APPSC & AEE – 2012
COMMON FOR CIVIL & MECHANICAL ENGG. (Paper – II)

01. Reynolds number which quantifies the role of viscous effect expressed as

(1) $\frac{V}{\sqrt{gd}}$ (2) $\frac{\rho Vd}{\mu}$ (3) $\frac{\rho V^2 L}{\sigma}$ (4) $V\sqrt{\frac{\rho}{E}}$

Ans: (2)

02. The lower limit of the critical Reynolds number below which all disturbances in pipe flow are damped out by viscous action has a value approximately equal to

(1) 1 (2) 500 (3) 1000 (4) 2000

Ans: (4)

03. The shear stress distribution in pipe flow is expressed by

(1) $\tau = \frac{1}{r}\left(\frac{dp}{dx}\right)$ (2) $\tau = -\left(\frac{dp}{dx}\right)\frac{r}{2}$ (3) $\tau = -2r\left(\frac{dp}{dx}\right)$ (4) $\tau = \frac{r^2}{L}\left(\frac{dp}{dx}\right)$

Ans: (2)

04. The Hagen – Poiseuille equation which governs the velocity distribution in laminar flow through pipes may be expressed as

(1) $\phi = \frac{\pi d^4 \Delta p}{128\mu L}$ (2) $\phi = \frac{\pi d^2 \Delta p}{128\mu L}$ (3) $\phi = \frac{128\mu L}{\pi d^2 \Delta p}$ (4) $\phi = \frac{128\mu L}{\pi d^4 \Delta p}$

Ans: (1)

05. The pressure drop per unit length of pipe in laminar flow is equal to

(1) $\frac{d^2}{32\mu V}$ (2) $\frac{32\mu VL}{\gamma d^2}$ (3) $\frac{32\mu V}{d^2}$ (4) $\frac{8\mu V}{d^2}$

Ans: (3)

06. In laminar flow through a circular tube, the Darcy – Weisbach friction is related to the Reynolds number by

(1) $f = \left(\frac{1}{R}\right)$ (2) $f = \left(\frac{16}{R}\right)$ (3) $f = \left(\frac{64}{R}\right)$ (4) $f = \left(\frac{0.316}{R^{1/4}}\right)$

Ans: (3)

07. The discharge in (m^3/s) for laminar flow through a pipe of diameter 0.04 m bearing a centerline velocity of 1.5 m/s is

(1) $\frac{3\pi}{59}$ (2) $\frac{3\pi}{2500}$ (3) $\frac{3\pi}{5000}$ (4) $\frac{3\pi}{10000}$

Ans: (4)

08. The most essential feature of a turbulent flow is

(1) large discharge
(2) High velocity
(3) velocity and pressure at a point exhibit irregular fluctuations of high frequency
(4) velocity at a point remains constant with time

Ans: (3)

09. The velocity distribution in turbulent flow follows a
(1) parabolic law (2) logarithmic law (3) linear law (4) hyperbolic law
Ans: (2)

10. Steel and cast iron pipes carrying fluid under pressure are regarded as hydraulically smooth when
(1) the boundary surface is relatively smooth
(2) the roughness projections are of low height
(3) the roughness elements are completely covered by the laminar sub-layer
(4) the laminar layer is thin as compared to the average height of roughness elements
Ans: (3)

11. The Darcy – Weisbach friction factor 'f' which is a direct measure of resistance to flow in pipes is dependant on
(1) roughness height, diameter and velocity
(2) relative roughness, diameter and viscosity
(3) relative roughness, velocity and viscosity
(4) relative height, diameter, velocity and kinematic viscosity
Ans: (4)

12. The parameters which determine the friction factor for turbulent flow in a rough pipe are
(1) Froude number and relative roughness
(2) Froude number and Mach number
(3) Reynolds number and relative roughness
(4) Mach number and relative roughness
Ans: (3)

13. In case of turbulent flow of a fluid through a circular tube, as compared to the case of laminar flow, at the same flow, rate, the maximum velocity is __________, shear stress at the wall is __________, and the pressure drop across a given length is________.
(1) higher, higher, higher (2) higher, lower, lower
(3) lower, higher, higher (3) lower, higher, lower
Ans: (3)

14. The hydraulic efficiency of an impulse turbine is maximum, when the velocity of wheel is ______ that of the jet velocity.
(1) one-fourth (2) one-half (3) three-fourth (4) double
Ans: (2)

15. The number of buckets on the periphery of a Pelton wheel is given by
(1) $\frac{D}{2d}+5$ (2) $\frac{D}{2d}+10$ (3) $\frac{D}{2d}+15$ (4) $\frac{D}{2d}+20$
Ans: (3)

16. In a reaction turbine, the draft tube is used
(1) to run the turbine full (2) to prevent air to enter the turbine
(3) to increase the effective head of water (4) to transport water to downstream
Ans: (3)

17. In an inward flow reaction turbine
    (1) the water flows parallel to the axis of the wheel
    (2) the water enters at the centre of the wheel and from there flows towards the outer periphery of the wheel
    (3) the water enters the wheel at outer periphery, and then flows towards the centre of the wheel
    (4) the flow of water is partly radial and partly axial

Ans: (3)

18. In a Kaplan turbine runner, the number of blades are generally
    (1) 2 to 4 (2) 4 to 8 (3) 8 to 16 (4) 16 to 24

Ans: (2)

19. The power developed by a turbine is
    (1) Directly proportional to $H^{1/2}$ (2) Inversely proportional to $H^{1/2}$
    (3) Directly proportional to $H^{3/2}$ (4) Inversely proportional to $H^{3/2}$

Ans: (3)

20. The specific speed of a turbine is given by
    (1) $\frac{N\sqrt{P}}{H^{3/2}}$ (2) $\frac{N\sqrt{P}}{H^{5/4}}$ (3) $\frac{N\sqrt{P}}{H^{2}}$ (4) $\frac{N\sqrt{P}}{H^{3}}$

Ans: (2)

21. The turbine to be used for 450 m head of water is
    (1) Pelton wheel (2) Francis turbine (3) Kaplan turbine (4) None of these

Ans: (1)

22. The cavitation in a hydraulic machine
    (1) causes noise and vibration of various parts (2) makes the surface rough
    (3) reduces the discharge of a turbine (4) causes sudden drop in power output and efficiency

Ans: (1)

23. The specific speed of a turbine is speed of an imaginary turbine, identical with the given turbine, which
    (1) delivers unit discharge under unit load
    (2) delivers unit discharge under unit speed
    (3) develops unit H.P. under unit head
    (4) develops unit H.P. under unit speed

Ans: (3)

24. In a centrifugal pump the liquid enters the pump
    (1) at the centre (2) at the top (3) at the bottom (4) from sides

Ans: (1)

25. Multistage centrifugal pumps are used to
(1) give high discharge
(2) pump viscous fluids
(3) produce high heads
(4) None of these

Ans: (3)

26. Theoretical power required to drive a reciprocal pump is
(1) $\frac{WQH_s}{60}$
(2) $\frac{WQH_s}{75}$
(3) $\frac{WQH_d}{60}$
(4) $\frac{270}{\pi}$

Ans: (4)

27. The specific speed of a centrifugal pump is given by
(1) $\frac{N\sqrt{Q}}{H^{2/3}}$
(2) $\frac{N\sqrt{Q}}{H}$
(3) $\frac{N\sqrt{Q}}{H^{3/4}}$
(4) $\frac{N\sqrt{Q}}{H^{5/4}}$

Ans: (3)

28. For centrifugal pump impeller, the maximum value of the vane exit angle is
(1) 10^o to 15^o
(2) 15^o to 20^o
(3) 20^o to 25^o
(4) 25^o to 30^o

Ans: (4)

29. Which of the following pumps is preferred for flood control and irrigation applications?
(1) Centrifugal pump
(2) Mixed flow pump
(3) Axial flow pump
(4) Reciprocating pump

Ans: (3)

30. In order to avoid cavitation in centrifugal pumps
(1) the suction pressure should be high
(2) the delivery pressure should be high
(3) the suction pressure should be low
(4) the delivery pressure should be low

Ans: (3)

31. In a propped cantilever beam, the number of points of contraflexure is
(1) 1
(2) 2
(3) 3
(4) 4

Ans: (1)

32. A fixed beam 'AB' 6 m long carries a vertical load 90kN at 2 m from 'A'. The fixed end moments at 'A' and 'B' are
(1) 40 kN-m, 80 kN-m
(2) 40 kN-m, 120 kN-m
(3) 80 kN-m, 40 kN-m
(4) 120 kN-m, 80 kN-m

Ans: (3)

33. In a fixed beam, at the fixed ends
(1) slope is zero and deflection is maximum
(2) slope is maximum and deflection is zero
(3) both slope and deflection are maximum
(4) slope and deflection are zero

Ans: (4)

34. If a fixed beam is subjected to a point load at mid span, total number of points of contraflexure are
(1) 1 (2) 2 (3) 3 (4) zero
Ans: (2)

35. A beam of length, *l*, fixed at both ends carries a uniformly distributed load of w per unit length. If EI is the flexural rigidity, then the maximum deflection in the beam is
(1) $\frac{wl^4}{192EI}$ (2) $\frac{wl^4}{24EI}$ (3) $\frac{wl^4}{384EI}$ (4) $\frac{wl^4}{12EI}$
Ans: (3)

36. Slenderness ratio of a column may be defined as the ratio of its effective length to the
(1) radius of column (2) minimum radius of gyration
(3) maximum radius of gyration (4) area of the cross-section
Ans: (2)

37. The crippling load of a column with one end fixed and other end hinged is
(1) $\sqrt{2}$ times that of a both ends hinged column
(2) Two times that of a both ends hinged column
(3) Four times that of a both ends hinged column
(4) Eight times that of a both ends hinged column
Ans: (2)

38. The formula given by I.S. code in calculating allowable stress for the design of eccentrically loaded columns is based on
(1) Johnson's parabolic formula (2) Straight line formula
(3) Perry's formula (4) Secant formula
Ans: (3)

39. The Rankine constant (a) in Rankine's formula is equal to
(1) $\frac{\pi^2 E}{\sigma_C}$ (2) $\frac{\sigma_C}{\pi^2 E}$ (3) $\frac{\pi^2}{\sigma_C E}$ (4) $\frac{E\sigma_C}{\pi^2}$
Ans: (2)

40. When both ends of the column are pinned, then the formula for crippling load (P) is equal to
(1) $P=\frac{\pi^2 EI}{l^2}$ (2) $P=\frac{4\pi^2 EI}{l^2}$ (3) $P=\frac{2\pi^2 EI}{l^2}$ (4) $P=\frac{\pi^2 EI}{l^2}$
Ans: (1)

41. In Rankine's formula, the material constant for mild steel is
(1) $\frac{1}{9000}$ (2) $\frac{1}{5000}$ (3) $\frac{1}{1600}$ (4) $\frac{1}{7500}$
Ans: (4)

42. If the flexural rigidity of the column is doubled, then the strength of the column is increased by
(1) 16 (2) 8 (3) 2 (4) 4
Ans: (3)

43. The diameter of the core for no tension in a column of diameter 120 mm is
(1) 30 mm (2) 15 mm (3) 40 mm (5) 20 mm
Ans: (1)

44. The least radius of gyration for solid circular column is
(1) d (2) $\frac{d}{2}$ (3) $\frac{d}{4}$ (4) $\frac{d}{3}$
Ans: (3)

45. In a mild steel tube 4 m long, the flexural rigidity of the tube is 1.2×10^{10} N-m^2. The tube is used as a strut with both ends hinged. The crippling load kN is given by
(1) 14.80 (2) 7.40 (3) 29.60 (4) 1.85
Ans: (2)

46. The ratio of pressures between two points X and Y located respectively at depths of 0.5 m and 8 m below water level in a tank is
(1) $1:\sqrt{2}$ (2) 1:2 (3) 1:8 (4) 1:16
Ans: (4)

47. The hydrostatic pressure in kgf exerted on one side of an annular area enclosed by concentric circles of radii 2 m and 1 m, and having its centroid 4 m below water surface is
(1) 10000 π (2) 11000 π (3) 12000 π (4) 24000 π
Ans: (3)

48. The depth of the centre of pressure of a vertical semi-circular plane of diameter 'd' submerged in a liquid, with diameter located at the free surface is
(1) $\frac{\pi d}{12}$ (2) $\frac{\pi d}{32}$ (3) $\frac{\pi d}{64}$ (4) $\frac{3\pi d}{32}$
Ans: (4)

49. A vertical rectangular plane surface is submerged in water with its top surface and bottom surface at 1.5 m and 6.0 m below the free water surface. The depth of centre of pressure below the free water surface is
(1) 4.0 m (2) 4.5 m (3) 4.375 m (4) 4.2 m
Ans: (4)

50. In an inclined plane submerged in water, the centre of pressure is located
(1) at the centroid (2) below the centroid
(3) above the cetnroid (4) anywhere in the plane
Ans: (2)

51. When a body floating in a liquid is given a small angular displacement, it stands oscillating about a point known as
(1) centre of pressure (2) centre of gravity
(3) centre of buoyancy (4) matacentre
Ans: (4)

52. A vertical triangular plane area, submerged in water, with on e side coinciding the free surface, vertex downward, with altitude, 'h', has the centre of pressure below the free surface by

(1) $\frac{h}{4}$ (2) $\frac{h}{3}$ (3) $\frac{2h}{3}$ (4) $\frac{h}{4}$

Ans: (4)

53. A vertical wall is subjected to a pressure due to a liquid on one of its sides. The total pressure on the wall per unit length is

(1) wH (2) $\frac{wH^2}{2}$ (3) $\frac{wH}{2}$ (4) $\frac{wH^2}{3}$

Ans: (2)

54. A vertical gate closes a horizontal tunnel 5 m high and 3 m wide running full with water. The pressure at the bottom of the gate is 196.2 kN/m^2. The total pressure on the gate is

(1) 2.0 MN (2) 2.575 MN (3) 5.525 MN (4) 1.75 MN

Ans: (2)

55. A body floating in a liquid is said to be in neutral equilibrium, if its metacentre

(1) coincides with its centre of gravity
(2) lies above its centre gravity
(3) lies below its centre of gravity
(4) lies below the centre of buoyancy and centre of gravity

Ans: (1)

56. A flow whose stream line is represented by a curve is called

(1) one dimensional flow (2) two dimensional flow
(3) three dimensional flow (4) four dimensional flow

Ans: (2)

57. The Bernoulli constants for points lying on the same stream line and those which lie on other stream lines will have the same value, if the flow is

(1) incompressible (2) steady (3) irrotational (4) uniform

Ans: (3)

58. The Bernoulli's equation written in conventional form represents total energy per unit of a certain quantity. Identify this quantify.

(1) energy per unit volume (2) energy per unit mass
(2) energy per unit weight (3) energy per unit specific weight

Ans: (3)

59. The total energy line is always higher than the hydraulic grade line, and the vertical distance between the two represents

(1) the datum head (2) the pressure head
(3) the velocity head (4) the piezometric head

Ans: (3)

60. The total energy represented by the Bernoulli's equation $\left(\frac{v^2}{2g}+\frac{p}{\gamma}+z\right)$ has the units

(1) N-m/m (2) N-m/N (3) N-m^2/s (4) N-m/s

Ans: (2)

61. In a double overhanging beam carrying udl throughout its length, the number of points of contra flexure are

(1) 1 (2) 2 (3) zero (4) 3

Ans: (2)

62. A beam ABCD is simply supported at B and C. The simply supported span BC=l. The overhangs are each 'a'. If the beam carries a udl of w/metre over the entire length, the maximum BM at the centre is

(1) $\frac{w\ell^2}{8}-\frac{wa^2}{4}$ (2) $\frac{wa^2}{4}$ (3) $\frac{wa^2}{2}$ (4) $\frac{wl^2}{8}-\frac{wa^2}{2}$

Ans: (3)

63. Rate of change of shear force is equal to

(1) Bending moment (2) Intensity of loading
(3) Maximum deflection (4) Slope

Ans: (2)

64. A cantilever is subjected to udl throughout the length. If the maximum shear force is 200kN and maximum bending moment is 400kN, the span "L" of the beam in metres is

(1) 3 (2) 2 (3) 4 (4) 8

Ans: (3)

65. A cantilever beam AB of length l is subjected to an anticlockwise couple of 'M' at a section C, distance 'a' from support. Then the maximum shear force is equal to

(1) M (2) $\frac{M}{2}$ (3) Zero (4) Ma

Ans: (3)

66. If SFD between two sections varies linearly, BM between these sections varies

(1) linearly (2) parabolically (3) constant (4) None of these

Ans: (2)

67. At section of a beam sudden in BM indicates the action of

(1) point load (2) couple (3) point load or couple (4) udl

Ans: (2)

68. In a double equal overhang beam, for maximum BM to be as small as possible, the supports must be placed at a distance 'x' from the ends of the beam. The value of x is

(1) 0.5*l* (2) 0.207 *l* (3) 0.53 *l* (4) 0.7*l*

Where *l* = span of the beam

Ans: (2)

69. A freely supported beam of span 6m is subjected to a point of 60 kN at mid span. The maximum BM is equal to
(1) 300 kN-m (2) 180 kN-m (3) 90 kN-m (4) 270 kN-m
Ans: (3)

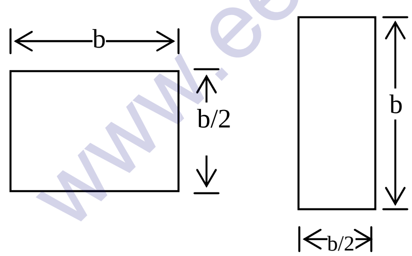
70. If a freely supported beam is subjected to udl throughout the span, the shape of the BMD is
(1) rectangle (2) straight line (3) equilateral triangle (4) parabola
Ans: (4)

71. Section modulus of a beam is defined as
(1) IY (2) $\frac{Y}{I}$ (3) $\frac{I}{Y_{max}}$ (4) Y^2I
Ans: (3)

72. A beam of uniform strength is one which has same
(1) bending moment throughout the section (2) shearing force throughout the section
(3) deflection throughout the beam (4) bending stress at every section
Ans: (4)

73. Neutral axis of a beam is the axis at which
(1) the shear force is zero
(2) the section modulus is zero
(3) the bending stress is maximum
(4) the bending stress is zero
Ans: (4)

74. A beam cross-section is used in two different orientations as shown in figure:



Bending moments applied in both causes are the same. The maximum bending stresses induced in cases (A) and (B) are related as
(1) $\sigma_A = \sigma_B$ (2) $\sigma_A = 2\sigma_B$ (3) $\sigma_A = \frac{\sigma_B}{2}$ (4) $\sigma_A = \frac{\sigma_B}{4}$
Ans: (2)

75. The ratio of flexural strength of a square section with its two sides horizontal to its diagonal horizontal is
(1) $\sqrt{2}$ (2) 2 (3) $2\sqrt{2}$ (4) $\frac{\sqrt{2}}{5}$
Ans: (1)

76. The ratio of maximum shear stress to the average shear stress in case of a rectangular beam is equal to
(1) 1.5 (2) 2.0 (3) 2.5 (4) 3
Ans: (1)

77. The nature of distribution of horizontal shear stress in a rectangular beam is
(1) linear (2) parabolic (3) hyperbolic (4) elliptic
Ans: (1)

78. Section modulus of a circular section about an axis through its centre of gravity is
(1) $\frac{\pi}{32}d^3$ (2) $\frac{\pi}{16}d^3$ (3) $\frac{\pi}{8}d^3$ (4) $\frac{\pi}{64}d^3$
Ans: (1)

79. A steel plate 50mm wide and 100mm thick is to be bent into a circular arc of radius 10m. If $E = 2\times10^5 N/mm^2$, then the maximum bending stress induced will be
(1) $200N/mm^2$ (2) $100\ N/mm^2$ (3) $10{,}000N/mm^2$ (4) $1000\ N/mm^2$
Ans: (1)

80. A beam of square section is placed with one diagonal placed horizontally. The maximum shear stress occurs at
(1) the N.A. (2) $\frac{3}{8}$ d from top (3) $\frac{3}{8}$d from N.A. (4) at the extreme fibres
Where d = depth of the beam
Ans: (2)

81. Torsional rigidity of a shaft is given by
(1) $\frac{T}{\ell}$ (2) $\frac{T}{J}$ (3) $\frac{T}{\theta}$ (4) $\frac{T}{r}$
Ans: (3)

82. Shear stress for a circular shaft due to torque varies
(1) from surface to centre parabolically
(2) from surface to centre linearly
(3) from centre to surface parabolically
(4) from centre to surface linearly
Ans: (4)

83. If two shafts of the same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal
(1) angle of twist (2) polar modulus of section
(3) polar moment of inertia (4) diameter
Ans: (2)

84. A circular shaft subjected to torsion undergoes a twist of 1^0 in a length of 1.2m. If the maximum shear stress induced is 100MPa and the rigidity modulus is 0.8×10^5 MPa, the radius of the shaft in mm should be

(1) $\frac{270}{\pi}$ (2) $\frac{\pi}{270}$ (3) $\frac{180}{\pi}$ (4) $\frac{\pi}{180}$

Ans: (1)

85. Two shafts are of same length and same material. The diameter and maximum shear stress of the second shaft is twice that of the first shaft. Then the ratio of power developed between the first and second shaft is

(1) 16 (2) $\frac{16}{3\sqrt{3}}$ (3) $\frac{1}{16}$ (4) $\frac{3}{16}$

Ans: (3)

86. The differential equation which gives the relation between BM, slope and deflection of a beam is

(1) $EI\frac{d^2y}{dx^2} = \frac{M}{I}$ (2) $\frac{d^2y}{dx^2} = M$

(3) $EI\frac{d^2y}{dx^2} = M$ (4) $EI\frac{dy}{dx} = \frac{M}{F}$

Ans: (3)

87. A rolled steel beam having a span of 4m carries a point load of 20kN at 3m from the left support. If the moment of inertia of the section is 1×10^7 mm^4 and E = $200kN/mm^2$, then the deflection of the beam under the point load is equal to

(1) 25 mm (2) 7.5mm (3) 13.33 mm (4) 50 mm

Ans: (2)

88. A cantilever of length '*l*' carries a udl of w per unit m, over the whole length. If the free end be supported over a rigid prop, the reaction of the prop will be

(1) $\frac{2w\ell}{8}$ (2) $\frac{5w\ell}{8}$ (3) $\frac{3w\ell}{8}$ (4) $\frac{7w\ell}{8}$

Ans: (3)

89. Radius of curvature of the beam is equal to

(1) $\frac{ME}{I}$ (2) $\frac{M}{EI}$ (3) $\frac{EI}{M}$ (4) $\frac{MI}{E}$

Ans: (3)

90. A simply supported beam span 3,m is subjected to a central point load of 5kN, then the slope at the mid span is equal to

(1) $\frac{25}{24EI}$ (2) $\frac{256}{EI}$ (3) $\frac{40}{48EI}$ (4) Zero

Ans: (4)

91. The ratio between the change in volume and original volume of the body is called
(1) tensile strain (2) compressive strain (3) volumetric strain (4) shear strain
Ans: (3)

92. The ratio between tensile stress and tensile strain or compressive stress and compressive strain is termed as
(1) modulus of rigidity (2) modulus of elasticity
(3) bulk modulus (4) modulus of subgrade reaction
Ans: (2)

93. Relation between E, K and C is given by
(1) $E = \frac{3K + C}{6KC}$ (2) $E = \frac{6KC}{K + 3C}$ (3) $E = \frac{3KC}{3K + C}$ (4) $E = \frac{9KC}{3K + C}$
Ans: (4)

94. The elongation of a conical bar due to its self weight is
(1) $\frac{\gamma \ell^2}{6E}$ (2) $\frac{\gamma \ell^2}{2E}$ (3) $\frac{\gamma \ell^2}{2E}$ (4) $\frac{\gamma \ell^2}{E}$
Where γ = unit weight of the material
Ans: (1)

95. Strain in a direction at right angles to the direction of applied force is known as
(1) shear strain (2) lateral strain (3) longitudinal strain (4) volumetric strain
Ans: (2)

96. Factor of safety is defined as the ratio of
(1) $\frac{\text{working stress}}{\text{ultimate stress}}$ (2) $\frac{\text{ultimate load}}{\text{design safe load}}$
(3) $\frac{\text{ultimate stress}}{\text{working stress}}$ (4) $\frac{\text{design safe load}}{\text{ultimate load}}$
Ans: (3)

97. The strain due to a temperature change in a simple bar is
(1) αt (2) α/t (3) t/α (4) $\alpha + t$
Ans: (1)

98. The ratio of total elongation of a bar of uniform cross-section produced under its own weight to the elongation produced by an external load equal to the weight of the bar is
(1) 1 (2) 2 (3) $\frac{1}{2}$ (4) $\frac{1}{4}$
Ans: (3)

99. Two bars A and B are of equal length but B has an area half that of A and bar A has young's modulus double that of B. When a load 'P' is applied to the two bars, the ratio of deformation between A and B is

(1) $\frac{1}{2}$ (2) 1 (3) 2 (4) $\frac{1}{4}$

Ans: (4)

100. The elongation of beam of length '*l*' and cross-sectional area 'A' subjected to a load 'P' is δl. If the modulus of elasticity is halved, the new elongation will be

(1) $\frac{\delta l}{2}$ (2) $2(\delta l)$ (3) δl (4) $\sqrt{2}\delta l$

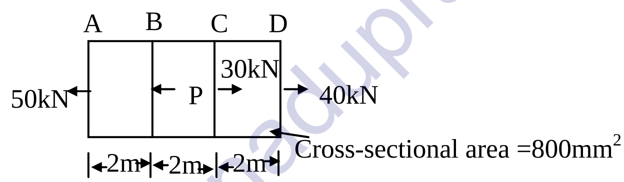
Ans: (2)

101. A 16m diameter central hole is bored out of a steel rod of 40mm diameter and length 1.6m. The tensile strength because of this operation

(1) increases (2) remains constant (3) decreases (4) None of these

Ans: (3)

102. The force P for equilibrium of the bar shown in the figure is



(1) 60kN (2) 40kN (3) 120kN (4) 20kN

Ans: (4)

103. The relationship between Young's modulus and shear modulus when $\frac{1}{m} = 0$, is

(1) E = 2C (2) E = 3C (3) E = 2C+1 (4) C = 2E

Ans: (1)

104. If a rigidly connected bar of steel and copper is coiled, the copper bar will be subjected to

(1) compression (2) shear (3) tension (4) None of these

Ans: (3)

105. The force required to punch a 10mm diameter hole in a mild steel plate 10mm thick, if the shear strength of mild steel is 360MPa is

(1) 9π kN (2) 36πkN (3) 18πkN (4) 2.25kN

Ans: (2)

106. The shear on principal plane is
(1) minimum (2) maximum (3) zero (4) infinity

Ans: (3)

107. If a body carries two unlike principal stresses, the maximum shear stress is given by
(1) sum of the principal stresses
(2) difference of the principal stresses
(3) half the difference of the principal stresses
(4) half the sum of the principal stresses

Ans: (3&4) (Options are vague. Using different logics. The options are 3&4 are correct

108. The radius of Mohr's circle for two unlike principal stresses of magnitude σ is
(1) $\frac{\sigma}{2}$ (2) σ (3) $\frac{\sigma}{4}$ (4) Zero

Ans: (2)

109. A solid circular shaft is subjected to a maximum shearing stress of 140MPa. The magnitude of maximum normal stress developed in the shaft is
(1) 140MPa (2) 80MPa (3) 70MPa (4) 60MPa

Ans: (1)

110. If the principal stresses at a point in a strained body are σ_x and σ_y ($\sigma_x > \sigma_y$), then the resultant stress on a plane carrying the maximum shear stress is equal to
(1) $\sqrt{\sigma_x^2 + \sigma_y^2}$ (2) $\sqrt{\sigma_x^2 - \sigma_y^2}$ (3) $\frac{\sqrt{\sigma_x^2 + \sigma_y^2}}{2}$ (4) $\frac{\sqrt{\sigma_x^2 - \sigma_y^2}}{2}$

Ans: (3)

111. A body is subjected to two normal stresses 20 kN/m^2 (tensile) and 10 kN/m^2 (compressive) acting mutually perpendicular to each other. The maximum shear stress is
(1) 30 kN/m^2 (2)5 kN/m^2 (3) 15 kN/m^2 (4) 10kN/m^2

Ans: (3)

112. Principal planes will be free of
(1) normal stress (2) shear stress
(3) both normal and shear stresses (4) None of these

Ans: (2)

113. On two perpendicular planes there are normal stresses, σ_1 and σ_2 and shear stress q. If $q^2 = \sigma_1 \sigma_2$, the major and minor principal stresses respectively are
(1) $\sigma_1 + \sigma_2$ and zero (2) $\sigma_1 + \sigma_2$ and $\sigma_1 - \sigma_2$
(3) Zero and $\sigma_1 - \sigma_2$ (4) $\sigma_1 - \sigma_2$ and $\sigma_1 + \sigma_2$

Ans: (1)

114. Angle between the principal planes is
(1) 270^0 (2) 180^0 (3) 90^0 (4) 45^0

Ans: (3)

115. For a two-dimensional stress system the coordinates of the centre of Mohr's circle are
(1) $\left[\frac{\sigma_x - \sigma_y}{2}, 0\right]$ (2) $\left[\frac{\sigma_x + \sigma_y}{2}, 0\right]$ (3) $\left[0, \frac{\sigma_x - \sigma_y}{2}\right]$ (4) $\left[0, \frac{\sigma_x + \sigma_y}{2}\right]$

Ans: (2)

116. For a maximum bending moment, shear force at that section should be
(1) zero (2) maximum
(3) minimum (4) None of the above

Ans: (1)

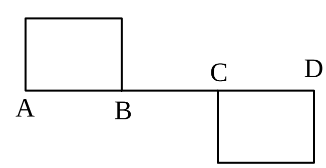
117. For uniform shear force throughout the span of a simply supported beam, it should carry
(1) a concentrated load at the mid-span
(2) a couple anywhere in the sections
(3) udl over its entire span
(4) two concentrated loads equally spaced

Ans: (2)

118. Maximum bending moment in a cantilever carrying a concentrated load at the free end occurs
(1) at the fixed end (2) at the free end
(3) at the mid span (4) None of these

Ans: (1)

119. The given figure shows the shear force diagram for the beam ABCD. Bending moment in the portion BC of the beam
(1) is zero
(2) varies linearly from B to C
(3) parabolic variation between B and C
(4) is a non – zero constant



Ans: (4)

120. At the point of contra flexure in a beam
(1) B.M. is zero (2) B.M. changes its sign
(3) S.F. is zero (3) Both S.F and B.M. change sign

Ans: (2)

121. The kinetic energy correction factor α is a measure of effect of non-uniform distribution of velocity which is caused on account of viscous and other resistances. It is expressed by
(1) $\frac{1}{A}\int_A \left(\frac{v}{V}\right)^2 dA$ (2) $\frac{1}{A}\int_A \left(\frac{v}{V}\right) dA$ (3) $\frac{1}{A}\int_A \left(\frac{v}{V}\right)^3 dA$ (4) $\frac{1}{A}\int_A \left(\frac{V}{v}\right)^3 dA$

Ans: (3)

122. A stagnation point is a point where
(1) pressure is zero (2) total energy is zero
(3) total energy is maximum (4) velocity of flow reduces to zero
Ans: (4)

123. Cavitation in fluid flow occurs when
(1) the total energy suddenly increases
(2) total energy decreases suddenly
(3) velocity head reduces to zero
(4) pressure of flow decreases to a value close to its vapour pressure
Ans: (4)

124. The momentum correction factor β is used to account for
(1) change in pressure
(2) change in mass rate of flow
(3) change in total energy
(4) non-uniform distribution of velocities at inlet and outlet sections
Ans: (4)

125. The change in moment of momentum of fluid due to flow along a curved path results in
(1) a dynamic force which passes through the centre of curvature
(2) a torque
(3) a change in energy
(4) a change in pressure
Ans: (2)

126. The velocity head representing the kinetic energy per unit weight of fluid is denoted by
(1) v^2 (2) $\frac{v^2}{2}$ (3) $\sqrt{2gh}$ (4) $\frac{v^2}{2g}$
Ans: (4)

127. A prandtl type pitot tube is used to measure the
(1) velocity of flow at the required point in a pipe
(2) pressure difference between two points in a pipe
(3) total pressure of liquid flowing in a pipe
(4) discharge through a pipe
Ans: (1)

128. While using the pitot-tube, it must ensured that its alignment is such that
(1) its horizontal leg is at right angles to the direction of flow
(2) its opening faces the downstream direction
(3) its opening faces upstream and the horizontal leg is perfectly aligned with the direction of flow
(4) the horizontal leg be inclined at 45^0 in plan
Ans: (3)

129. The coefficient of discharge 'C_d' of a venturi meter lies within the limits
(1) 0.7 – 0.9 (2) 0.6 – 0.8 (3) 0.75 – 0.95 (4) 0.95 – 0.99
Ans: (4)

130. When the venturi meter is inclined, then for a given flow it will give the reading as
(1) same (2) more (3) less (4) no relation
Ans: (1)

131. The velocity of liquid flowing through the divergent portion of a venturi meter
(1) remains constant (2) decreases (3) increases (4) no relationship
Ans: (2)

132. The head loss is more in a
(1) nozzle meter (2) venture meter
(3) inclined venture meter (4) orifice meter
Ans: (4)

133. If successive measurements with a Prandtl-pitot tube indicate that the tip piezo meter reading varies only across the flow, and the side piezometer reading varies only in the direction of flow, the flow is evidently
(1) uniform, irrotational (2) non-uniform, rotational
(3) uniform, rotational (4) non-uniform, irrotational
Ans: (2)

134. A mechanical device, which has rotation elements, the speed of rotation of which is a function of velocity of flow, and which is used measure the velocity of liquid in open channels, is
(1) Anemometer (2) Orifice meter (3) Current meter (4) Rotameter
Ans: (3)

135. A mouthpiece and an orifice, both of the same diameter 'd', are discharging under the same head 'H'. The discharge through the mouthpiece will be
(1) the same as that of the orifice (2) less than that of the orifice
(3) more than that of the orifice (4) no relationship
Ans: (3)

136. As compared to a rectangular weir, a triangular weir measures low discharges more accurately, the discharge through the latter being
(1) $\frac{2}{3}C_d\sqrt{2g}\tan\theta.H^{\frac{5}{2}}$ (2) $\frac{8}{15}C_d\sqrt{2g}\tan\theta.H^{\frac{5}{2}}$
(3) $\frac{8}{15}C_d\sqrt{2g}\tan\theta.H^{\frac{3}{2}}$ (4) $\frac{2}{3}C_d\sqrt{2g}\tan\theta.H^{\frac{3}{2}}$
Ans: (2)

137. A Cippoletti weir is a
(1) rectangular weir with sharp edges
(2) high triangular notch
(3) trapezoidal notch with 45^0 slopes
(4) trapezoidal notch with sides inclined at 1H : 4V
Ans: (4)

138. The time taken for a tank, filled to a height 'h' above its flat base, to empty through an orifice in the base varies as the following power of 'h'.

(1) 1 (2) $\frac{1}{2}$ (3) $-\frac{1}{2}$ (4) $\frac{1}{3}$

Ans: (2)

139. The equation of state for a perfect a perfect gas is

(1) $\frac{P}{V} = RT$ (2) $\frac{P}{T} = \frac{V}{R}$ (3) PV = RT (4) $\frac{P}{\rho} = T$

Ans: (3)

140. If the compression or expansion of a gas takes place in such a way that the gas neither gives heat nor takes heat from its surroundings, the process is said to be

(1) Isothermal (2) Adiabatic (3) Isobaric (4) None of these

Ans: (2)

141. For an adiabatic process,

(1) PV = a constant (2) PV^n = a constant

(3) $\frac{P}{\rho^K}$ = a constant (4) $\frac{P}{K^\rho}$ = a constant

Ans: (3)

142. Momentum equation is completely independent of

(1) compressibility effects (2) frictional effects

(3) viscous effects (4) momentum flux

Ans: (3)

143. The velocity of elastic pressure wave in a fluid medium is equal to

(1) sonic velocity (2) half of sonic velocity

(3) square root of sonic velocity (4) Bulk Modulus

Ans: (1)

144. Mach number is given by

(1) $\frac{\text{Acoustic speed}}{\text{Stream speed}}$ (2) $\frac{\text{Stream speed}}{\text{Acoustic speed}}$

(3) product of gas constant and temperature (4) half of Bulk Modulus

Ans: (2)

145. Mach cone is possible in

(1) Stationary fluids (2) Subsonic flow

(3) Transonic flow (4) Supersonic flow

Ans: (4)

146. The range of Mach number for a subsonic flow is
(1) $0 < M < 1$ (2) $0.3 < M < 1$ (3) $0.8 < M < 1.2$ (4) $M > 1$

Ans: (2)

147. The differential form of continuity equation for one dimensional steady flow compressible fluids with usual terms is

(1) $\frac{d\rho}{\rho} + \frac{dA}{A} = 0$ (2) $\frac{dA}{A} = \frac{d\rho}{\rho} + \frac{dV}{V}$

(3) $\frac{dA}{\rho} = \frac{dV}{V} - \frac{d\rho}{\rho}$ (4) $\frac{dA}{A} = -\frac{d\rho}{\rho} - \frac{dV}{V}$

Ans: (4)

148. For flow in a nozzle discharging from a tap "choking" condition occurs, when the flow the nozzle exit is
(1) subsonic (2) supersonic (3) critical (4) transonic

Ans: (3)

149. Effect of compressibility of a fluid can neglected if Mach number is
(1) equal to 1 (2) greater than 1
(3) less than 1 but greater than 0.4 (4) less than 0.4

Ans: (4)

150. Laminar flow through a circular tube studied experimentally by
(1) Newton (2) Pascal
(3) Hagen and Poiseuille (4) Prandtl

Ans: (3)

Key Prepared by
ACE Engineering Academy