PRINTED SAMPLE

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EA/634 **2013**

Series **A**

Notification No. 24/2012
D.O.E : 16/6/2013

CONCERNED SUBJECT

(English Version)

Paper – II

*Time : **150** Minutes* *Max. Marks : **150***

INSTRUCTIONS

1. Please check the Test Booklet and ensure that it contains all the questions. If you find any defect in the Test Booklet or Answer Sheet, please get it replaced immediately.

2. The Test Booklet contains **150** questions. Each question carries **1** mark.

3. The Test Booklet is printed in four (4) Series, viz. [A] [B] [C] [D]. The Series, [A] or [B] or [C] or [D] is printed on the right-hand corner of the cover page of the Test Booklet. Mark your Test Booklet Series [A] or [B] or [C] or [D] in Part C on side 1 of the Answer Sheet by darkening the appropriate circle with Blue/Black Ball point pen.

Example to fill up the Booklet Series

If your Test Booklet Series is **A**, please fill as shown below :

● Ⓑ Ⓒ Ⓓ

If you have not marked the Test Booklet Series at Part C of side 1 of the Answer Sheet or marked in a way that it leads to discrepancy in determining the exact Test Booklet Series, then, in all such cases, your Answer Sheet will be invalidated without any further notice. No correspondence will be entertained in the matter.

4. Each question is followed by 4 answer choices. Of these, you have to select one correct answer and mark it on the Answer Sheet by darkening the appropriate circle for the question. If more than one circle is darkened, the answer will not be valued at all. Use Blue/Black Ball point pen to make heavy black marks to fill the circle completely. Make **no** other stray marks. Use of whitener is prohibited. If used the Answer Sheet is liable for invalidation.

e.g. : If the answer for Question No. **1** is Answer choice (2), it should be marked as follows :

1	①	●	③	④

5. Use Blue/Black Ball Point Pen only, failing which your Answer Sheet will be invalidated. Gel pens/pencils are not allowed. It is not required to darken the second copy separately.

6. Mark Paper Code and Roll No. as given in the Hall Ticket with Blue/Black Ball point pen by darkening appropriate circles in Part A of side 1 of the Answer Sheet. Incorrect/not encoding will lead to ***invalidation*** of your Answer Sheet.

Example : If the Paper Code is **027**, and Roll No. is **95640376** fill as shown below :

Paper Code

0	2	7
●	○	○
①	①	①
②	●	②
③	③	③
④	④	④
⑤	⑤	⑤
⑥	⑥	⑥
⑦	⑦	●
⑧	⑧	⑧
⑨	⑨	⑨

Roll No.

9	5	6	4	0	3	7	6
⓪	⓪	⓪	⓪	●	⓪	⓪	⓪
①	①	①	①	①	①	①	①
②	②	②	②	②	②	②	②
③	③	③	③	③	●	③	③
④	④	④	●	④	④	④	④
⑤	●	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	●	⑥	⑥	⑥	⑥	●
⑦	⑦	⑦	⑦	⑦	⑦	●	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
●	⑨	⑨	⑨	⑨	⑨	⑨	⑨

7. Please get the signature of the Invigilator affixed in the space provided in the Answer Sheet. An Answer Sheet without the signature of the Invigilator is liable for ***invalidation***.

8. DO NOT fold, tear, wrinkle, tie, staple, do any rough work or make any stray marks on the OMR Answer Sheet, otherwise your Answer Sheet will be invalidated.

9. Using the Whitener/Blade/Eraser or any kind of tampering to change the answers on OMR Answer Sheet will lead to invalidation.

10. Do **not** mark answer choices on the Test Booklet. Violation of this will be viewed seriously.

11. Before leaving the examination hall, the candidate should hand over the original OMR Answer Sheet (top sheet) to the Invigilator and carry the bottom sheet (duplicate) for his/her record, failing which disciplinary action will be taken.

1. 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

2. The maximum strain energy stored in a body without permanent deformation is
   (1) Resilience
   (2) Proof Resilience
   (3) Modulus of Resilience
   (4) Impact Resilience

3. The shape of the kern area for a rectangular section is
   (1) circle
   (2) square
   (3) rectangle
   (4) parallelogram

4. 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

5. 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

6. 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) $\frac{P}{A}\left(2 + \sqrt{2 + \frac{2AEh}{PL}}\right)$

7. Poisson's ratio for a cast iron is _____ .
   (1) 0·27
   (2) 0·31
   (3) 0·33
   (4) 0·36

8. The tensile longitudinal stress produces
   (1) Compressive longitudinal strain
   (2) Tensile longitudinal strain
   (3) Shear strain
   (4) Tensile lateral strain

9. Rivets are made normally of _____ material.
   (1) Brittle
   (2) Hard
   (3) Ductile
   (4) Malleable

10. 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

11. 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

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

(1) 2

(2) 1/2

(3) 4

(4) 1/4

13. 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

14. All short columns fail due to

(1) Crippling

(2) Buckling

(3) Crushing

(4) Twisting

15. 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

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

(1) Breaking load

(2) Permissible load

(3) Crippling load

(4) Ultimate load

17. 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) $\frac{2\pi^2 EI}{L^2}$

18. 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

19. 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) $\frac{2\pi^2 EI}{L^2}$

20. 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) $\frac{2\pi^2 EI}{L^2}$

21. The value of Poisson's ratio of cork is _____.

(1) 0·0

(2) 0·1

(3) 0·2

(4) 0·3

22. 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

23. 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

24. 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

25. 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

26. 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

27. 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

28. 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) $\frac{bh^3}{4}$

29. 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)

30. 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

31. 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

32. 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

33. 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

34. 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

35. 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

36. 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

37. 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

38. 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

39. 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

40. 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

41. 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

42. 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

43. 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 $E = 2 \times 10^5$ 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

44. 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 $E = 2 \times 10^5$ N/mm^2)

(1) 100 N/mm^2

(2) 200 N/mm^2

(3) 400 N/mm^2

(4) 600 N/mm^2

45. 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 $E = 2 \times 10^5$ 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

46. 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 ?

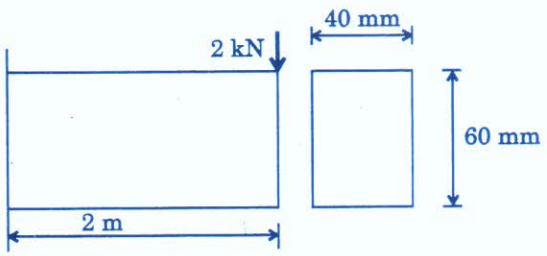
(1) 3 k N/m

(2) 30 k N/m

(3) 300 k N/m

(4) 0·3 k N/m

47. 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

48. 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

49. 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

50. 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

51. 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

52. 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

53. 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

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

(1) remains constant

(2) changes gradually

(3) changes suddenly

(4) is zero

55. 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

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

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

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

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

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

57. 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

58. 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) $\frac{wb^3}{24EI}$

59. 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

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

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

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

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

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

61. Triangle law of forces is derived from _____ .

(1) parallelogram law of forces

(2) law of transmissibility of forces

(3) Newton's law of gravitation

(4) All the above

62. The resultant of two forces each equal to P/4 and acting at right angles is _____ .

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

(2) $\frac{P}{\sqrt{2}}$

(3) $\sqrt{2}\ P$

(4) 2P

63. What is the torque transmitted by a solid shaft of diameter (D), when subjected to a shear stress (τ) ?

(1) $\frac{\pi}{16}\tau D^2$

(2) $\frac{\pi}{16}\tau D^3$

(3) $\frac{\pi}{32}\tau D^2$

(4) $\frac{\pi}{32}\tau D^3$

64. When a solid shaft is subjected to torsion, the shear stress induced in the shaft at its centre is

(1) zero

(2) minimum

(3) maximum

(4) average

65. Strain energy stored in a hollow circular shaft of external diameter D and internal diameter d when subjected to a shearing stress τ is equal to

(1) $\frac{\tau^2}{2c}\left(\frac{D^2 - d^2}{D}\right) \times$ Volume of shaft

(2) $\frac{\tau^2}{2c}\left(\frac{D^2 + d^2}{D}\right) \times$ Volume of shaft

(3) $\frac{\tau^2}{4c}\left(\frac{D^2 - d^2}{D}\right) \times$ Volume of shaft

(4) $\frac{\tau^2}{4c}\left(\frac{D^2 + d^2}{D}\right) \times$ Volume of shaft

66. Find the maximum shear stress induced in a solid circular shaft of diameter 200 mm when the shaft transmits 190 kW power at 200 rpm.

(1) 4·67 N/mm^2

(2) 5·78 N/mm^2

(3) 5·14 N/mm^2

(4) 6·12 N/mm^2

67. Euler's buckling formula is applicable for columns

(1) subjected to eccentric loads

(2) having inertial curvature

(3) initially straight and subjected to only axial loads

(4) All of the above

68. A cantilever of length of span l carries a uniformly distributed load of w per unit length over its entire span. If its span is halved, then its slope will become

(1) half

(2) one-fourth

(3) one-eighth

(4) one-sixteenth

69. A cantilever beam of span l is carrying a triangular load of zero intensity at its free end to w per unit length at its fixed end. The deflection at its free end will be

(1) $Wl^4/30EI$

(2) $Wl^4/24EI$

(3) $Wl^4/16EI$

(4) $Wl^4/12EI$

70. The shear force at any section of the conjugate beam is equal to the slope of the elastic curve at the corresponding section of the actual beam.

The above theorem belongs to :

(1) Mohr's theorem I

(2) Mohr's theorem II

(3) Conjugate beam theorem I

(4) Conjugate beam theorem II

71. If the actual beam has both ends fixed, then the ends of the conjugate beam will be

(1) Fixed at both ends

(2) Free at both ends

(3) Fixed at one end, free at other end

(4) Hinged at one end, free at other end

72. All the members in a planar truss are _____ force members.

(1) Two

(2) Three

(3) Four

(4) None of these

73. Forces at the ends of the member act _____ member in a plane truss.

(1) perpendicular to

(2) along the axis of

(3) inclined to

(4) inclined at 30° to

74. All the loadings in plane truss are applied at _____ .

(1) any point in the member

(2) joints

(3) mid points

(4) base

75. Relation between number of members (m) and joints (j) in a plane truss is

(1) $m - 3 = 4 (j - 3)$

(2) $m - 2 = 4 (j - 2)$

(3) $m - 3 = 2 (j - 3)$

(4) $m - 2 = 2 (j - 2)$

76. An ideal flow of any fluid must fulfil the following :

(1) Newton's law of viscosity

(2) Newton's law of motion

(3) Boundary layer theory

(4) Continuity equation

77. The stress-strain relation of the Newtonian fluids is

(1) Linear

(2) Parabolic

(3) Hyperbolic

(4) Involutic

78. The velocity distribution in a laminar flow through a circular pipe follows as

(1) parabolic

(2) linear law

(3) logarithmic law

(4) None of the above

79. The units of kinematic viscosity are

(1) kg/m^2-sec

(2) kg-sec/m^2

(3) m/kg-sec

(4) m^2/sec

80. Froude's number is defined as the ratio of

(1) inertia force to viscous force

(2) inertia force to gravity force

(3) inertia force to elastic force

(4) inertia force to pressure

81. Differential manometers are used for measuring

(1) velocity at a point in a fluid

(2) pressure at a point in a fluid

(3) pressure difference between two points

(4) All of the above

82. A rotameter is a device used to measure

(1) Velocity of fluid in pipes

(2) Velocity of gauges

(3) Vortex flow

(4) Flow of fluids

83. Surface tension is a phenomenon due to

(1) cohesion only

(2) viscous force

(3) adhesion between liquid and solid molecules

(4) difference in magnitude between the forces due to adhesion and cohesion

84. A measure of the effect of compressibility in fluid flow is the magnitude of a dimensionless parameter known as

(1) Reynolds number

(2) Mach number

(3) Weber number

(4) Froude number

85. For air flow at room temperature to be incompressible, the fluid velocity must not exceed

(1) 100 m/sec

(2) 70 m/sec

(3) 50 m/sec

(4) 25 m/sec

86. Mercury is used in barometers on account of

(1) its high density

(2) negligible capillarity effect

(3) very low vapour pressure

(4) its low compressibility

87. Which of the following fluids has the highest compressibility ?

(1) Water

(2) Air at 1 atm. pressure

(3) A gas at 5 atm. pressure

(4) All of (1), (2) & (3)

88. The pressure gradient in the horizontal direction in a static fluid is represented by

(1) $\frac{\partial p}{\partial z} = -\gamma$

(2) $\frac{\partial p}{\partial x} = \gamma$

(3) $\frac{\partial p}{\partial x} = 0$

(4) $\frac{\partial p}{\partial z} = 0$

where z direction is vertically upwards, and x is along horizontal.

89. Flow of a fluid in a pipe takes place from

(1) higher level to lower level

(2) higher pressure to lower pressure

(3) higher energy to lower energy

(4) None of the above

90. The point through which the resultant hydrostatic force acts is called

(1) metacentre

(2) centre of pressure

(3) centre of buoyancy

(4) centre of gravity

91. The hydrostatic pressure on a plane surface of area 'A' is given by

(1) $0{\cdot}5\ \gamma A h_c$

(2) $\gamma A h_c$

(3) $2\ \gamma A h_c$

(4) $1{\cdot}5\ \gamma A h_c$

where h_c = depth of centroid of the area below the liquid surface.

92. When a static liquid is subjected to uniform rotation in a container, the free surface assumes a shape of :

(1) a cone

(2) a circular cylinder

(3) a paraboloid of revolution

(4) an ellipsoid of revolution

93. A circular plate 1 m in diameter is submerged vertically in water such that its upper edge is 8 m below the free surface of water. The total hydrostatic pressure force on one side of the plate is

(1) 6·7 kN

(2) 65·4 kN

(3) 45·0 kN

(4) 77·0 kN

94. The flow in a river during the period of heavy rainfall is

(1) steady, uniform, two-dimensional

(2) unsteady, uniform, three-dimensional

(3) unsteady, non-uniform and three-dimensional

(4) steady, non-uniform and three-dimensional

95. A water supply pipe line changes its alignment through a bend. When the flow in the pipe line is increased by operating a valve, the flow in the bend is classified as

(1) unsteady, uniform flow

(2) unsteady, non-uniform flow

(3) steady, uniform flow

(4) steady, non-uniform flow

96. The continuity equation in fluid mechanics is a mathematical statement embodying the principle of

(1) conservation of energy

(2) conservation of mass

(3) conservation of momentum

(4) None of the above

97. The concept of stream function which is based on the principle of continuity is applicable to

(1) three-dimensional flow

(2) two-dimensional flow only

(3) uniform flow cases only

(4) irrotational flow only

98. The velocity potential function for a source varies with distance 'r' as

(1) $\frac{1}{r}$

(2) $\frac{1}{r^2}$

(3) e^r

(4) $ln\ r$

99. A stagnation point is a point

(1) where the pressure reduces to zero

(2) where the total energy is zero

(3) where the velocity of flow reduces to zero

(4) where the total energy is maximum

100. A venturimeter is a device based on the Bernoulli principle and is used for measuring

(1) piezometric head

(2) velocity head

(3) flow rate

(4) total energy

101. The total-energy-line is always higher than the hydraulic grade line. The vertical distance between the two represents

(1) the datum head

(2) the pressure head

(3) the velocity head

(4) the piezometric head

102. 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

103. 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

104. The existence of boundary layer is on account of

(1) fluid density

(2) gravitational effect

(3) fluid viscosity

(4) surface tension

105. Laminar flow through a circular tube was studied experimentally by

(1) Newton

(2) Pascal

(3) Hagen and Poiseuille

(4) Prandtl

106. 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

107. 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

108. 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) $f = \frac{64}{R}$

109. 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

110. 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) $3\pi/10000$

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

(1) Mouthpiece

(2) Cipolletti weir

(3) Venturimeter

(4) Pitot tube

112. 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

113. 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

114. 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) $C_d\ B \sqrt{2g}\ H^{3/2}$

115. 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

116. 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

117. 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

118. 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

119. 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

120. 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

121. An oil of specific gravity 0·7 and pressure 0·14 kgf/cm^2 will have the height of oil as

(1) 70 cm of oil

(2) 2 m of oil

(3) 20 cm of oil

(4) 80 cm of oil

122. The mean velocity in open channels can be estimated from the known velocity at the free surface. It is approximately equal to

(1) 0·88

(2) 0·75

(3) 0·65

(4) 1·10

123. The critical depth is the depth of flow at which

(1) the specific energy is maximum

(2) the unit discharge 'q' is minimum

(3) the specific energy is minimum

(4) the Froude number is greater than unity

124. In a subcritical flow, as the specific energy in a channel is decreased, the depth of flow

(1) also decreases

(2) increases

(3) does not vary

(4) approaches to a minimum value which corresponds to the minimum specific energy

125. In case of uniform flow in the channel, the water surface slope $\frac{dy}{dx}$ is equal to

(1) 1

(2) ∞

(3) 0

(4) 1000

126. A control section is one where a definite relationship between depth of flow and discharge exists. A critical depth section is a control section. Which of the following cases represents control sections ?

(i) Hydraulic jump

(ii) Flow under a sluice gate

(iii) Flow over a small hump

(iv) Overflow spillway

(v) Change of slope from mild to steep

(vi) Supercritical flow in channel

(1) ii, iv, v

(2) iv, v, vi

(3) v, iv, iii

(4) None of these

127. Mach number is a measure of compressibility effects in fluid flow. Indicate up to what mach number can a fluid flow be considered incompressible.

(1) 1

(2) 0·1

(3) 0·3

(4) 0·8

128. An isometric flow is one which is

(1) adiabatic

(2) isothermal

(3) isothermal and reversible

(4) adiabatic and irreversible

129. A shock wave which occurs in a supersonic flow represents a region in which

(1) there is no change in pressure, temperature and density

(2) there is sudden change in pressure, temperature and density

(3) a zone of silence exists

(4) velocity is zero

130. The sonic velocity in a fluid medium is directly proportional to

(1) square root of pressure

(2) square root of temperature

(3) density

(4) mach number

131. A fluid jet of cross-sectional area 'A' and velocity 'v' strikes a flat plate moving with a velocity 'u'. The fluid mass striking it for a second is

(1) ρAv

(2) $\rho A (v - u)$

(3) $\rho A (u - v)$

(4) $\rho A (v + u)$

132. The dynamic force exerted by a fluid of cross-section area 'A' and velocity 'v' on a moving flat plate held at right angles to the direction of jet is

(1) ρAvu

(2) $\rho A (v - u) u$

(3) $\rho A (v - u)^2$

(4) $\rho A (v + u) u$

'u' being the velocity of flat plate in the direction of the jet.

133. Turbines give best performance (i.e. work at peak efficiency) when they are operated at full or design load. The performance of many turbines deteriorates considerably at part loads. Which of the following turbines is best suited for operation at part loads ?

(1) Pelton turbine

(2) Francis turbine

(3) Propeller turbine

(4) Kaplan turbine

134. The power which appears in the expansion for the specific speed is

(1) the water horse power

(2) the horse power developed by the runner

(3) the shaft horse power (brake horse power)

(4) the power input to the turbine

135. The power obtainable from an impulse turbine is proportional to the number of nozzles used. A pelton turbine with six nozzles has a specific speed of 8·1. The specific speed per nozzle is

(1) 1·35

(2) 3·3

(3) 2

(4) 8·1

136. The difference between the power obtained from the turbine shaft and the power supplied by water at its entry to the turbine is equal to the

(1) hydraulic losses

(2) mechanical losses

(3) hydraulic and mechanical losses

(4) mechanical and volumetric losses

137. Cavitation, being related to occurrence of low pressure in flow, would definitely occur if

(1) the pressure anywhere in the flow approaches the atmospheric value

(2) the pressure anywhere in the flow falls to a value very close to the vapour pressure of the liquid at the prevailing temperature

(3) the pressure is lower than the vapour pressure

(4) None of the above

138. The velocity with which the water approaches a notch is called

(1) velocity of flow

(2) velocity of approach

(3) velocity of whirl

(4) None of the above

139. Power transmitted through pipes will be maximum when head lost due to friction is equal to

(1) $\frac{1}{2}$ total head at the inlet of the pipe

(2) $\frac{1}{4}$ total head at the inlet of the pipe

(3) total head at the inlet of the pipe

(4) $\frac{1}{3}$ total head at the inlet of the pipe

140. A body is called a stream lined body when it is placed in a flow and the surface of the body

(1) coincides with the stream lines

(2) does not coincide with the stream lines

(3) is perpendicular to the stream lines

(4) is inclined to the stream lines

141. The entrance length or length of establishment of flow is

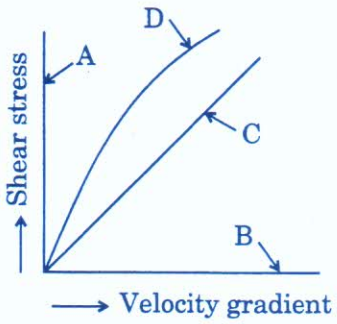
(1) the pipe length inside the reservoir

(2) the initial length in which the flow develops fully such that the velocity profile does not change downstream

(3) the length in which the boundary layer remains uniform

(4) the length of pipe from its entrance in which the flow may be assumed irrotational

142. Curve-D in Fig. corresponds to



(1) ideal fluid

(2) Newtonian fluid

(3) non-Newtonian fluid

(4) non-ideal fluid

143. The energy loss in pipe lines is due to

(1) viscous action

(2) surface roughness only

(3) friction offered by pipe walls as well as by the various actions

(4) turbulent shear stress alone

144. In flow through pipe bends, the pressure on inner and outer radii

(1) do not vary and are the same as at the centre of pipe

(2) vary, it being more on the inner one

(3) are different; pressure increases with increase in radius and is, therefore, more at the outer radius

(4) stand at the same level increasing gradually towards the pipe centre

145. Vorticity is given by _____ times the rotation.

(1) 1

(2) 2

(3) 3

(4) 4

146. The condition for maximum transmission of power through a pipe line is that one-third of the available head must be consumed in friction. The corresponding efficiency of pipe line is

(1) 66·67%

(2) 33·3%

(3) 100%

(4) $\sqrt{2}/33$

147. In order to have a continuous flow through a siphon, no portion of the pipe should be higher than

(1) 10 m

(2) 10·33 m

(3) 5·5 m

(4) 7·75 m

148. Water hammer is a phenomenon which is caused by

(1) sudden opening of a valve in a pipe line

(2) sudden closing of a valve in a pipe line

(3) incompressibility of fluid

(4) the pipe material being elastic

149. A surge tank is a device connected to the penstock pipe line and installed as close to the powerhouse as the topography of the area permits. The main function of the surge tank is to

(1) restrict the water hammer effects to a small length of penstock

(2) provide a free-water surface near the turbines

(3) act as a reservoir

(4) protect the penstock pipe line from bursting

150. The difference in pressure head, measured by a mercury water differential manometer for a 20 cm difference of mercury level will be

(1) 2·72 m

(2) 2·52 m

(3) 2·0 m

(4) 0·2 m