D x L/δL
= 0.0045/30 x 200/0.09
= 0.33.

24. The Poissons ratio of a material is 0.3. what will be the ratio of Youngs modulus to bulk modulus?
a) 1.4
b) 1.2
c) 0.8
d) 0.6

Answer: - Option B
Explanation:- As we know E = 3k(1- 2μ)
So E/K = 3(1-2×0.3) = 1.2.

25. What is the bulk modulus of elasticity?
a) The ratio of shear stress to shear strain

b) The ratio of direct stress to direct strain
c) The ratio of volumetric stress to volumetric strain
d) The ratio of direct stress to volumetric strain

Answer: - Option D
Explanation:- When a body is subjected to the mutually perpendicular like and equal direct stresses, the ratio of direct stress to the corresponding volumetric strain strain is found to be constant for a given material when the deformation is within a certain limit. This ratio is known as the bulk modulus.

26. For a material, Youngs modulus is given as 1.2×10^5 and Poissons ratio 1/4. Calculate the bulk modulus.
a) 0.7×10^5
b) 0.8×10^5
c) 1.2×10^5
d) 1.2×10^5

Answer: - Option B
Explanation:- The bulk modulus is given as $K = E/3(1 – 2\mu)$
$= 1.2 \times 10^5/3(1 – 2/4)$
$= 0.8 \times 10^5$.

27. Determine the Poissons ratio and bulk modulus of a material, for which Youngs modulus is 1.2 and modulus of rigidity is 4.8.
a) 0.33, 7
b) 0.25, 8
c) 0.5, 9
d) 0, 10

Answer: - Option B
Explanation:- As we know, $E = 2C(1 + \mu)$
$\mu = 0.25$
$K = E / 3(1 – 2\mu)$
$= 8$.

28. How the elastic constants E and K are related?
a) $E = 2K(1 – 2\mu)$
b) $E = 3K(1 – 2\mu)$
c) $E = 2K(1 – \mu)$
d) $E = K(1 – 2\mu)$

Answer: - Option B
Explanation:- As $E = 2G(1 + \mu) = 3K(1 – 2\mu)$.

29. Which of the following is true if the value of Poisson’s ratio is zero?
a) The material is rigid
b) The material is perfectly plastic
c) The longitudinal strain in the material is infinite
d) There is no longitudinal strain in the material

Answer: - Option A
Explanation:- If the Poissons ratio is zero then the material is rigid.

30. The property by which a body returns to its original shape after removal of the force is called _____

a) Plasticity
b) Elasticity
c) Ductility
d) Malleability

Answer: - Option B
Explanation:- When an external force acts on a body, the body tends to undergo some deformation. If the external force is removed and the body comes back to its original shape and size, the body is known as elastic body and this property is called elasticity.

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Question Bank for Multiple Choice Questions

Program: Diploma in Mechanical engineering	**Program Code:- ME**
Scheme:-I	**Semester:- 3**
Course:- Strength of Materials	**Course Code:- 22306**

04 – SFD & BMD	**Marks:-28**

Content of Chapter:-

4.1 Types of Beams (Simply supported with or without overhang, Cantilever), Types of loads (Point load, Uniformly distributed load) Bending of Beam, deflected shapes.
4.2 Meaning of SF & BM, Relation between them, Sign convection.
4.3 SFD & BMD, Location of point of maximum BM, Deflected shape from maximum BMD, Location of point of Contra-flexure
4.4 Theory of Simple bending, Assumptions in theory of bending, flexural formula, Neutral axis.
4.5 Moment of resistance, Section Modulus.
4.6 Bending stress variation diagram across depth for cantilever and simply supported beam for symmetrical and unsymmetrical sections.
4.7 Transverse shear stress, average and maximum shear stress, Shear stress variation diagram.

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

ANS:C

2. The other side of the simply supported beam is having pin support, what is the support this side?
a) Roller
b) Pin
c) Hinge
d) Rolling hinge

Answer: - Option A
Explanation: -. The simply supported beams are supported only at one side the pin. This means the other side is having the roller. The beams are such designed because they are the structures which are being made so as to support the loadings which are perpendicular to the axis of that structure. Thus not pinned both sides.

3. A cantilever is a beam whose

a) Both ends are supported either on rollers or hinges
b) One end is fixed and other end is free
c) Both ends are fixed
d) Whose both or one of the end has overhang.

Answer: - Option B

Explanation: -. A cantilever is a beam whose One end is fixed and other end is free.

4. Point of contra-flexure is a *
a) Point where Shear force is maximum
b) Point where Bending moment is maximum
c) Point where Bending moment is zero
d) Point where Shear force is minimum

Answer: - Option C
Explanation: -. Point of contra-flexure is a where Bending moment is zero.

5. The beam which extending beyond the support, that beam is called as.....

A. Simply supported beam
B. Cantilever beam
C. Fixed beam
D. Overhanging beam

Answer: - Option D

Explanation: -. The beam which extending beyond the support, that beam is called as Overhanging beam.

6. When shear force zero that points bending moment is.....
A. Maximum
B. Minimum
C. Infinite
D. Zero

Answer: - Option A

Explanation: -. When shear force zero that points bending moment is Maximum AND Vice versa.

7. Bending moment is zero on cantilever beam at a....

A. Free end
B. Fixed end

Answer: - Option A

Explanation: -. Bending moment is zero on cantilever beam at a free end because negligible distance.

8. Point of cotraflexure occurs in.....

A. Simply supported beam
B. Cantilever beam

C. Fixed beam
D. Overhanging beam

Answer: - Option D

Explanation: - Mostly sagging and hogging occurs in Overhanging beam so Point of cotraflexure occurs in Overhanging beam.

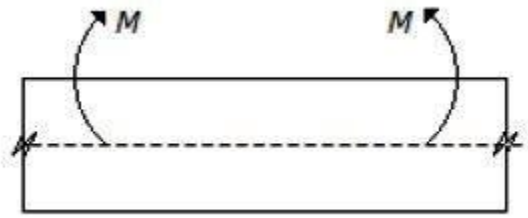
9. When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the

(A) Top layer
(B) Bottom layer
(C) Neutral axis
(D) Every cross-section

Answer: - Option B

Explanation: - When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the Bottom layer of rectangular beam.

10. The lower layer of the beam as shown in the below figure, will be



(A) In tension
(B) In compression
(C) Neither in tension nor in compression
(D) None of these

Answer: - Option A

Explanation: - When a rectangular beam is subjected to moment, the maximum tension is developed on the lower layer of rectangular beam.

11. 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

Answer: - Option B

Explanation: - On Neutral axis there is no deformation so at this point neither elongated nor shortened.

12. 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

Answer: - Option A
Explanation: - Based on below formula Bending stress(σb) is Directly proportional to the distance (y) of layer from the neutral layer.

Beam Bending Stress Formula

$$\sigma = \frac{My}{I_x}$$

$\sigma -$ *bending stress in* N/m^2
$M -$ *moment of neutral axis* Nm
$y -$ *perpendicular distance to neutral axis in* m
$I_x -$ *second moment area of neutral axis in* m^4

13. A continuous beam is one which is

(A) Fixed at both ends
(B) Fixed at one end and free at the other end
(C) Supported on more than two supports
(D) Extending beyond the supports

Answer: - Option C

Explanation: - A continuous beam is one which is Supported on more than two supports.

14. A beam supported on more than two supports is called

(A) Simply supported beam
(B) Fixed beam
(C) Overhanging beam
(D) Continuous beam

Answer: - Option D
Explanation: - A continuous beam is one which is supported on more than two supports.

15. The shear force diagram for a cantilever beam of length *l* and carrying a gradually varying load from zero at free end and *w* per unit length at the fixed end is a

A. horizontal straight line

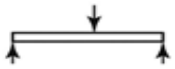
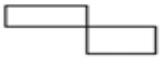
B. vertical straight line

C. inclined line

D. parabolic curve

Answer: - Option D
Explanation: - The shear force diagram for a cantilever beam of length *l* and carrying a gradually

varying load from zero at free end and *w* per unit length at the fixed end is a 2nd order derivative so parabolic curve.

Load	Slope for shear force	Slope for bending Moment
P 	Constant 	Linear 
Uniformly distributed load 	Linear 	Parabolic 
Uniformly varying load 	Parabolic 	Cubic 

16. A beam of *T*-section is subjected to a shear force of *F*. The maximum shear force will occur at the

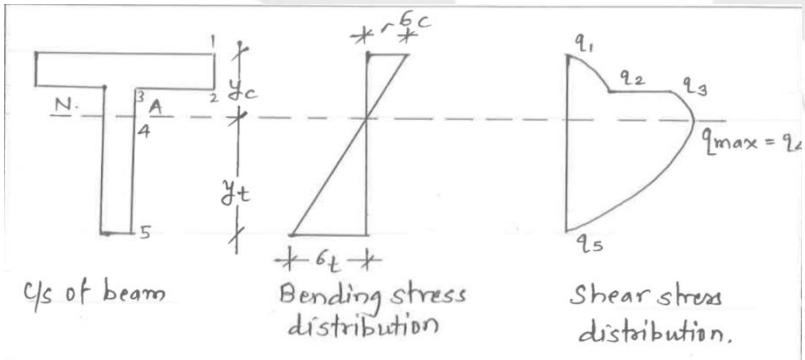
A. top of the section

B. bottom of the section

C. neutral axis of the section

D. junction of web and flange

Answer: - Option C
Explanation: - The maximum shear force will occur at the neutral axis of the section



17. When the shear force diagram is a parabolic curve between two points, it indicates that there is a

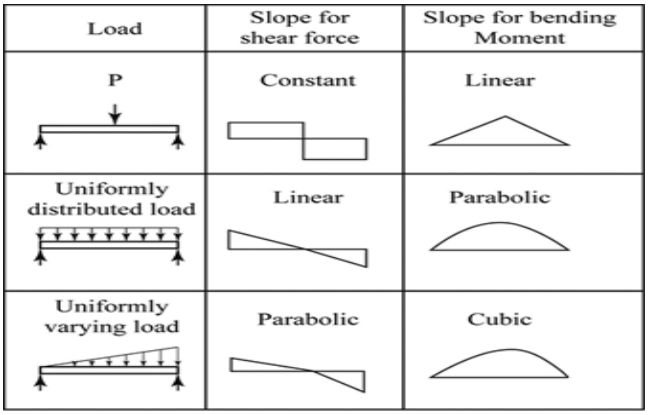
A. point load at the two points

B. no loading between the two points

C. uniformly distributed load between the two points

D. uniformly varying load between the two points

Answer: - Option D
Explanation: -



18. The shear force diagram for a simply supported beam carrying a uniformly distributed load of *w* per unit length, consists of

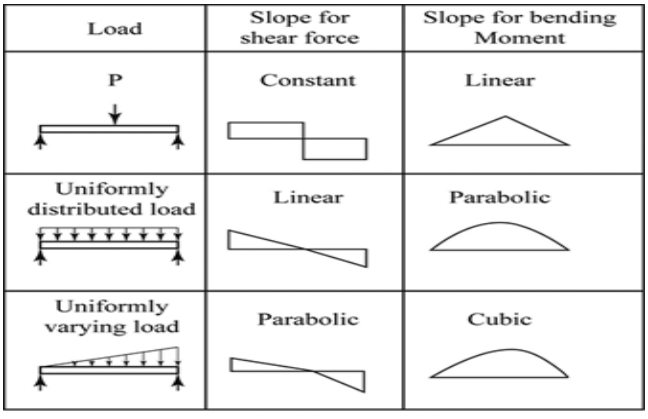
A. one right angled triangle

B. two right angled triangles

C. one equilateral triangle

D. two equilateral triangles

Answer: - Option B
Explanation: -



19. In a simple bending theory, one of the assumptions is that the material of the beam is isotropic. This assumption means that the

A. normal stress remains constant in all directions

B. normal stress varies linearly in the material

C. elastic constants are same in all the directions

D. elastic constants varies linearly in the material

Answer: - Option C
Explanation: - Isotropic means elastic constants are same in all the directions.

20. The bending moment in the centre of a simply supported beam carrying a uniformly distributed load of *w* per unit length is

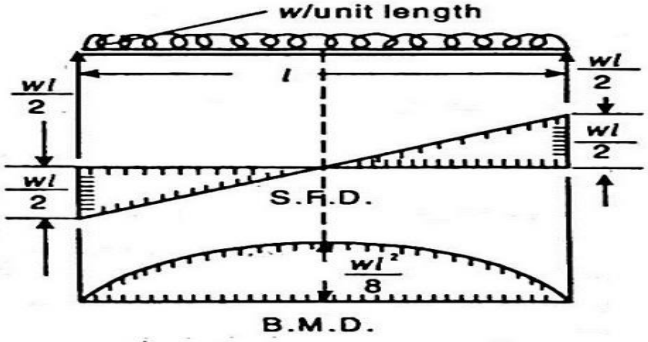
A. zero

B. $wl^2/2$

C. $wl^2/4$

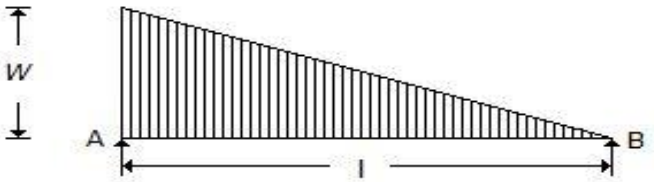
D. $wl^2/8$

Answer: - Option D
Explanation: -



Simply supported beam with a U.D.L.

21. The maximum bending moment for the beam shown in the below figure, lies at a distance of _____ from the end *B*.



A. l/2

B. l/3

C. $\frac{l}{\sqrt{2}}$

D. $\frac{l}{\sqrt{3}}$

Answer: - Option D
Explanation: - M(a)=0 => L* Ra =(WL/2) * (2L/3) = WL/3.
=> Rb= WL/2 - WL/3 = WL/6.

Fx= Rb - load on lenght Ax.
= WL/6 - (wx/L) * x/2.
= WL/6 - wx^2/2L -->(1).

Apply x = 0 and x = L.

At some point S.F must be zero then (1) equal to zero.
X = L/√3. Ans.

22 . When shear force at a point is zero, then bending moment is _____ at that point.

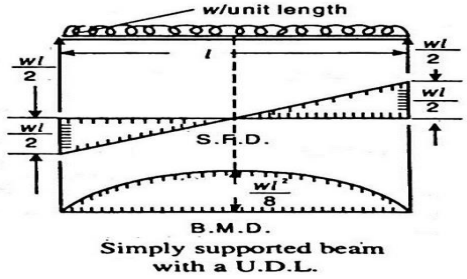
A. zero

B. minimum

C. maximum

D. infinity

Answer: - Option C
Explanation: - When shear force at a point is zero, then bending moment is maximum at that point.



23. When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the

A. top layer

B. bottom layer

C. neutral axis

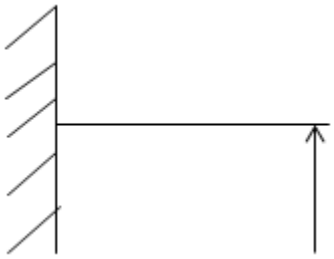
D. every cross-section

Answer: - Option B
Explanation: - When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the bottom layer.

24. Example for cantilever beam is _____
a) Portico slabs
b) Roof slab
c) Bridges
d) Railway sleepers

Answer: - Option A
Explanation: A beam which is fixed at one end and is free at other end, it is called cantilever beam. The examples for it are portico slabs and sunshades.

25. The diagram depicts _____ kind of beam.



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

Answer: - Option A
Explanation: A beam which is fixed at one end and free at other end is called cantilever beam. In this case, some support other than the existing ones may be provided in order to avoid excessive deflection or to reduce the amount of bending moment, the additional support is known as a prop. The beam is known as a propped cantilever beam.

26. Fixed beam is also known as _____
a) Encastered beam
b) Built on beam
c) Rigid beam

d) Tye beam

Answer: - Option A
Explanation: A beam which is fixed at both supports is called fixed beam or encastered beam. All framed structures are examples of fixed beams.

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

Answer: - Option A
Explanation: These loads are uniformly spread over a portion or whole area. They are generally represented as rate of load that is Kilo Newton per meter length (KN/m).

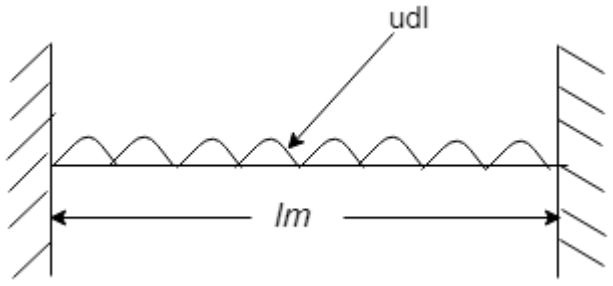
28. Continuous beams are _____
a) Statically determinate beams
b) Statically indeterminate beams
c) Statically gravity beams
d) Framed beams

Answer: - Option B
Explanation Fixed beams and continuous beams are statically indeterminate beams which cannot be analyzed only by using static equations.

29. 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

Answer: - Option A
Explanation A Beam extended beyond its support. And the position of extension is called as over hung portion.

30. Units of U.D.L?



a) KN/m
b) KN-m
c) KN-m×m

d) KN

Answer: - Option A
Explanation: As these loads distribute over span the units for this kind of loads will be load per meter length i.e KN/m. It is denoted by "w".

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

Answer: - Option B
Explanation: In a simple support there will not be any resistance to horizontal loads, moment or rotation. In fact, it only offers a vertical reaction normal to the axis of the beam.

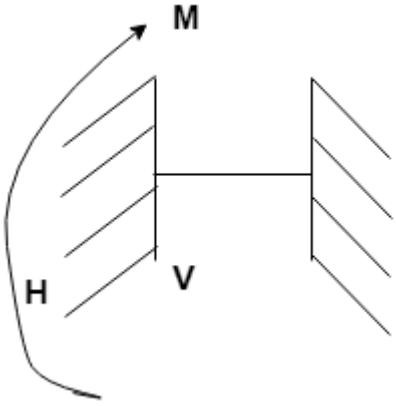
32. _____ support develops support moment.
a) Hinged
b) Simple
c) Fixed
d) Joint

Answer: - Option C
Explanation: A fixed support offers resistance against horizontal and vertical movement and against the rotation of the member and that in turn developers support moment.

33. Hinge support is called as _____
a) Socket joint
b) Swivel joint
c) Ball joint
d) Pin joint

Answer: - Option D
Explanation: Hinge support is one, in which the position is fixed but not the direction. In their words hinged support offers resistance against vertical and horizontal moments.it is fixed in such a way that it resembles like a pin joint.

34. Name the support from following figure.



a) Hinge support
b) Fixed support

c) Free support
d) Roller support

Answer: - Option B
Explanation: In the above figure we can observe that the beam is supported at both the ends so the beam is fixed at both ends. Hence the support is a fixed support.

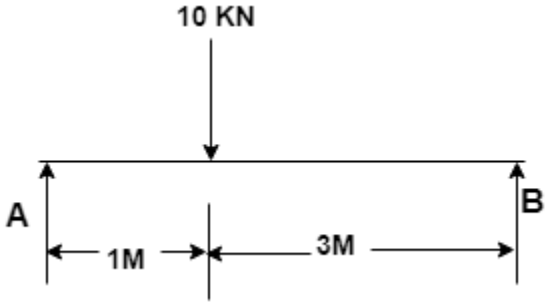
35. For a simply supported beam, the moment at the support is always _____
a) Maximum
b) Zero
c) Minimum
d) Cannot be determined

Answer: - Option B
Explanation: As the moment is a product of force and perpendicular distance, the flexural moment at the support is zero because there is no distance at the support.

36. "Hinged support offers resistance against rotation".
a) True
b) False

Answer: - Option B
Explanation: A hinged support offers resistance against horizontal and vertical movement but not against rotation. It support offers a vertical and horizontal reaction only.

37. Find the reaction at simple support A?



a) 6.5 kN
b) 9 kN
c) 10 kN
d) 7.5 kN

Answer: - Option D
Explanation: Total load = 10 kN
Taking moment at A = 0
4 × R @ B – 10 = 0
R @ B = 2.5 kN
Reaction at A = 10 – 2.5 = 7.5kN.

38. Roller support is same as _____
a) Hinged support
b) Fixed support
c) Simply support

d) Roller support

Answer: - Option C
Explanation: The support reaction is normal to the axis of the beam. It facilitates the vertical support. It helps the beam to overcome the temperature stresses effectively. It is similar to simple support.

39. Hinged supports offers vertical and _____ reaction.
a) Horizontal
b) Moment
c) Rotation
d) Couple

Answer: - Option A
Explanation: A hinged support offers a vertical and horizontal reaction. The pin jointed support offers resistance against horizontal and vertical movements but not against rotation movement.

40. 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

Answer: - Option B
Explanation: Beam is structural member which is subjected to Transverse loads and couples to get shear force and bending moment.

41. A cantilever is a beam whose
A.Both ends are supported either on rollers or hinges
B.One end is fixed and other end is free
C.Both ends are fixed
D.Whose both or one of the end has overhang

Answer: - Option B
Explanation: A cantilever is a beam whose One end is fixed and other end is free.

42. Eccentric load causes

(a) Only bending stress
(b) Only normal stress
(c) Bending and normal stress
(d) None

Answer: - Option C
Explanation:-Due to Eccentric load causes

43. A dam under axial and transverse load is a case of

(a) Buckling

(b) Eccentric loading

(c) Bending

(d) None

Answer: - Option B
Explanation:- A dam under axial and transverse load is a case of Eccentric loading.

44. Bending occurs due to the application of

(a) Axial load
(b) Transverse load
(c) Torsional load
(d) None

Answer: - Option B
Explanation:- Bending occurs due to the application of Transverse load.

45. Bending stresses in a beam are maximum at the
(a) Centroid axis
(b) Extreme fibers
(c) Geometric axis
(d) None
Answer: - Option B
Explanation:- Bending stresses in a beam are maximum at the *Extreme fibers.*

46. Bending stresses in a beam is zero at the
(a) Centroid axis
(b) Extreme fibers
(c) Geometric axis
(d) None
Answer: - Option A
Explanation:- Bending stresses in a beam is zero at the *Centroid axis.*

47. Variation of bending stresses in a beam have
(a) Parabolic variation
(b) Linear variation
(c) Cubical variation
(d) None
Answer: - Option B
Explanation:- Variation of bending stresses in a beam have Linear variation.

48. Bending stress will be least at the extreme fibers for

(a) Maximum area of cross section
(b) Maximum moment of inertia
(c) Maximum section modulus
(d) None
Answer: - Option C
Explanation:- . Bending stress will be least at the extreme fibers for *Maximum section modulus*

49. Moment of resistance of a beam should be
(a) Greater than the bending moment
(b) Less than the bending moment
(c) Two times the bending moment
(d) None
Answer: - Option A
Explanation:- Moment of resistance of a beam should be Greater than the bending moment.

50. Bending stress is
a. Tensile
b. Compressive
c. Tensile + Compressive
d. None

Answer: - Option C
Explanation:- Bending stress is Tensile + Compressive

51. In beam bending, Young's modulus in tension is
a. > than Young's modulus in compression
b. < than Young's modulus in compression
c. = Young's modulus in compression
d. None
Answer: - Option C
Explanation:- *In beam bending, Young's modulus in tension is* equal to Young's modulus in compression.

52. The radius of curvature before bending is
a. Very small
b. Very large
c. Medium
d. None
Answer: - Option B
Explanation:- *The radius of curvature before bending is* Very large

53. Neutral layer is a part of
a. Centroid axis
b. Neutral axis
c. Longitudinal axis
d. None
Answer: - Option B
Explanation:- Neutral layer is a part of Neutral axis.

54. Which stress comes when there is an eccentric load applied?
a) Shear stress
b) Bending stress
c) Tensile stress
d) Thermal stress

Answer: - Option B
Explanation:- When there is an eccentric load it means that the load is at some distance from the axis. This causes compression in one side and tension on the other. This causes bending stress.

55. What is the expression of the bending equation?
a) $M/I = \sigma/y = E/R$
b) $M/R = \sigma/y = E/I$
c) $M/y = \sigma/R = E/I$
d) $M/I = \sigma/R = E/y$

Answer: - Option A
Explanation:- The bending equation is given by $M/I = \sigma/y = E/R$
where
M is the bending moment
I is the moment of inertia
y is the distance from neutral axis
E is the modulus of elasticity
R is the radius.

56. 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

Answer: - Option B
Explanation:- When a beam is in bending the layer in the direction of bending will be In compression and the other will be in tension. One side of the neutral axis will be shortened and the other will be elongated.

57. 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

Answer: - Option A
Explanation:- From the bending equation $M/I = \sigma/y = E/R$ Here stress is directly proportional to the distance of layer from the neutral layer.

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

d) Uniform

Answer: - Option C
Explanation:- At the end supports, the moment (couple) developed is zero, because there is no distance to take the perpendicular acting load. As the distance is zero, the moment is obviously zero.

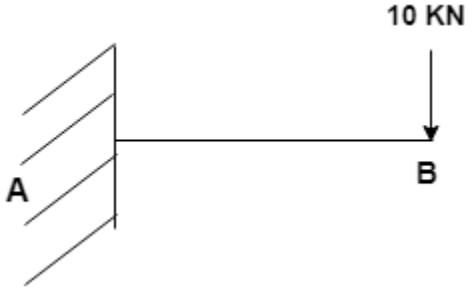
59. What is the maximum shear force, when a cantilever beam is loaded with udl throughout?
a) w×l
b) w
c) w/l
d) w+l

Answer: - Option A
Explanation:- In cantilever beams, the maximum shear force occurs at the fixed end. In the free end, there is zero shear force. As we need to convert the udl in to load, we multiply the length of the cantilever beam with udl acting upon. For maximum shear force to obtain we ought to multiply load and distance and it surely occurs at the fixed end (w×l).

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

Answer: - Option B
Explanation:- The positive bending moment is considered when it causes convexity downward or concavity at top. This is sagging. In simply supported beams, it occurs at mid span because the bending moment at the supports obviously will be zero hence the positive bending moment occurs in the mid span.

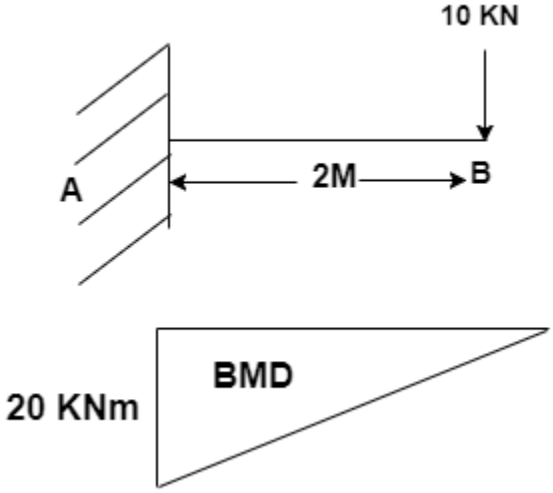
61. What will be the variation in BMD for the diagram? [Assume l = 2m].



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

Answer: - Option B

Explanation:- At support B, the BM is zero. The beam undergoes maximum BM at fixed end. By joining the base line, free end and maximum BM point. We obtain a right angled triangle.



62. Which of the following statements are correct about a cantilevered beam with point load acting on the extreme end of the beam?
a) Bending stresses induced in the beam are constant throughout the length of the beam
b) Bending stresses induced in the beam decreases linearly from fixed end to free end
c) Bending stresses induced in the beam increases linearly from fixed end to free end
d) Bending stresses induced in the beam decreases exponentially from fixed end to free end

Answer: - Option B
Explanation:- Bending stresses induced in the beam decreases linearly from fixed end to free end. The point load acting induces normal as well as shear stresses, but when length beam is large the shear stresses are negligible

63. The cantilever beam is having pin supports both sides of it.
a) True
b) False

Answer: - Option B
Explanation:- The one end of the cantilever beam is fixed and the other one is having its end as free. This is the other type of the beam which is being designed to support the loadings which are perpendicular to the support. Thus the cantilever is free from one end and fixed at another.

64. We apply the equations of _____ to determine various forces acting on the beams.
a) Equilibrium
b) Rotation moment
c) Linear moment
d) Translation

Answer: - Option A
Explanation:- The force developed by a support doesn't allow the translation of its attached member. This is the basic condition for the equilibrium of the forces in any dimension. And many other are applied at the points where the forces are to be determined. Thus equilibrium equations are being applied at the points where the main forces are to be determined.

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

Answer: - Option C
Explanation:- As shear force at any section is equal to the algebraic sum of the forces, the units of the shear force are also in kilo newtons and it is denoted by kN.

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Question Bank for Multiple Choice Questions

Program: Diploma in Mechanical engineering	**Program Code:- ME**
Scheme:-I	**Semester:- 3**
Course:- Strength of Materials	**Course Code:- 22306**

05 – TORSION	**Marks:-08**
Content of Chapter:- 5.1 Torsion: Concept, field applications(Shaft, Flange coupling, shear bolts), torsional rigidity, torsional equation and asssumptionsMeaning of SF & BM, Relation between them, Sign convection. 5.2 Torsional Restistance for hollow and solid circular shafts, Power transmitted by shaft 5.3 Theory of Simple bending, Assumptions in theory of bending, flexural formula, Neutral axis.	

1. In the torsion equation ,term *J*/*R* is called

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{l}$$

   A. shear modulus

   B. section modulus

   C. polar modulus

   D. none of these

Answer: - Option C

Explanation:- Torsional equation is T/J = τ/R = Cθ/l

2. The torque transmitted by a solid shaft of diameter (*D*) is (where τ = Maximum allowable shear stress)

A. $\frac{\pi}{4} \times \tau \times D^3$

B. $\frac{\pi}{16} \times \tau \times D^3$

C. $\frac{\pi}{32} \times \tau \times D^3$

D. $\frac{\pi}{64} \times \tau \times D^3$

Answer: - Option B
Explanation:- Torque is equal to ς=16T/ЛD^3

3. The product of the tangential force acting on the shaft and its distance from the axis of the shaft (i.e. radius of shaft) is known as

A. bending moment

B. twisting moment

C. torsional rigidity

D. flexural rigidity

Answer: - Option B
Explanation:- The product of the tangential force acting on the shaft and its distance from the axis of the shaft (i.e. radius of shaft) is known as twisting moment

4. Torsional sectional modulus is also known as _____
A. Polar modulus
B. Sectional modulus
C. Torsion modulus
D. Torsional rigidity

Answer: - Option A
Explanation:- Torsional sectional modulus is also known as Polar modulus.

5. The power transmitted by shaft SI system is given by _____
A. 2πNT/60
B. 3πNT/60
C. 2πNT/45
D. NT/60 W

Answer: - Option A
Explanation:- Standard Formula, P=2πNT/60

6. Calculate the torque which a shaft of 300 mm diameter can safely transmit, if the shear stress is 48 N / mm^2.
A. 356 kNm
B. 254 kNm
C 332 kNm
D 564 kNm

Answer: - Option B
Explanation:- ς=16T/ЛD^3 so T=ς*Л*D^3/16= 48*Л*300^3/16=254469004.94Nmm=254.4 kNm

7. What is the unit of polar moment of inertia?
   A. m^2
   B. m^5
   C. m^3
   D. m^4

   Answer: - Option D
   Explanation:- polar moment of inertia J=ЛD^4/32= So unit is m^4

8. A shaft is said to be in pure torsion if

A. Turning moment is applied at one end and other end is free
B. Turning force is applied at one end and other end is free
C. Two opposite turning moments are applied to the shaft
D. Combination of torsional load and bending load is applied to the shaft

Answer: - Option C
Explanation:- A shaft is said to be in pure torsion if Two opposite turning moments are applied to the shaft.

9. If diameter of a shaft is doubled the power transmitted capacity will be.
   A. Either twice or half
   B. Four times
   C. Eight times
   D. Same

Answer: - Option C
Explanation:- Power=Torque*ω=Лd^3/16ς*ω= so if diameter is double then power is Eight times.

10. Which material is suitable for shaft material?
    A. High speed steel
    B. Stainless steel or high carbon steel
    C. Grey cast iron
    D. Steel having approx. 0.4% carbon and 0.8% manganese

Answer: - Option D

Explanation:- Shaft material should be medium carbon steel i.e Steel having approx. 0.4% carbon and 0.8% manganese.

11.The Torsional equation is

(A) $M/I = \sigma/y = E/R$
(B) $T/J = \tau/R = C\theta/l$
(C) $M/R = T/J = C\theta/l$
(D) $T/I = \tau/J = R/C\theta$

Answer: - Option B

Explanation:- Torsional equation is $T/J = \tau/R = C\theta/l$

12. The unit of Torque in SI units

(a) kg-m
(b) kg-cm
(c) N-m
(d) N/m2

Answer: - Option C
Explanation:- Torque defined as, multiply the force (F) by the distance away from the rotational axis.

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

Answer: - Option A
Explanation:- The ratio of polar moment of inertia to radius of section is called Polar modulus or Torsional section modulus. Its units are mm^3 or m^3 (in SI).

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

Answer: - Option C
Explanation:- The polar modulus is a measure of the strength of shaft in rotation. As the value of Polar modulus increases torsional strength increases.

15**.** What are the units of torsional rigidity?
a) Nmm^2
b) N/mm
c) N-mm
d) N

Answer: - Option C

Explanation:- The product of modulus of rigidity (G) and polar moment of inertia (J) is called torsional rigidity. Torsional rigidity is a torque that produces a twist of one radian in a shaft of unit length.

16. The angle of twist can be written as _____
a) TL/J
b) CJ/TL
c) TL/CJ
d) T/J

Answer: - Option C
Explanation:- The angle of Twist = TL/CJ, Where T = Torque in Nm, L = Length of shaft, GJ = Torsional rigidity.

17. "Torsion" is defined as _____
a) compressive force
b) type of friction
c) twisting
d) object at rest

Answer: - Option C
Explanation:- Torsion is defined as the twisting of a specimen caused by a certain amount of torque. Compressive forces are forces that are applied to an object that results in the specimen getting compacted.

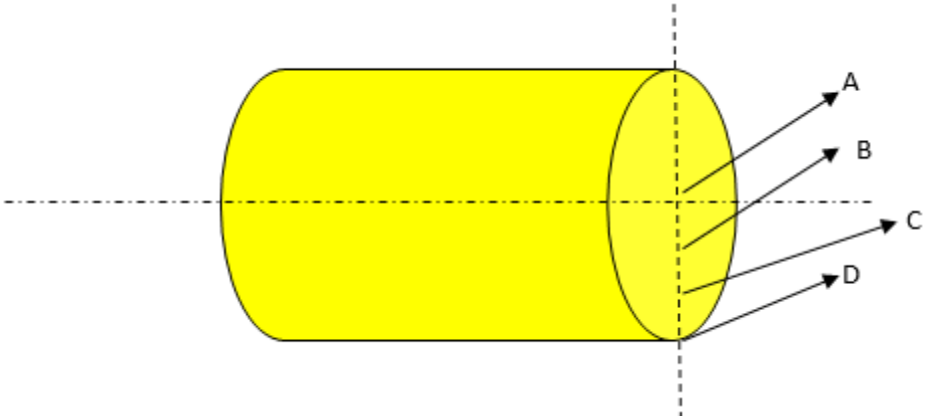
18. Torsional strength is the _____
a) capacity of a material to withstand the twisting load
b) ability to apply force
c) gravitational attraction
d) electrical force

Answer: - Option A
Explanation:- The capacity of a material to withstand the twisting load is called torsional strength. It is also called modulus of rupture. Gravitational force is the force of attraction present between particles.

19**.** The torsion test cannot determine _____
a) modulus of elasticity in shear
b) torsional yield strength
c) modulus of rupture
d) tensile strength

Answer: - Option D
Explanation:-: The Torsion test apply shear strength in shear mode, so the only uniaxial tensile properties cannot be determined by the torsion test.

20. In the following torsional test sample, the highest shear stress will be at point _____



a) A
b) B
c) C
d) D

Answer: - Option D
Explanation:-The shear stress will be zero in the center of the cylinder, and it will be maximum at the circumference or the surface of the cylinder. So, in this case, at point D, the shear stress will be maximum.

21. The maximum shear stress for a solid cylindrical bar having diameter D, and torsional moment equal to T will be _____
a) $16T/\pi D^3$
b) $16T/\pi D^4$
c) $8T/\pi D$
d) TD

Answer: - Option A
Explanation:-The Shear stress is equal to
-> T*r/J; Where T is the torsional moment, r is the distance of the point from the center of the cylinder, J is the polar moment of inertia.
-> So $J=\pi D^4/32$
The shear stress will be maximum when the r is equal to D/2 or at the surface of the cylinder.
So, substitute the values in the equation;
-> $T*r/J = 16T/\pi D^3$

22. In the torsion test, the obtained data are with respect to _____
a) stress vs. strain
b) shear stress vs. strain
c) shear stress vs. Shear strain
d) twisting moment vs. Angle of twist

Answer: - Option D
Explanation:-The primary as in tensile test are load vs. elongation; similarly in torsion test, they are Twisting angle vs. the angle of twist.

23. The brittle fracture in the torsion test results in _____ geometry.
a) flat facet
b) helical shape
c) cup and cone

d) shear fracture

Answer: - Option B
Explanation:-The brittle material in the plane is perpendicular to the direction of the maximum tensile stress. This plane bisects the angle between the two planes of the maximum shear stress and makes an angle of 45º with longitudinal and transverse directions; it results in the helical fracture.

24. Which of the following assumptions are made in torsion theory?

a. Shaft is perfectly straight

b. Material of the shaft is heterogeneous

c. Twist cannot be uniform along the length of the shaft

d. All of the above

Answer: - Option A
Explanation:- Assumptions of torsion theory is Shaft is perfectly straight.

25. A member subjected to couple produces rotational motion about its longitudinal axis called as
a. torsion
b. twisting moment
c. both a. and b.
d. none of the above

Answer: - Option C
Explanation:- A member subjected to couple produces rotational motion about its longitudinal axis called as torsion and twisting moment.

26. What is the S.I. unit of torsional rigidity?

a. Nm
b. $N.m^2$
c. Nm/ radian
d. None of the above

Answer: - Option C
Explanation: - . Unit of torsional rigidity= $N.m^2$

27. Magnitude of shear stress induced in a shaft due to applied torque varies from

a. Maximum at centre to zero at circumference.

b. Maximum at centre to minimum (not-zero) at circumference.

c. Zero at centre to maximum at circumference.

d. Minimum (not zero) at centre to maximum at circumference.

Answer: - Option C
Explanation: - shear stress induced in a shaft due to applied torque varies from Zero at centre to maximum at circumference.

28. The variation of shear stress in a circular shaft subjected to torsion is

a. Linear

b. Parabolic

c. Hyperbolic.

d. Uniform.

Answer: - Option A
Explanation: - The variation of shear stress in a circular shaft subjected to torsion is Linear.

29. A solid shaft of same cross sectional area and of same material as that of a hollow shaft can resist

a. Less torque.

b. More torque.

c. Equal torque.

d. Unequal torque.

Answer: - Option A
Explanation: - A solid shaft of same cross sectional area and of same material as that of a hollow shaft can resist less torque

30. The shafts are designed on the basis of

a. strength and rigidity.

b. ductility.

c. malleablility.

d. resilience.

Answer: - Option A
Explanation: - The shafts are designed on the basis of strength and rigidity

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Question Bank for Multiple Choice Questions

Program: Diploma in Mechanical engineering	**Program Code:- ME**
Scheme:-I	**Semester:- 3**
Course:- Strength of Materials	**Course Code:- 22306**

06 – DIRECT AND BENDING STRESSES	**Marks:-10**
Content of Chapter:- 6.1 Axial and eccentric load, effects of eccentricity, field case(Hook, clamp, Bench Vice, Frame etc.) 6.2 Axial stress and bending stress, resultant stress intensities, resultant stress variation (Eccentricity about one axis only) 6.3 Limiting eccentricity, core section 6.4 No tension condition	

1. Which stress comes when there is an eccentric load applied?
a) Shear stress
b) Bending stress
c) Tensile stress
d) Thermal stress

Answer: - Option B
Explanation:- When there is an eccentric load it means that the load is at some distance from the axis. This causes compression in one side and tension on the other. This causes bending stress.

2. 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

Answer: - Option A
Explanation:- The bending equation is given by M/I = σ/y = E/R
where
M is the bending moment
I is the moment of inertia
y is the distance from neutral axis
E is the modulus of elasticity
R is the radius.

3. 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

Answer: - Option B
Explanation:- When a beam is in bending the layer in the direction of bending will be In compression and the other will be in tension. One side of the neutral axis will be shortened and the other will be elongated.

4. 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

Answer: - Option A
Explanation:- From the bending equation M/I = σ/y = E/R Here stress is directly proportional to the distance of layer from the neutral layer.

5. Eccentrically loaded structures have to be designed for _____
a) Uniaxial force
b) Biaxial force
c) Combined axial force
d) Combined biaxial force

Answer: - Option C
Explanation:- When the line of action of the resultant compressive force doesn't coincide with the centre of gravity of the cross section of the structure, it is called eccentrically loaded structure. They have to be designed for combined axial force.

6. Unsymmetrical bending occurs due to _____
a) The Beam cross section is unsymmetrical
b) The shear Centre does not coincide with the neutral axis
c) The Beam is subjected to trust in addition to bending moment
d) The bending moment diagram is unsymmetrical

Answer: - Option D
Explanation:- If the bending moment diagram of a beam seems to unsymmetrical, then with respect to that diagram, the bending is said to be unsymmetrical bending.

7. The maximum stress under bending and axial loading is
(a) $\sigma_b + \sigma_a$
(b) $\sigma_b - \sigma_a$
(c) $\sigma_b + \sigma_b$

(d) None

Answer: - Option A
Explanation:- The maximum stress under bending and axial loading is $=\sigma_b + \sigma_a$

8. The minimum stress under bending and axial loading is

(a) $\sigma_b + \sigma_a$
(b) $\sigma_b - \sigma_a$
(c) $\sigma_b + \sigma_b$

(d) None

Answer: - Option B
Explanation:- The minimum stress under bending and axial loading is $=\sigma_b - \sigma_a$

9. When $\sigma_b > \sigma_a$, the neural axis will lie

(a) Within the cross section

(b) Outside the cross section

(c) On the outer edge of the cross section

(d) None

Answer: - Option A
Explanation:- When $\sigma_b > \sigma_a$, the neural axis will lie Within the cross section.

10. When $\sigma_b = \sigma_a$, the neural axis will lie

(a) Within the cross section

(b) Outside the cross section

(c) On the outer edge of the cross section

(d) None

Answer: - Option C
Explanation:- When $\sigma_b = \sigma_a$, the neural axis will lie On the outer edge of the cross section.

11. When $\sigma_b < \sigma_a$, the neural axis will lie

(a) Within the cross section

(b) Outside the cross section

(c) On the outer edge of the cross section

(d) None

Answer: - Option C
Explanation:- When $\sigma_b < \sigma_a$, the neural axis will lie On the outer edge of the cross section.

12. When eccentricity (e) is about two axis (e_1 and e_2), then the maximum stress in the section is

(a) $\sigma_{be1} + \sigma_{be2} + \sigma_a$

(b) $\sigma_{be1} — \sigma_{be2} + \sigma_a$

(c) $\sigma_{be1} + \sigma_{be2} — \sigma_a$

(d) None

Answer: - Option A
Explanation:- When eccentricity (e) is about two axis (e_1 and e_2), then the maximum stress in the section is **$\sigma_{be1} + \sigma_{be2} + \sigma_a$.**

13. For zero tensile stress under eccentric loading in a beam of rectangular cross section, the rule applicable is

(a) Middle Quarter Rule

(b) Middle Third Rule

(c) Middle Quarter as well as Middle Third Rule

(d) None

Answer: - Option B
Explanation:- For zero tensile stress under eccentric loading in a beam of rectangular cross section, the rule applicable is Middle Third Rule.

14. For zero tensile stress under eccentric loading in a beam of circular cross section, the rule applicable is

(a) Middle Quarter Rule

(b) Middle Third Rule

(c) Middle Quarter as well as Middle Third Rule

(d) None

Answer: - Option A
Explanation:- For zero tensile stress under eccentric loading in a beam of circular cross section, the rule applicable is Middle Quarter Rule.

15. The name of the area of a beam in which eccentricity lies is

(a) Quarter area

(b) Middle area

(c) Kernel Area

(d) None

Answer: - Option C
Explanation:- The name of the area of a beam in which eccentricity lies is Kernel Area.

16. An industrial brick chimney is a case of combined axial and bending loading, the failure will occur due to

(a) Tensile stress

(b) Compressive stress

(c) hear stress

(d) None

Answer: - Option A
Explanation:- An industrial brick chimney is a case of combined axial and bending loading, the failure will occur due to Tensile stress.

17. An industrial Mild Steel chimney is a case of combined axial and bending loading, the failure will occur due to

(a) Tensile stress

(b) Compressive stress

(c) hear stress

(d) None

Answer: - Option B
Explanation:- An industrial Mild Steel chimney is a case of combined axial and bending loading, the failure will occur due to Compressive stress.

18. Middle third rule applies to a beam with eccentric loading of

(a) Circular section'

(b) Elliptical section

(c) Triangular section

(d) None

Answer: - Option D
Explanation:- Middle third rule applies to a beam with eccentric loading of Rectangular Section.

19. Middle Quarter rule applies to a beam of

(a) Circular section'

(b) Elliptical section

(c) Triangular section

(d) None

Answer: - Option D
Explanation:- Middle Quarter rule applies to a beam with eccentric loading of Circular section'**.**

20. Where is the beam under combined axial and bending loading

(a) Building beam
(b) Chimney
(c) Bridge beam
(d) None

Answer: - Option B

Explanation:- Chimney is the beam under combined axial and bending loading.

21. Bending of a short column under axial compressive load will occur due to

(a) Transverse load
(b) Axial load
(c) Torsion load
(d) None

Answer: - Option A

Explanation:- Bending of a short column under axial compressive load will occur due to *Transverse load.*

22. For no tension, middle third rule applies to

(a) Circular section
(b) Triangular section
(c) Rectangular section
(d) None

Answer: - Option C

Explanation:- For no tension, middle third rule applies to Rectangular section.

23. For no tension, middle quarter rule applies to a

(a) Circular section
(b) Triangular section
(c) Rectangular section
(d) None

Answer: - Option A

Explanation:- For no tension, middle quarter rule applies to Rectangular section.

24. The one side of the kernel section of a rectangular section for no tension is
(a) $(1/4)\ (b2 + h2)^{0.5}$
(b) $(1/8)\ (b2 + h2)^{0.5}$
(c) $(1/6)\ (b2 + h2)^{0.5}$
(d) None

Answer: - Option C
Explanation:- The one side of the kernel section of a rectangular section for no tension is $(1/6)\ (b2 + h2)^{0.5}$

25. The radius of the kernel section of a circular section for no tension is

(a) d/4
(b) d/6
(c) d/8
(d) None

Answer: - Option C

Explanation:- The radius of the kernel section of a circular section for no tension is d/8.

26. Eccentric load causes

(a) Only bending stress
(b) Only normal stress
(c) Bending and normal stress
(d) None

Answer: - Option C
Explanation:-Due to Eccentric load causes

27. A dam under axial and transverse load is a case of

(a) Buckling

(b) Eccentric loading

(c) Bending

(d) None

Answer: - Option B
Explanation:- A dam under axial and transverse load is a case of Eccentric loading.

28. Bending occurs due to the application of

(a) Axial load
(b) Transverse load
(c) Torsional load
(d) None

Answer: - Option B
Explanation:- Bending occurs due to the application of Transverse load.

29. Bending stresses in a beam are maximum at the
(a) Centroid axis
(b) Extreme fibers
(c) Geometric axis
(d) None
Answer: - Option B
Explanation:- Bending stresses in a beam are maximum at the *Extreme fibers.*

30. Bending stresses in a beam is zero at the
(a) Centroid axis
(b) Extreme fibers
(c) Geometric axis
(d) None
Answer: - Option A
Explanation:- Bending stresses in a beam is zero at the *Centroid axis.*

31. Variation of bending stresses in a beam have
(a) Parabolic variation
(b) Linear variation
(c) Cubical variation
(d) None
Answer: - Option B
Explanation:- . Variation of bending stresses in a beam have *Linear variation.*

32 Bending stress will be least at the extreme fibers for
(a) Maximum area of cross section
(b) Maximum moment of inertia
(c) Maximum section modulus
(d) None
Answer: - Option C
Explanation:- . Bending stress will be least at the extreme fibers for *Maximum section modulus*

33. Moment of resistance of a beam should be

(a) Greater than the bending moment
(b) Less than the bending moment
(c) Two times the bending moment
(d) None
Answer: - Option A
Explanation:- Moment of resistance of a beam should be Greater than the bending moment.

34. Bending stress is
   e. Tensile
   f. Compressive
   g. Tensile + Compressive
   h. None

Answer: - Option C
Explanation:- Bending stress is Tensile + Compressive

35. In beam bending, Young's modulus in tension is
   e. > than Young's modulus in compression
   f. < than Young's modulus in compression
   g. = Young's modulus in compression
   h. None
Answer: - Option C
Explanation:- In beam bending, Young's modulus in tension is equal to Young's modulus in compression.

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