Q 1. If $u = x^2 - y^2$, then the conjugate harmonic function is

(a) $2xy$

(b) $x^2 + y^2$

(c) $y^2 - x^2$

(d) $-2xy$

Q 2. The solution of the differential equation $x\frac{dy}{dx} - y = 3$ represents a family of

(a) Straight lines

(b) Circles

(c) Parabolas

(d) Ellipses

Q 3. If $A = \begin{bmatrix} 8 & 5 \\ 7 & 6 \end{bmatrix}$ then the value of $|A^{121} - A^{120}|$ is

(a) 1

(b) 0

(c) 120

(d) 121

Q 4. The value of $\lim_{x\to\infty}\left(\frac{1}{x} - \frac{1}{sinx}\right)$

(a) $\frac{1}{2}$

(b)1

(c) 0

(d) Infinite

Q 5. For the vectors $\vec{V} = 2yz\hat{\imath} + 3xz\hat{\jmath} + 4xy\hat{k}$, the value of $\nabla.(\nabla \times \vec{V})$ is

(a) 1

(b)3

(c) 0

(d)-1

Q 6. The value of k for which the function $f(x) = \begin{cases} ke^{-3x}, & x > 0 \\ 0, & elsewhere \end{cases}$ is the probability density function, is

(a) 1

(b) 3

(c) 1/3

(d) 2

Q 7. If 35 is removed from the data 30, 34, 35, 36, 37, 38, 39, 40 then median increases by

(a) 2

(b) 1

(c) 0.8

(d) 0.5

Q 8. If a random variable X satisfies the Poisson distribution with mean 3, then the probability that $X \geq 2$ is

(a) $1\text{-}e^{-3}$

(b) 4 e-3

(c) $1+4e^{-3}$

(d) $1\text{-}4e^{-3}$

Q 9. The unit normal to the surface $x^2 + y^2 + z^2 = 48$ at the point (4, 4, 4) is

(a) $\frac{1}{\sqrt{5}}, \frac{1}{\sqrt{5}}, \frac{1}{\sqrt{5}}$

(b) $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

(c) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$

(d) $\frac{1}{\sqrt{7}}, \frac{1}{\sqrt{7}}, \frac{1}{\sqrt{7}}$

Q 10. Which of the following is true regarding the function $f(x) = x^3 - 6x^2 + 12x - 18$?

(a) f(x) is an increasing function on R

(b) f(x) is a decreasing function on R

(c) f(x) is neither increasing nor decreasing function on R

(d) None of the above

Q 11. A cylindrical elastic body subjected to pure torsion about its axis develops

(a) tensile stress in a direction 45° to the axis

(b) no tensile or compressive stress

(c) maximum shear stress along the axis of the shaft

(d) maximum shear stress at 45° to the axis

Q 12. The three-dimensional state of stress at a point is given by

$$[\sigma] = \begin{bmatrix} 30 & 10 & -10 \\ 10 & 0 & 20 \\ -10 & 20 & 0 \end{bmatrix} \text{MN/m}^2$$

The shear stress in the x-y plane at the same point is then equal to

(a) zero MN/m^2 (b) -10 MN/m^2

(c) 10 MN/m^2 (d) 20 MN/m^2

Q 13. A rod of length L and diameter D is subjected to a tensile load P. Which of the following is sufficient to calculate the resulting change in diameter?

(a) Young's modulus

(b) Shear modulus

(c) Poisson's ratio

(d) Both Young's modulus and shear modulus

Q 14. In terms of Poisson's ratio (μ) the ratio of Young's modulus (E) and shear modulus (G) of elastic material is

(a) $2(1+\mu)$ (b) $2(1-\mu)$

(c) $\frac{1}{2}(1+\mu)$ (d) $\frac{1}{2}(1-\mu)$

Q 15. A thin cylinder of inner radius 500 mm and thickness 10 mm subjected to an internal pressure of 5 MPa. The average circumferential (hoop) stress in MPa is

(a) 100

(b) 250

(c) 500

(d) 1000

Q 16. A long thin walled cylindrical shell, closed at both the ends, is subjected to an internal pressure. The ratio of the hoop stress (circumferential stress) to longitudinal stress developed in the shell is

(a) 0.5

(b) 1.0

(c) 2.0

(d) 4.0

Q 17. For a simply supported beam on two end supports, the Bending moment is maximum

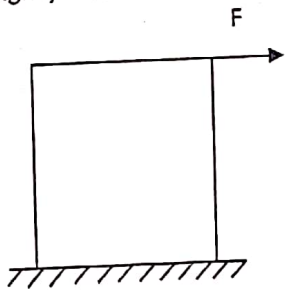
(a) usually on the supports

(b) always at mid span

(c) where there is no shear force

(d) where the deflection is maximum

Q 18. A block of steel is loaded by a tangential force on its top surface while the bottom surface is held rigidly. The deformation of the block is due to



(a) shear only

(b) bending only

(c) shear and bending

(d) torsion

Q 19. The second moment of a circular area about the diameter is given by (D is the diameter)

(a) $\frac{\pi D^4}{4}$ (b) $\frac{\pi D^4}{16}$

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

Q 20. A simply supported laterally loaded beam was found to deflect more than a specified value. Which of the following measures will reduce deflection?

(a) Increase the moment of inertia

(b) Increase the span of the beam

(c) Select a different material having lesser modulus of elasticity

(d) Magnitude of the load to be increased

Q 21. An axial residual compressive stress due to a manufacturing process is present on the outer surface of a rotating shaft subjected to bending. Under a given bending load, the fatigue life of the shaft in the presence of the residual compressive stress is

(a) decreased

(b) increased or decreased, depending on the external bending load

(c) neither decreased nor increased

(d) increased

Q 22. A cantilever beam of length L is subjected to a moment M at the free end. The moment of inertia of the beam cross section about the neutral axis is I and the Young's modulus is E. The magnitude of the maximum deflection is

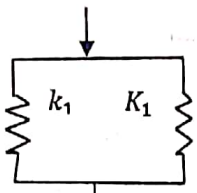
(a) $\frac{ML^2}{2EI}$ (b) $\frac{ML^2}{EI}$

(c) $\frac{2ML^2}{EI}$ (d) $\frac{4ML^2}{EI}$

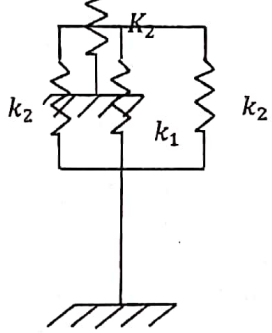
Q 23. The figure shows arrangement of springs. They have stuffiness K_1 and K_2 as marked. Which of the following arrangements offers a stiffness = $\frac{2K_1k_2}{K_1+2K_2}$

(a)

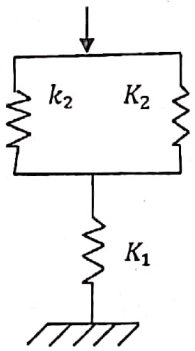
(b)



(c)



(d)



Q 24. If the length of a Column is doubled, the critical load becomes

(a) $\frac{1}{2}$ of the original value

(*b*) $\frac{1}{4}$ of the original value

(c) $\frac{1}{8}$ of the original value

(d) $\frac{1}{16}$ of the original value

Q 25. Critical damping is

(a) Largest amount of damping for which no oscillation occurs in free vibration
(b) Smallest amount of damping for which no oscillation occurs in free vibration
(c) Largest amount of damping for which the motion is simple harmonic in free vibration
(d) Smallest amount of damping for which the motion is simple harmonic in free vibration

Q 26. In the design of shafts made of ductile materials subjected to twisting moment and bending moment, the recommended theory of failure is

(a) maximum principal stress theory
(b) maximum principal strain theory
(c) maximum shear stress theory
(d) maximum strain-energy theory

Q 27.Torque to weight ratio for a circular shaft transmitting power is directly proportional to the

(a) square root of the diameter
(b) diameter
(c) square of the diameter
(d) cube of the diameter

Q 28. Stress concentration in a machine component of a ductile material is not so harmful as it is in a brittle material because

(a) in ductile material local yielding may distribute stress concentration

(b) ductile material has larger young's modulus

(c) Possion ratio is larger in ductile materials

(d) Modulus of rigidity is larger in ductile materials

Q 29. The process of shot peening increases the fatigue life of steel springs mainly because it result in

(a) surface hardening

(b) increased stiffness of the material

(c) structural changes in the material

(d) residual compression at the surface

Q 30. Weldments in fabricated steel beams are designed for

(a) bending stresses at the flange

(b) shear stresses in transverse plane

(c) combination of bending and shear

(d) None of these because in fabricated beams welds not to get stressed

Q 31. The bolts in a rigid flanged coupling connecting two shafts transmitting power are subjected to

(a) shear force and bending moment

(b) axial force

(c) torsion

(d) torsion and bending moment

Q 32. Bolts in the flanged end of pressure vessel are usually pre-tensioned. Indicate which of the following statements is true

(a) Pre-tensioning helps to seal the pressure vessel

(b) Pre-tensioning increase the fatigue life of the bolts

(c) Pre- tensioning reduces the maximum tensile stress in the bolts

(d) Pre- tensioning helps to reduce the effect of pressure pulsations in the pressure vessels.

Q 33. Starting friction is low in

(a) hydrostatic lubrication

(b) hydrodynamic lubrication

(c) mixed (or semi fluid) lubrication

(d) boundary lubrication

Q 34. A solid circular shaft needs to be designed to transmit a torque of 50 N.m. If the allowable shear stress of the material is 140 MPa, assuming a factor of safety of 2, minimum allowable design diameter in mm is

(a) 8 (b) 16

(c) 24 (d) 34

Q 35. A wire rope is designated as 6 × 19 standard hoisting. The number 6 × 19 represent

(a) diameter in millimetre × length in meter

(b) diameter in centimetre × length in meter

(c) number of strands × number of wires in each strand

(d) number of wires in each strand × number of strands

Q 36. A static fluid can have

(a) Non-zero normal and shear stress

(b) Negative normal stress and zero shear stress

(c) Positive normal stress and zero shear stress

(d) Zero normal stress and non-zero shear stress

Q 37. For the stability of a floating body, under the influence of gravity alone, which of the following is TRUE?

(a) Metacenter should be below centre of gravity.

(b) Metaceter should be above centre of gravity.

(c) Metacenter and centre of gravity must lie on the same horizontal line.

(d) Metacenter and centre of gravity must lie on the same vertical line.

Q 38. A Fluid is said to be Newtonian fluid when the shear stress is

(a) directly proportional to the velocity gradient

(b) inversely proportional to the velocity gradient

(c) independent of the velocity gradient

(d) None of these

Q 39. The SI unit of kinematic viscosity (v) is

(a) m^2/sec (b) kg/m-sec

(c) m/sec^2 (d) m^3/sec^2

Q 40. A streamlined body is defined as a body about which

(a) The flow is laminar

(b) The flow is along the streamlines

(c) The flow separation is suppressed

(d) The drag is zero

Q 41. Streamlines, path lines and streak lines are virtually identical for

(a) Uniform flow

(b) Flow of ideal fluids

(c) Steady flow

(d) Nonuniform flow

Q 42. In a flow field the stream lines and equipotential lines

(a) Are parallel

(b) Cut at any angle

(c) Are orthogonal everywhere in the field

(d) Cut orthogonal except at the stagnation points

Q 43. Naiver Stoke's equation represents the conservation of

(a) Energy (b) Mass

(c) Pressure (d) Momentum

Q 44. A steamline and an equipotential line in a flow field

(a) are parallel to each other

(b) are perpendicular to each other

(c) intersect at an acute angle

(d) are identical

Q 45. When wet steam flows through a throttle valve and remains wet at exit

(a) Its temperature and quality increases
(b) Its temperature decreases but quality increases
(c) Its temperature increases but quality decreases
(d) Its temperature and quality decreases

Q 46. For casting of turbine blades made of high temperature and high strength alloys, the most suitable process is

(a) Die casting
(b) Investment casting
(c) Centrifugal casting

(d) Slush casting

Q 47. In DC welding, straight polarity (electrode negative) results in

(a) Lower penetration
(b) Lower deposition rate
(c) Less heating of work piece
(d) Smaller weld pool

Q 48. High alloy steels components are preheated before welding for reducing

(a) Heat affected zone
(b) Total energy consumption
(c) Welding time
(d) Welding stresses

Q 49. In welding process, penetration is increased by

(a) Increasing current and decreasing speed
(b) Decreasing both current and speed
(c) Increasing both arc voltage and speed
(d) Increasing arc voltage and decreasing current

Q 50. The size of BUE in metal cutting increases with

(a) Very high speed
(b) Large uncut chip thickness
(c) Use of cutting fluid
(d) Increase in positive rake angle

Answer Key (Mechanical)

Q No.	Answer	Q. No.	Answer
1	A	26	C
2	A	27	B
3	B	28	A
4	C	29	D
5	C	30	C
6	B	31	D
7	D	32	A
8	D	33	A
9	B	34	B
10	A	35	C
11	A	36	C
12	C	37	B
13	D	38	A
14	C	39	A
15	B	40	C
16	C	41	C
17	C	42	C
18	C	43	D
19	D	44	B
20	A	45	B
21	D	46	B
22	A	47	B
23	D	48	D
24	B	49	A
25	B	50	B