**72.** While applying the momentum equation the net force that acts over the control volume is required to be evaluated. Which of the following forces are generally considered in determining the net force ?

(a) gravity force
(b) various forces
(c) pressure force
(d) boundary resistance
(e) elastic force
(f) surface tension force

(1) a, b, c
(2) a, e, f
(3) a, d, e
(4) a, c, d

**73.** The boundary layer exists in

(1) flow of ideal fluids
(2) flow of real fluids
(3) only pipe flow
(4) only flow over flat surfaces

**74.** The existence of boundary layer is on account of

(1) fluid density
(2) gravitational effect
(3) fluid viscosity
(4) surface tension

**75.** Laminar flow through a circular tube was studied experimentally by

(1) Newton
(2) Pascal
(3) Hagen and Poiseuille
(4) Prandtl

**76.** The lower limit of the critical Reynolds number below which all disturbances (or sources of turbulence) in pipe flow are damped out by viscous action has a value approximately equal to

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

**77.** The point, about which a floating body starts oscillating when the body is tilted, is called

(1) centre of pressure
(2) centre of buoyancy
(3) centre of gravity
(4) metacentre

**78.** In laminar flow through a circular tube, the Darcy – Weisbach friction factor (f) depends only on the Reynolds number (R), and the two are related by

(1) $f = \frac{1}{R}$
(2) $f = \frac{16}{R}$
(3) $f = \frac{0{\cdot}316}{R^{1/4}}$
(4) $f = \frac{64}{R}$

**79.** According to Ehrenberger, the Darcy's law is void for velocities 'u' less than

(1) 1 m/s
(2) 10 cm/s
(3) 3 to 4·5 mm/s
(4) 5 to 10 mm/s

80. The discharge in $m^3/s$ for laminar flow through a pipe of diameter 0·04 m having a centreline velocity of 1·5 m/s is

(1) $3\pi/59$

(2) $3\pi/2500$

(3) $3\pi/5000$

(4) $3\pi/10000$

81. Which of the following devices are usually used in measuring pipe flow ?

(1) Mouthpiece

(2) Cipolletti weir

(3) Venturimeter

(4) Pitot tube

82. Arrange the following flow measuring devices in the decreasing order of head loss caused by them :

(a) nozzle meter

(b) venturimeter

(c) orifice meter

(1) b, a, c

(2) a, b, c

(3) c, a, b

(4) c, b, a

83. Arrange the hydraulic coefficients of orifice in increasing order of magnitude :

(i) $C_v$

(ii) $C_c$

(iii) $C_d$

(1) i, ii, iii

(2) iii, ii, i

(3) ii, iii, i

(4) iii, i, ii

84. The discharge through a sharp-crested rectangular weir is given by [with usual notations]

(1) $C_d\ B\ \sqrt{2g}\ H$

(2) $\frac{2}{3} C_d\ B\ \sqrt{2g}\ H$

(3) $\frac{2}{3} C_d\ B\ \sqrt{2g}\ H^{3/2}$

(4) $C_d\ B\ \sqrt{2g}\ H^{3/2}$

85. 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 through the orifice

(2) more than discharge of orifice

(3) less than that through the orifice

(4) None of these

86. The head over a 90° V-notch weir increases from 0·15 to 0·30 m. The ratio of the net discharge to the original discharge is

(1) 1·414

(2) 2·00

(3) 4·000

(4) 5·657

87. 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) $-1$

88. Uniform flow in open channels is characterised by

(1) a change in depth of flow

(2) a constant discharge passing down the channel

(3) a constant depth of flow

(4) no variation of velocity at flow

89. The Chezy's constant 'c' which appears in the Chezy's equation for mean velocity in open channels

(1) is a dimensionless constant

(2) has a constant value for different types of channels

(3) had dimensions $L^{1/2} T^{-1}$

(4) None of these

90. The maximum velocity in open channels occurs

(1) at the mid depth

(2) at the free surface

(3) a little below the free surface

(4) near the channel bottom

91. The following data is related to a screw jack :
Pitch of the threaded screw = 8 mm
Diameter of the threaded screw = 40 mm
Coefficient of the friction between screw and nut = 0·1
Load = 20 kN
Assuming that the load rotates with the screw, determine the Efficiency.

(1) 0·683

(2) 0·386

(3) 0·836

(4) 0·638

92. A load of 15 kN is raised by means of a screw jack. The mean diameter of the square threaded screw is 42 mm and the pitch is 10 mm. A force of 120 N is applied at the end of a lever to raise the load. Determine the length of the load.

(1) 218·7

(2) 318·7

(3) 418·7

(4) 518·7

93. A load of 15 kN is raised by means of a screw jack. The mean diameter of the square threaded screw is 42 mm and the pitch is 10 mm. A force of 120 N is applied at the end of a lever to raise the load. Determine the mechanical advantage.

(1) 25

(2) 125

(3) 625

(4) 0

**94.** A shaft runs at 80 rpm and drives another shaft at 150 rpm through the belt drive. The diameter of the driving pulley is 600 mm. Determine the diameter of the driven pulley taking the belt thickness as 5 mm.

(1) 320 mm

(2) 317·7 mm

(3) 304·8 mm

(4) 304·9 mm

**95.** A shaft runs at 80 rpm and drives another shaft at 150 rpm through the belt drive. The diameter of the driving pulley is 600 mm. Determine the diameter of the driven pulley taking the belt thickness as 5 mm and a total slip of 4%.

(1) 320 mm

(2) 317·7 mm

(3) 304·8 mm

(4) 304·9 mm

**96.** A shaft runs at 80 rpm and drives another shaft at 150 rpm through the belt drive. The diameter of the driving pulley is 600 mm. Determine the diameter of the driven pulley taking the belt thickness as 5 mm and a slip of 2% on each pulley.

(1) 340 mm

(2) 317·7 mm

(3) 304·8 mm

(4) 304·9 mm

**97.** A bar of copper and steel form a composite system which is heated to a temperature of 45°C. The stress in the copper bar will be _____.

(1) tensile stress

(2) compressive stress

(3) bursting stress

(4) shear stress

**98.** A cylindrical pipe of diameter 1·5 m and thickness 1·5 cm is subjected to an internal fluid pressure of 1·2 $N/mm^2$. The hoop stress developed in the pipe is _____.

(1) 30 $N/mm^2$

(2) 60 $N/mm^2$

(3) 90 $N/mm^2$

(4) 15 $N/mm^2$

**99.** A cylinder of internal diameter 2·5 m and of thickness 5 cm contains a gas. If the tensile stress in the material is not to exceed 80 $N/mm^2$, the internal pressure of the gas should be _____.

(1) 3·2 $N/mm^2$

(2) 6·4 $N/mm^2$

(3) 7·2 $N/mm^2$

(4) 1·6 $N/mm^2$

**100.** A thin cylinder of internal diameter 1·25 m contains a fluid at an internal pressure of 2 $N/mm^2$. The longitudinal and circumferential stresses are not to exceed 30 $N/mm^2$ and 45 $N/mm^2$ respectively. The maximum thickness of the cylinder is _____.

(1) 2·08 cm

(2) 2·22 cm

(3) 2·77 cm

(4) 2·80 cm

**101.** A water main 80 cm diameter contains water at a pressure head of 100 m. If the weight density of water is 9810 $N/m^3$ and the permissible stress is 20 $N/mm^2$, then the thickness of the metal required for the water main is _____.

(1) 0·5 cm

(2) 1 cm

(3) 2 cm

(4) 4 cm

**102.** A cylinder of thickness 1·5 cm has to withstand maximum internal pressure of 1·5 $N/mm^2$. If the ultimate tensile stress in the material of the cylinder is 300 $N/mm^2$, factor of safety 3·0 and joint efficiency 80%, the diameter of the cylinder is _____.

(1) 160 m

(2) 160 cm

(3) 160 mm

(4) 160 km

**103.** A hollow cylindrical drum 600 mm in diameter and 3 m long, has a shell thickness of 10 mm. If the drum is subjected to an internal air pressure of 3 $N/mm^2$, the increase in its volume is _____.

(Take E = 2 × $10^5$ $N/mm^2$ and Poisson's ratio = 0·3 for the material)

(1) 792623000 $mm^3$

(2) 692723000 $mm^3$

(3) 962723000 $mm^3$

(4) 862793000 $mm^3$

**104.** A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. The maximum stress induced is _____.

(Take E = 2 × $10^5$ $N/mm^2$)

(1) 100 $N/mm^2$

(2) 200 $N/mm^2$

(3) 400 $N/mm^2$

(4) 600 $N/mm^2$

**105.** A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. The bending moment which will produce the maximum stress is given by _____.

(Take E = 2 × $10^5$ $N/mm^2$)

(1) 1·0 k N-m

(2) 1·6 k N-m

(3) 1·2 k N-m

(4) 1·4 k N-m

**106.** A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What uniformly distributed load per metre may the beam carry, if the bending stress is not to exceed 120 $N/mm^2$ ?

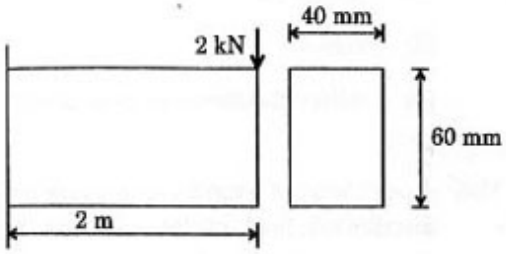
(1) 3 k N/m

(2) 30 k N/m

(3) 300 k N/m

(4) 0·3 k N/m

107. A cantilever of length 2 m fails when a load of 2 kN is applied at the free end. If the section of the beam is 40 mm × 60 mm, the stress at failure will be _____ .




(1) 1666·7 N/mm$^2$

(2) 166·67 N/mm$^2$

(3) 16·667 N/mm$^2$

(4) 1·6667 N/mm$^2$

108. The maximum stress induced in a cast iron pipe of external diameter 40 mm, internal diameter 20 mm and of length 4 m when the pipe is supported at its ends and carries a point load of 80 N at its centre, is

(1) 1·358 N/mm$^2$

(2) 13·58 N/mm$^2$

(3) 135·8 N/mm$^2$

(4) 1358 N/mm$^2$

109. A beam which is fixed at one end and free at the other end is known as _____ .

(1) cantilever beam

(2) simply supported beam

(3) overhanging beam

(4) roller beam

110. Thin cylinders are frequently required to operate under pressure upto _____ .

(1) 5 MN/m$^2$

(2) 15 MN/m$^2$

(3) 30 MN/m$^2$

(4) 250 MN/m$^2$

111. If the end portion of a beam is extended beyond the support, such a beam is known as _____

(1) cantilever beam

(2) simply supported beam

(3) overhanging beam

(4) roller beam

112. In case of a circular section, the maximum shear stress is _____ percent more than the mean shear stress.

(1) 10

(2) 20

(3) 33·33

(4) 66·66

113. The shear force _____ at a section where there is a vertical point load.

(1) remains constant

(2) changes gradually

(3) changes suddenly

(4) is zero

114. The shear force between any two vertical loads _____ .

(1) remains constant

(2) changes gradually

(3) changes suddenly

(4) is zero

115. A square section with side 'x' of a beam is subjected to a shear force 'S'. The magnitude of shear stress at the top edge of the square is

(1) $\frac{1{\cdot}5\,S}{x^2}$

(2) $\frac{S}{x^2}$

(3) $\frac{0{\cdot}5\,S}{x^2}$

(4) Zero

116. The diameter of kernel of a circular section is _____ .

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

(2) $\frac{d}{3}$

(3) $\frac{d}{4}$

(4) $\frac{d}{\sqrt{2}}$

117. Bending moment is _____ at a section where shear force is zero after changing its sign.

(1) maximum

(2) minimum

(3) zero

(4) either maximum or minimum

118. A cantilever of length $l$ is carrying a uniformly distributed load of 'w' per unit run for a distance of 'b' from fixed end. The slope at the free end is given as

(1) $\frac{wb^3}{6EI}$

(2) $\frac{wb^3}{8EI}$

(3) $\frac{wb^3}{12EI}$

(4) $\frac{wb^3}{24EI}$

119. When a beam is subjected to a couple at a section, then bending moment _____ at the section.

(1) changes suddenly

(2) changes gradually

(3) remains unaltered

(4) is zero

120. The radius of gyration of a solid sphere of radius 'r' is equal to _____ . 1

(1) $0{\cdot}8\,r^2$

(2) $0{\cdot}5\,r^2$

(3) $0{\cdot}4\,r^2$

(4) $0{\cdot}3\,r^2$

**121.** The ratio of shear modulus to the elastic modulus for a Poisson's ratio of 0·4 will be

(1) 5/6
(2) 6/5
(3) 3/5
(4) 1/2

**122.** The maximum strain energy stored in a body without permanent deformation is

(1) Resilience
(2) Proof Resilience
(3) Modulus of Resilience
(4) Impact Resilience

**123.** The shape of the kern area for a rectangular section is

(1) circle
(2) square
(3) rectangle
(4) parallelogram

**124.** A train starts from rest on a curved track of radius 800 m. Its speed increases uniformly and after 3 minutes it is 72 km/hr. The tangential acceleration after 2 minutes would be

(1) $\frac{1}{9}$ m/sec$^2$
(2) $\frac{2}{9}$ m/sec$^2$
(3) $\frac{1}{2}$ m/sec$^2$
(4) $\frac{1}{3}$ m/sec$^2$

**125.** The maximum stress induced in a body if the load 'P' is applied suddenly upon an area of cross section 'A' is

(1) P/A
(2) 2 P/A
(3) 3 P/A
(4) 4 P/A

**126.** The maximum stress induced in a body if the load 'P' is applied with impact upon an area of cross section 'A' is

(Where h = Height through which the load falls
E = Modulus of rigidity
L = Length of the body)

(1) $\frac{P}{A}\left(1 + \sqrt{1 + \frac{2AEh}{PL}}\right)$
(2) $\frac{P}{A}\left(2 + \sqrt{1 + \frac{2AEh}{PL}}\right)$
(3) $\frac{P}{A}\left(1 + \sqrt{2 + \frac{2AEh}{PL}}\right)$
(4) $\frac{P}{A}\left(2 + \sqrt{2 + \frac{2AEh}{PL}}\right)$

**127.** Poisson's ratio for a cast iron is _____ .

(1) 0·27
(2) 0·31
(3) 0·33
(4) 0·36

**128.** The tensile longitudinal stress produces

(1) Compressive longitudinal strain
(2) Tensile longitudinal strain
(3) Shear strain
(4) Tensile lateral strain

**129.** Rivets are made normally of _____ material.

(1) Brittle
(2) Hard
(3) Ductile
(4) Malleable

**130.** The depth of weld in case of a butt weld is _____ the thickness of the plate.

(1) Less than
(2) More than
(3) Two times
(4) Equal to

131. An angle section welded to a plate is an example of

(1) Symmetrical welded joint

(2) Unsymmetrical welded joint

(3) Axi-symmetrical welded joint

(4) Symmetrical welded section

132. In case of thin walled cylinders, the ratio of longitudinal stress is _____ .

(1) 2

(2) 1/2

(3) 4

(4) 1/4

133. If the value of Young's modulus of elasticity is zero, it implies that the material is

(1) highly elastic

(2) plastic

(3) compressible

(4) incompressible

134. All short columns fail due to

(1) Crippling

(2) Buckling

(3) Crushing

(4) Twisting

135. For a beam of span 'L' subjected to a couple 'M' at the centre, the shear force at the left support is _____ .

(1) $\frac{4M}{L}$

(2) $\frac{2M}{L}$

(3) $\frac{M}{L}$

(4) Zero

136. The load at which the column just buckles is called

(1) Breaking load

(2) Permissible load

(3) Crippling load

(4) Ultimate load

137. The Crippling load (P) for a column by Euler's formula when both ends are hinged is
(Where E = Young's Modulus of the material of the column
L = Actual length of the column
I = Least moment of inertia of the column)

(1) $\frac{\pi^2 EI}{L^2}$

(2) $\frac{\pi^2 EI}{4L^2}$

(3) $\frac{4\pi^2 EI}{L^2}$

(4) $\frac{2\pi^2 EI}{L^2}$

138. A uniform beam of effective length L, fixed at one end and loaded at the centre, will have maximum deflection at

(1) free end

(2) $\frac{L}{\sqrt{3}}$ from free end

(3) $\frac{L}{\sqrt{2}}$ from free end

(4) $\frac{L}{\sqrt{5}}$ from free end

**139.** The Crippling load (P) for a column by Euler's formula when both ends are fixed is

(Where E = Young's Modulus of the material of the column

L = Actual length of the column

I = Least moment of inertia of the column)

(1) $\frac{\pi^2 EI}{L^2}$

(2) $\frac{\pi^2 EI}{4L^2}$

(3) $\frac{4\pi^2 EI}{L^2}$

(4) $\frac{2\pi^2 EI}{L^2}$

**140.** The Crippling load (P) for a column by Euler's formula when one end is fixed and the other end is hinged is

(Where E = Young's Modulus of the material of the column

L = Actual length of the column

I = Least moment of inertia of the column)

(1) $\frac{\pi^2 EI}{L^2}$

(2) $\frac{\pi^2 EI}{4L^2}$

(3) $\frac{4\pi^2 EI}{L^2}$

(4) $\frac{2\pi^2 EI}{L^2}$

**141.** The value of Poisson's ratio of cork is _____.

(1) 0·0

(2) 0·1

(3) 0·2

(4) 0·3

**142.** A body is to be moved up an inclined plane by applying a force parallel to the plane surface. It is found that a force of 3 kN is required to just move it up the plane when the angle of inclination is 10° whereas the force needed increases to 4 kN when the angle of inclination increases to 15°. Find the weight of the body.

(1) W = 10950 N

(2) W = 12950 N

(3) W = 13950 N

(4) W = 11950 N

**143.** A square threaded bolt with a core diameter of 25 mm and a pitch of 10 mm is tightened by screwing a nut. The mean diameter of the bearing surface of the nut is 60 mm. The coefficient of friction for the nut and the bolt is 0·12 and for the nut and the bearing surface it is 0·15. Determine the force required at the end of 400 mm long spanner if the load on the bolt is 12 kN.

(1) 112·7 N

(2) 212·7 N

(3) 312·7 N

(4) 500 N

144. A load of 15 kN is raised by means of a screw jack. The mean diameter of the square threaded screw is 42 mm and the pitch is 10 mm. A force of 120 N is applied at the end of a lever to raise the load. What is the efficiency ?

(1) 0·384

(2) 0·483

(3) 0·843

(4) 0·834

145. The deformation of any structure takes place in such a manner that the work of deformation is a minimum. This is known as

(1) Principle of least work

(2) Law of minimum energy

(3) Principle of failure of structure

(4) None of the above

146. A body is to be moved up an inclined plane by applying a force parallel to the plane surface. It is found that a force of 3 kN is required to just move it up the plane when the angle of inclination is 10° whereas the force needed increases to 4 kN when the angle of inclination increases to 15°. Find the coefficient of fricition.

(1) 0·786

(2) 0·0786

(3) 7·86

(4) 0·00786

147. A rope of weight 0·50 kg/m hangs from a drum for a height of 6 m. The work done in winding up the rope will be

(1) 3 kg.m

(2) 6 kg.m

(3) 9 kg.m

(4) 12 kg.m

148. Find the moment of inertia of a triangle about the base AB where AB = b and height = h.

(1) $\frac{bh^3}{12}$

(2) $\frac{hb^3}{12}$

(3) $\frac{bh^3}{3}$

(4) $\frac{bh^3}{4}$

149. What is the centroid of a rectangle with length = a and width = b ?

(1) (a/2, b/2)

(2) (a/3, b/3)

(3) (a/4, b/4)

(4) (a/5, b/5)

150. The following data is related to a screw jack :
Pitch of the threaded screw = 8 mm
Diameter of the threaded screw = 40 mm
Coefficient of the friction between screw and nut = 0·1
Load = 20 kN
Assuming that the load rotates with the screw, determine the ratio of torques required to raise and lower the load.

(1) 2·26

(2) 3·36

(3) 4·56

(4) 6·76