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Question Booklet Series

Question Booklet **D**

CIVIL ENGINEERING/TECHNOLOGY

(Objective)

Time Allowed : 2 Hours | **Maximum Marks : 50**

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **100** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. **Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet and the Booklet contains 20 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this Booklet, get it replaced immediately by a complete Booklet of the same series.**
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An OMR Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. **You must write your Name, Roll No. and other particulars on the first page of the OMR Answer Sheet provided, failing which your OMR Answer Sheet will not be evaluated.**
7. You will encode your **Roll Number** and the **Question Booklet Series A, B, C or D** as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on **Page–2** of your OMR Answer Sheet. **If you do not encode or fail to encode the correct series of your Question Booklet, your OMR Answer Sheet will not be evaluated correctly.**
8. Questions and their responses are printed in English only in this Booklet. Each question comprises **four** responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your OMR Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the OMR Answer Sheet.
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11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

SEAL

1. The function $F(z)=\frac{1}{(z+1)(z+3)}$ in the domain $|z|>3$ has a Laurent's expansion given by

(A) $\frac{1}{z^2}-\frac{2}{z^3}+\frac{13}{z^4}-\frac{20}{z^5}+\cdots$

(B) $\frac{1}{z^2}-\frac{8}{z^3}+\frac{13}{z^4}-\frac{40}{z^5}+\cdots$

(C) $\frac{1}{z^2}-\frac{4}{z^3}+\frac{13}{z^4}-\frac{40}{z^5}+\cdots$

(D) $\frac{1}{z^2}-\frac{4}{z^3}+\frac{13}{z^4}-\frac{20}{z^5}+\cdots$

2. The function $\sin z$ is analytic in

(A) $C\cup\{\infty\}$

(B) C except on the negative real axis

(C) $C-\{0\}$

(D) C

3. Which of the following measures of central tendency is not affected by extreme value?

(A) Arithmetic mean

(B) Median

(C) Geometric mean

(D) Harmonic mean

4. The standard deviation of the wages of 85 employees is ₹ 15·40. After one year, each of them is given an increment of ₹ 25. The standard deviation of new wages is

(A) ₹ 15·40

(B) ₹ 40·40

(C) ₹ 20·40

(D) ₹ 10·40

5. If X is a Poisson random variable with $P(X=1)=2P(X=3)$, then what is the expected value of X ?

(A) 3

(B) $\sqrt{3}$

(C) $\sqrt{6}$

(D) 2

6. Find the inverse Laplace transform of $\log\left(\frac{1+s}{s}\right)$.

(A) $\frac{1}{t}(1+e^{-t})$ (B) $\frac{1}{t}(1-e^{-t})$

(C) $\frac{1}{t}(1-e^{t})$ (D) $\frac{1}{t}(1+e^{t})$

7. The Laplace transformation of $f(t) = |t-1| + |t+1|$, $t \geq 0$ is

(A) $\frac{1}{s}\left(1+\frac{e^{-s}}{s}\right)$ (B) $\frac{1}{s}\left(1-\frac{e^{s}}{s}\right)$

(C) $\frac{2}{s}\left(1+\frac{e^{-s}}{s}\right)$ (D) $\frac{2}{s}\left(1+\frac{e^{s}}{s}\right)$

8. A body weighing 4·9 kg is hung from a spring. A pull of 10 kg will stretch the spring to 5 cm. The body is pulled down 6 cm below the static equilibrium position and then released. Then the maximum velocity and the period of oscillation are

(A) 1·2 m/sec, 0·314 sec

(B) 1·3 m/sec, 1·314 sec

(C) 1·2 m/sec, 0·369 sec

(D) 1·2 m/sec, 0·325 sec

9. The particular integral of the following differential equation

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$$

is

(A) $-e^x(x\sin x + 2\cos x)$

(B) $-e^x(\sin x + \cos x)$

(C) $-e^x(\sin x + 2\cos x)$

(D) $-e^x(x\sin x + \cos x)$

10. If $r = |\vec{r}|$; where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then which of the following is true?

(A) $\nabla f(r) = f(r)\,\nabla r$

(B) $\nabla \log r = \frac{\vec{r}}{r^2}$

(C) $\nabla(e^{r^2}) = 2e^r\vec{r}$

(D) grad $|\vec{r}|^2 = r \cdot \vec{r}$

11. Which of the following is not true?

(A) curl (curl $\vec{v}$) = grad div $\vec{v} - \nabla^2\vec{v}$

(B) grad (div $\vec{v}$) = curl (curl $\vec{v}$) + $\nabla^2\vec{v}$

(C) $\nabla \times (\nabla \times \vec{v}) = \nabla(\nabla \cdot \vec{v}) - \nabla^2\vec{v}$

(D) $\nabla(\nabla \cdot \vec{v}) = \nabla \cdot (\nabla \times \vec{v}) + \nabla^2\vec{v}$

12. Which of the following statements is true for Stokes' theorem?

(A) $\vec{F} = (x^2+y^2)\hat{i} - 2xy\hat{j}$ taken round the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$

(B) $\vec{F} = (x^2+y^2)i - 2xy\hat{j}$ taken round the rectangle bounded by the lines $x = a$, $y = 0$, $y = b$

(C) $\vec{F} = (x^2+y^2)i - 2xy\hat{j}$ taken round the rectangle bounded by the lines $x = 0$, $y = 0$

(D) $\vec{F} = (x^2+y^2)\hat{i} - 2xy\hat{j}$ taken round the rectangle bounded by the lines $x = 2$, $y = 3$

13. Let B be a 5×3 matrix and let C be a 3×5 matrix, both with real entries. Set $A = BC$. Then the possible value of the rank of A when both B and C have rank 2 is

(A) 0

(B) 1

(C) 1 or 2

(D) 2

14. Let Γ be a simple closed curve in the complex plane and let z_0 be a point in the interior of this curve. Then the value of

$$\int_\Gamma \frac{z^3+2z}{(z-z_0)^3}dz$$

is

(A) $12\pi iz_0$

(B) $3\pi iz_0$

(C) $6\pi iz_0$

(D) $9\pi iz_0$

15. The extremal function $y(x)$ of the integral $\int_0^1 (y^2-(y')^2)dx$ is

(A) $y(x) = A\cos x + B\sin x$

(B) $y(x) = Ae^x + Be^{-x}$

(C) $y(x) = A\cosh x + B\sinh x$

(D) $y(x) = Ae^{-x} + Be^{-2x}$

16. All the possible solutions (λ, u), where $\lambda \in R$ and $u \neq 0$, to the boundary value problem

$$u''(x)+\lambda u(x) = 0,\ x \in (0, 1),$$
$$u(0) = u(1) \text{ and } u'(0) = u'(1)$$

are

(A) $\lambda = 0$ and u = constant :

$$\lambda = 4n^2\pi^2 \text{ and}$$
$$u_n = A\cos 2n\pi x + B\sin 2n\pi x,\ n \in N$$

(B) $\lambda = 0$ and u = constant :

$$\lambda = 4n\pi^2 \text{ and}$$
$$u_n = A\cos 2n\pi x + B\sin 2n\pi x,\ n \in N$$

(C) $\lambda = 0$ and u = constant :

$$\lambda = 4n\pi^2 \text{ and}$$
$$u_n = A\cos \pi nx + B\sin \pi nx,\ n \in N$$

(D) $\lambda = 0$ and u = constant :

$$\lambda = 4n^2\pi^2 \text{ and}$$
$$u_n = A\cos 2\pi nx + B\sin 2\pi nx,\ n \in N$$

17. If $u = f(y/x)$, then which of the following is true?

(A) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$

(B) $y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 0$

(C) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$

(D) $y\frac{\partial u}{\partial x} + x\frac{\partial u}{\partial y} = 1$

18. Let f be a function of two variables and

$$r=\frac{\partial^2 f}{\partial x^2},\quad s=\frac{\partial^2 f}{\partial x\,\partial y},\quad t=\frac{\partial^2 f}{\partial y^2}$$

then the function f has minimum value if

(A) $rt-s^2\geq 0$ and $r>0$

(B) $rt-s^2>0$ and $r<0$

(C) $rt-s^2<0$ and $r>0$

(D) $rt-s^2>0$ and $r>0$

19. If $u=x^2-y^2$, then a corresponding analytic function is

(A) $f(z)=z+c$

(B) $f(z)=z^2$

(C) $f(z)=z^2+c$

(D) $f(z)=z$

20. The solution of the simultaneous equations

$3x+2y+7z=4;\ 2x+3y+z=5$ and $3x+4y+z=7$

is

(A) $x=\frac{7}{8},\ y=-\frac{9}{8},\ z=-\frac{1}{8}$

(B) $x=-\frac{7}{8},\ y=\frac{9}{8},\ z=\frac{1}{8}$

(C) $x=\frac{7}{8},\ y=\frac{9}{8},\ z=-\frac{1}{8}$

(D) $x=\frac{7}{8},\ y=-\frac{9}{8},\ z=\frac{1}{8}$

21. Given a wave equation

$$\frac{\partial^2 Z}{\partial y^2}=C^2\frac{\partial^2 Z}{\partial x^2}$$

By separation of variables, let $Z(x,\ y)=X(x)Y(y)$ be a solution of wave equation, substituting it in wave equation, one gets

$$\frac{d^2X}{dx^2}-kX=0 \text{ and } \frac{d^2Y}{dy^2}-kc^2Y=0$$

If $k=0$, then the solution is (c's are constants)

(A) $Z(x,\ y)=c_1x+c_2$

(B) $Z(x,\ y)=c_1x$

(C) $Z(x,\ y)=(c_1x+c_2)(c_3x+c_4)$

(D) $Z(x,\ y)=(c_1x+c_2)(c_3y+c_4)$

22. The heights in centimetres of 5 students are 165, 175, 176, 159 and 170. The sample mean and sample median are respectively

(A) 169, 170

(B) 170, 170

(C) 170, 169

(D) 169, 176

23. The boundary value problem $-u'' = 2x$ with boundary conditions $u(1) = 0 = u(0)$ has

(A) unique solution

(B) multiple solutions

(C) no solution

(D) infinitely many solutions

24. Let f be a function defined by

$$f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

then $f'(0)$ is equal to

(A) 0

(B) 1

(C) Does not exist

(D) None of the above

25. Let A be a 3×3 matrix, where the eigenvalues are -1, 1, 2. The values of α, β, γ satisfying are given by

(A) $\alpha = \frac{1}{2}, \beta = 1, \gamma = \frac{1}{2}$

(B) $\alpha = -\frac{1}{2}, \beta = 1, \gamma = \frac{1}{2}$

(C) $\alpha = \frac{1}{2}, \beta = -1, \gamma = \frac{1}{2}$

(D) $\alpha = -\frac{1}{2}, \beta = 1, \gamma = -\frac{1}{2}$

26. The solution of the differential equation

$$(x^3 - 3xy + y^2)\frac{dy}{dx} + xy = 0$$

is given by

(A) $y(1-y) = A(y-2x)$

(B) $y^2(x-y) = A(y-2x)^2$

(C) $y(x-y)^2 = A(y-2x)$

(D) $y(x-y) = A(y-2x)^2$

27. If $\left|\frac{z-5i}{z+5i}\right| = 1$, then $z = x + iy$ lies on

(A) the real axis

(B) the straight line $x = 5$

(C) the straight line $y = 5$

(D) a circle passing through the origin

28. The order and degree of the differential equation

$$\frac{d^2y}{dx^2} + y + \sqrt{1 + \left(\frac{dy}{dx}\right)^3} = 0$$

are

(A) first order and second degree

(B) first order and first degree

(C) second order and first degree

(D) second order and second degree

29. The nth divided difference of a polynomial of nth degree is

(A) constant

(B) zero

(C) variable

(D) linear

30. Which of the following is true for backward difference operator?

(A) $\nabla^n f(x) = \sum_{r=0}^{n} {}^nC_r f(x - rh)$

(B) $\nabla^n f(x) = \sum_{r=0}^{n} (-1)^{n-r} f(x - rh)$

(C) $\nabla^n f(x) = \sum_{r=0}^{n} (-1)^{n-r} {}^nC_r (x - rh)$

(D) None of the above

31. The function $f(x) = |x|$ at the origin is

(A) continuous

(B) differentiable

(C) discontinuous

(D) None of the above

32. The product of the eigenvalues of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

is

(A) 0

(B) 1

(C) -1

(D) 2

33. What is the volume bounded by the cylinder $x^2 + y^2 = 4$ and planes $y + z = 3$ and $z = 0$?

(A) 6π

(B) 12π

(C) 9π

(D) 18π

34. Defined

$$f(x) = \begin{cases} 1, & \text{when } x \text{ is rational} \\ 0, & \text{when } x \text{ is irrational} \end{cases}$$

Then f is

(A) continuous at $x = 1$

(B) discontinuous at $x = 0$

(C) discontinuous at each x

(D) None of the above

35. Let $a > 0$ and let

$S = \{(x, y, z) \in \mathbb{R}^3 ; x^2 + y^2 + z^2 = a^2\}$

The value of $\iint_S (x^4 + y^4 + z^4)\, dS$ is

(A) $\frac{12}{5} a^6$

(B) $\frac{12}{5} \pi a^5$

(C) $\frac{12}{5} \pi a^6$

(D) $\frac{12}{5} \pi a^4$

36. The value of

$\iint_{R^2} e^{-(3x+2y)^2 - (4x+y)^2}\, dx\, dy$

is

(A) $\pi / 5$ (B) $\pi / 3$

(C) $\pi / 6$ (D) $\pi / 2$

37. A fair coin is tossed ten times. What is the probability that we can observe a string of eight heads, in succession, at some time?

(A) 2^{-5}

(B) 2^{-7}

(C) 2^{-9}

(D) 2^{-8}

38. Simpson's rule gives the exact value of $\int_0^1 P(t)\, dt$ for every polynomial of degree less than or equal to

(A) 1

(B) 2

(C) 3

(D) 4

39. If $x_1 = \begin{bmatrix} 1 \\ i \end{bmatrix}$, $x_2 = \begin{bmatrix} i \\ 1 \end{bmatrix}$ are given vectors and

$A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and if $P = [x_1, x_2]$

then $P^{-1}AP$ is

(A) $\begin{bmatrix} e^{i\theta} & 0 \\ 0 & e^{-i\theta} \end{bmatrix}$ (B) $\begin{bmatrix} e^{-i\theta} & 0 \\ 0 & e^{i\theta} \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$

40. T is non-singular matrix iff

(A) Nullity $(T) \neq 0$

(B) Nullity $(T) = 0$

(C) Nullity (T) = Rank (T)

(D) Rank $(T) = 0$

41. If the length of a cantilever carrying an isolated load at its free end is doubled, then the deflection of the free end will be

(A) 8 times

(B) 1/8 times

(C) 3 times

(D) 1/3 times

42. The ratio of maximum velocity to average velocity of viscous fluid through a circular pipe is

(A) 0·5

(B) 0·75

(C) 1·25

(D) 2

43. A piezometer opening in pipes measures

(A) velocity head

(B) static pressure

(C) total pressure

(D) negative static pressure

44. The phenomenon occurring in an open channel when a rapidly flowing stream abruptly changes to a slowly flowing stream causing a distinct rise of liquid surface, is

(A) water hammer

(B) hydraulic jump

(C) critical discharge

(D) None of the above

45. The ratio of the inertia and gravitational force acting in any flow, ignoring other forces, is called

(A) Euler number

(B) Froude number

(C) Reynolds number

(D) Weber number

46. Flow in pipes is laminar, if Reynolds number is

(A) less than 2100

(B) more than 3000

(C) between 2100 and 3000

(D) None of the above

47. For most economical rectangular section of a channel, the depth is

(A) kept one-fourth of the width

(B) kept three times the hydraulic radius

(C) kept half of the width

(D) hydraulic mean depth

48. The dimensions of the dynamic viscosity (μ) are

(A) MLT^{-2}

(B) $M^{-1}L^{-1}T^{-1}$

(C) $ML^{-1}T^{-1}$

(D) MLT^{-1}

49. The diameter of longitudinal bars of a column should never be less than

(A) 6 mm

(B) 8 mm

(C) 10 mm

(D) 12 mm

50. The effective span of a simply supported slab, is

(A) distance between the centres of the bearings

(B) clear distance between the inner faces of the walls plus twice the thickness of the wall

(C) clear span plus effective depth of the slab

(D) None of the above

51. For initial estimate for a beam design, the width is assumed

(A) 1/15th of span

(B) 1/20th of span

(C) 1/25th of span

(D) 1/30th of span

52. The transverse reinforcements are provided at right angles to the main reinforcement to

(A) distribute the load

(B) resist the temperature stress

(C) resist the shrinkage stress

(D) All of the above

53. The shear reinforcement in RCC is provided to resist

(A) vertical shear

(B) horizontal shear

(C) diagonal compression

(D) diagonal tension

54. In a singly reinforced beam, if the permissible stress in concrete reaches earlier than that in steel, the beam section is called

(A) under-reinforced section

(B) over-reinforced section

(C) economic section

(D) critical section

55. The minimum clear cover for RCC columns shall be

(A) greater of 40 mm or diameter of the main reinforcement

(B) smaller of 40 mm or diameter of the main reinforcement

(C) greater of 25 mm or diameter of the main reinforcement

(D) smaller of 25 mm or diameter of the main reinforcement

56. The stress which is responsible for retaining water in capillary tube above the free water surface of the water body in which the capillary tube is inserted, is

(A) capillary compression

(B) capillary tension

(C) capillary pore pressure

(D) None of the above

57. A coarse grained soil has void ratio of 0·75 and specific gravity of 2·75. The critical gradient at which quicksand condition occurs, is

(A) 0·75

(B) 0·50

(C) 1

(D) 0·25

58. In a compaction test, with the increase in compactive effort

(A) both maximum dry density and optimum moisture content increase

(B) both maximum dry density and optimum moisture content decrease

(C) maximum dry density increases but optimum moisture content decreases

(D) maximum dry density decreases but optimum moisture content increases

59. The negative skin friction on a pile

(A) acts downward and increases the load-carrying capacity of the pile

(B) acts upward and increases the load-carrying capacity of the pile

(C) acts downward and reduces the load-carrying capacity of the pile

(D) acts upward and reduces the load-carrying capacity of the pile

60. The soil which is transported by the running water is called

(A) aeolian soil

(B) alluvial soil

(C) marine soil

(D) lacustrine soil

61. Which of the following properties of soil is the measure of particle size range?

(A) Effective size

(B) Uniformity coefficient

(C) Coefficient of curvature

(D) None of the above

62. The ratio of settlement at any time t to the final settlement is known as

(A) coefficient of consolidation

(B) degree of consolidation

(C) compression index

(D) None of the above

63. Cohesive soil is

(A) good for backfill because of low lateral pressure

(B) poor for backfill because of large lateral pressure

(C) good for backfill because of high shear strength

(D) None of the above

64. Taylor's stability number is given by

(A) $\frac{F_c}{c\gamma H}$

(B) $\frac{\gamma H}{cF_c}$

(C) $\frac{c}{F_c\gamma H}$

(D) $\frac{H}{cF_c\gamma}$

65. The ultimate bearing capacity of a purely cohesive soil at ground surface for a rough based footing as given by Terzaghi, is

(A) $5{\cdot}7c_u$

(B) $5{\cdot}14c_u$

(C) $5{\cdot}14c_u + \gamma D_f$

(D) None of the above

66. The total lateral pressure on the vertical face of a retaining wall of height h (levelled backfill) acts parallel to the free surface and from the base at a height of

(A) $h/4$

(B) $h/3$

(C) $h/2$

(D) $2h/3$

67. Clayey soil is best compacted by

(A) sheep foot rollers

(B) vibratory rollers

(C) heavy drum rollers

(D) ramming and pneumatic tampings

68. In plastic analysis, the shape factor for circular sections, is

(A) 1·5

(B) 1·6

(C) 1·697

(D) None of the above

69. The most economical section for a column, is

(A) rectangular

(B) solid round

(C) flat strip

(D) tubular section

70. If the depths of two column sections are equal, then the column splice is provided

(A) with filler plates

(B) with bearing plates

(C) with filler and bearing plates

(D) None of the above

71. For a column of height L fixed in position and direction both at its top and bottom, its effective length, is

(A) L

(B) $2L$

(C) $\frac{1}{2}L$

(D) None of the above

72. Aerobic bacteria

(A) flourish in the presence of free oxygen

(B) consume organic matter as their food

(C) oxidize organic matter in sewage

(D) All of the above

73. Biochemical Oxygen Demand (BOD) for the first 20 days is generally referred to

(A) initial demand

(B) first stage demand

(C) carbonaceous demand

(D) All of the above

74. Chlorination of water is done for the removal of

(A) bacteria

(B) suspended solids

(C) sediments

(D) hardness

75. The most dangerous pollutant in vehicular emissions is

(A) CO

(B) SO_2

(C) CO_2

(D) O_3

76. The gas evolved in sewers is

(A) carbon dioxide

(B) hydrogen sulphide

(C) methane

(D) All of the above

77. The maximum superelevation on hill roads should not exceed

(A) 5%

(B) 7%

(C) 8%

(D) 10%

78. The type of transition curves generally provided on hill roads, is

(A) circular

(B) cubic parabola

(C) lemniscate

(D) spiral

79. For a vehicle moving with a speed of 80 km per hour, the brake reaction time, in ordinary cases, is

(A) 1 sec

(B) 1·5 sec

(C) 2 sec

(D) 2·5 sec

80. The road foundation for modern highways construction, was developed by

(A) Tresaguet

(B) Telford

(C) McAdam

(D) Telford and McAdam simultaneously

81. When a canal is carried over a natural drainage, the structure provided, is known as

(A) syphon

(B) aqueduct

(C) superpassage

(D) syphon-aqueduct

82. The intensity of irrigation means

(A) percentage of culturable commanded area to be irrigated annually

(B) percentage of gross commanded area to be irrigated annually

(C) percentage of the mean of culturable commanded area and the gross commanded area to be irrigated annually

(D) total depth of water supplied by the number of waterings

83. According to Khosla, the exit gradient of surface flow

(A) depends upon the b/d ratio

(B) is independent of the b/d ratio

(C) is independent of the depths of d/s cutoff walls

(D) None of the above

84. A counterberm is

(A) a horizontal benching provided on the inside slope

(B) a horizontal benching provided on the outside slope

(C) a vertical benching provided on the outer edge of the bank

(D) a vertical benching provided on the inner edge of the bank

85. Coning of wheels is provided

(A) to check lateral movement of wheels

(B) to avoid damage to inner faces of rails

(C) to avoid discomfort to passengers

(D) All of the above

86. Bull-headed rails are generally provided on

(A) points and crossing

(B) straight tangents

(C) curved tracks

(D) metre gauge tracks

87. The most commonly used pump for lifting water in water supply mains, is

(A) axial flow pump

(B) reciprocating pump

(C) rotary type pump

(D) centrifugal pump

88. The permissible pH value for public water supplies may range between

(A) 4·5 to 5·5

(B) 5·5 to 6·5

(C) 6·5 to 8·5

(D) 8·5 to 10·5

89. Closed contours of decreasing values towards their centre, represent

(A) a hill

(B) a depression

(C) a saddle or pass

(D) a riverbed

90. A relatively fixed point of known elevation above datum, is called

(A) benchmark

(B) datum point

(C) reduced level

(D) reference point

91. The method of finding out the difference in elevation between two points for eliminating the effect of curvature and refraction, is

(A) reciprocal levelling

(B) precise levelling

(C) differential levelling

(D) flying levelling

92. The curvature of the earth's surface, is taken into account only if the extent of survey is more than

(A) 100 sq. km

(B) 160 sq. km

(C) 200 sq. km

(D) 260 sq. km

93. A rectangular bar of width b and height h is being used as a cantilever. The loading is in a plane parallel to the side b. The section modulus is

(A) $\frac{bh^2}{6}$

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

(C) $\frac{hb^2}{6}$

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

94. If the shear force along a section of a beam is zero, the bending moment at the section is

(A) zero

(B) maximum

(C) minimum

(D) average of maximum and minimum

95. The shape of the bending moment diagram over the length of a beam, carrying a uniformly distributed load is always

(A) linear

(B) parabolic

(C) cubical

(D) circular

96. Which of the following is/are correct?

(A) A ductile material has large plastic zone.

(B) A brittle material has no plastic zone.

(C) A rigid material has no plastic zone.

(D) All of the above

97. A beam of length L is pinned at both ends and is subjected to a concentrated bending moment M at its centre. The maximum bending moment in the beam is

(A) M

(B) $M/2$

(C) $M/3$

(D) $ML/2$

98. According to Unwin's formula, the diameter d of a rivet of a plate of thickness t is

(A) $d = 6{\cdot}05t$

(B) $d = 1{\cdot}5t + 4$

(C) $d = 5t$

(D) $d = t + 1{\cdot}5$

99. If a shaft is simultaneously subjected to a torque T and a bending moment M, then the ratio of the maximum bending stress and the maximum shearing stress is

(A) M/T

(B) T/M

(C) $2M/T$

(D) $2T/M$

100. n and j are numbers of members and joints in a frame. It contains redundant members if

(A) $n = 2j - 3$

(B) $n < 2j - 3$

(C) $n < j - 3$

(D) $n > 2j - 3$

★★★