PART-A

1. Which of the following best expresses the meaning of 'Exasperate'?
A) Elevate
B)-Irritate
C) Distrust
D) Transcend

2. Which of the following is opposite in meaning to the word 'Captivate"?
A) Canvass
B) Fascinate
C) Offend
D) Campaign

3. Which of the alternatives best expresses the meaning of the underlined phrase in the following sentence?
Sheetal is in the habit of taking French leave very often.
A) Taking sick leave
B) Taking extra ordinary leave
C) Taking leave on medical grounds
D) Taking leave without permission

4. Below are given three statements, such as P, Q, and R, followed by four conclusions. You have to take the given statements to be true even if they appear to be at variance with commonly known facts and then decide which of the conclusions logically follow(s) from the given statements.
Statements
P. All books are notes.
Q. Some notes are watches.
R. No watch is a pencil.
Conclusions
I. Some watches are books.
II. Some notes are pencils.
III. No watch is a book.
IV. Some notes are not pencils.
A) I and either II or IV follow
B) I, III and IV follow
C) I, II and III follow
D) Either I or III and IV follow

5. At which of the following places is the Indian National Defence University being set up?
A) Hyderabad, Telangana
B) Bhubaneswar, Odisha
C) Gurgaon, Haryana
D) Jodhpur, Rajasthan

6. Who was the last Hindu king of North India?
A) Pushyabhuti
B) Harshavardhana
C) Pushyamitra
D) Skandagupta

7. Which one of the following travelers visited India during the Gupta period?
A) Hiuen-Tsang
B) Fa-Hien
C) Marco Polo
D) Nicolo Conti

8. The 'International Day of Older Persons' is observed every year on
A) 1st October
B) 2nd October
C) 3rd October
D) 4th October

9. Santosh Trophy is related to
A) Cricket
B) Hockey
C) Football
D) Badminton

10. What is the full form of HTTP in data communication?
A) Hardware Test Trial Protocol
B) Hyper Text Transfer Package
C) Hyper Text Transfer Protocol
D) Hyphenated Text Transfer Protocol

11. Language of the Preamble of the Indian Constitution has been borrowed from
A) US
B) Canada
C) Australia
D) Ireland

12. Which of the following terms is used in banking or finance?
A) Moral Suasion
B) Nelson
C) Jacksonian Seizure
D) Incarnation

13. The Nawabganj Bird Sanctuary in Uttar Pradesh has been renamed after
A) Govind Ballabh Pant
B) Ashfaqullah Khan
C) Ram Prasad Bismil
D) Chandrashekhar Azad

14. $1^3 + 7^3 + 13^3 = ?$
A) 254
B) 2541
C) 2540
D) 25400

15. If a sum of money doubles itself in 6 years, it becomes 5 times in how many years?
A) 12 years
B) 24 years
C) 10 years
D) 13 years

16. A mixture of 40 litres of milk and water contains 10% water. How much water should be added to it so that water may be 20% in the new mixture?
A) 50
B) 150
C) 200
D) 375

17. Three years ago, the average age of a family of five members was 16 years. A baby having been born, the average age of the family is now the same as before. Find the age of the baby.
A) One year
B) Two years
C) Three years
D) Four years

18. The speed of a car is increased by 2 km every one hour. If the distance travelled in the first hour was 35 km, what was the total distance travelled in 12 hours?
A) 562 km
B) 552 km
C) 482 km
D) 662 km

19. Ashish drives his car _extremely_ fast when there is rainfall.
The underlined word is an example of
A) Noun
B) Adverb
C) Adjective

D) Pronoun

20. Which of the following is correctly spelt?

A) Commodious

B) Commodius

C) Commodous

D) Commodos

21. Which part of the following sentence contains error?

A) Never I have listened /

B) to such beautiful music /

C) as the piece we heard /

D) on the radio last night.

22. Which of the alternatives is correct, if the following sentence is changed into passive voice?
Open your door.

A) Your door has opened.

B) Has your door be opened?

C) Let your door be opened.

D) Let's open your door.

23. Which part of the following sentence contains error?

A) Ganges, one of the most sacred rivers /

B) to Hindus, /

C) is a trans-boundary river of Asia /

D) which flows through the nations of India and Bangladesh

24. He has_____fear of heights.

A) A

B) An

C) The

D) None of the above

25. Select the correct plural of 'arch'

A) Arches

B) Archs

C) Archees

D) Arch

PART-B

26. The integral $\int_{Z|=2} \frac{\cos z}{z^3} dz$ equals

A) πi

B) $-\pi i$

C) $2\pi i$

D) $-2\pi i$

27. For every path between the limits. $\int_{-2}^{-2+4}(2+z)^2 dz$ is equal to

A) $i/3$

B) $i/2$

C) $-i/3$

D) $-i/4$

28. The value of $\int_0^{2+i}(\overline{z})\ dz$ along the line $2y\ = x$ is

A) $\frac{5}{3}(2+i)$

B) $\frac{5}{3}(2-i)$

C) $2-i$

D) none of these

29. The diagonal elements of Hermitian matrix are

A) complex number

B) real number

C) natural number

D) none of these

30. The vectors $(1/4, 0, -1/4), (1/3, -1/3, 0))$ and $(0, 1/2, 1/2)$ are

A) linearly independent,

B) linearly dependent

C) constant

D) none of these

31. If A and B are two matrices then

A) $rank\ (AB)\ =\ rank\ (B^T A^T)$

B) $rank\ (AB)\ =\ rank(A^T B^T)$

C) $rank\ (AB)\ not\ equal\ to\ rank\ Rank\ (AB)^T$

D) none of these

32 The value of determinant $\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix}$ is

A) abc

B) $a^2b^2c^2$

C) $bc\ +\ ca\ +\ ab$

D) $zero$

33. If V is n dimensional vector space then any subset of V containing m vectors is linearly independent if

A) $m < n$

B) $n < m$

C) $m = n$

D) None of these

34. The singleton set $\{\alpha\}$ is linearly independent iff

A) $\alpha = 0$

B) $\alpha \neq 0$

C) α is a scalar

D) None of these

35. If V is finite dimensional vector space and W is any other vector space both over the same field F and $T : V \rightarrow W$ is a linear transformation then

A) $rank\ (T)\ +\ nullity\ (T)\ =\ dim\ V$

B) $rank\ (T)\ =\ dim\ V + nullity\ (T)$

C) $rank\ (T)\ +\ dim\ (V)\ =\ nullity\ (T)$

D) $rank\ (T)\ =\ nullity\ (T)$

36. The system of equations $\begin{array}{c} 2z + y = 5 \\ x - 3y = -1 \\ 3x + 4y = k \end{array}$ is consistent when $k =$

A) 1

B) 2

C) 5

D) 10

37. If $A = \begin{bmatrix} 3 & 2 & -1 \\ 2 & 2 & -1 \\ 2 & 2 & 0 \end{bmatrix}$ then the characteristic polynomial for A is

A) $x^3 + 5x + 8x + 4$

B) $x^2 + 5x$

C) $x^3 - 5x + 8x - 4$

D) None of these

38. If two vectors are linearly dependent then for some scalar c

A) $\alpha = c\beta$

B) $c + \beta$

C) $\alpha = c - \beta$

D) None of these

39. A matrix M has eigen value values 1 and 4 with corresponding eigen vectors $(1, -1)^T$ and $(2, 1)^T$ respectively. Then M is

A) $\begin{pmatrix} -4 & -8 \\ 5 & 9 \end{pmatrix}$

B) $\begin{pmatrix} 9 & -8 \\ 5 & -4 \end{pmatrix}$

C) $\begin{pmatrix} 2 & 2 \\ 1 & 3 \end{pmatrix}$

D) $\begin{pmatrix} 3 & 2 \\ 1 & 2 \end{pmatrix}$

40. If V is the vector space of $m \times n$ matrices over the field K then dim V is
A) n
B) m
C) mn
D) $m - n$

41. If M is a 7×5 matrix of rank 3 and N is a 5×7 matrix of rank 5 then rank MN is
A) 1
B) 2
C) 5
D) 3

42. The eigen values of a skew-symmetric matrix are
A) always zero
B) always pure imaginary
C) either zero or imaginary
D) always real

43. The system of simultaneous linear equations $x + y + z = 0$ and $x - y - z = 0$ has
A) no solution in R^3
B) a unique solution R^3
C) infinitely many solutions in R^3
D) more than 2 but finitely many solutions in R^3

44. If $A = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}$ and I is the 2×2 identity matrix then which of the following the zero matrix?
A) $A^2 - A - 5I$
B) $A^2 + A - 5I$
C) $A^2 + A - I$
D) $A^2 - 3A + 5I$

45. The rank of the linear transformation $T: R^3 \rightarrow R^2$ defined by $T(x\ y\ z\ )T(x\ y\ z) = (y\ 0\ z)$ is
A) 0
B) 1
C) 2
D) 3

46. Let $(Z,*)$ be an algebraic structure, where Z is the set of integers and the operation"*" is a binary operation defined by $n * m == max\{n.m\}$. Then (Z, *) is a
A) groupoid
B) semigroup
C) monoid

D) group

47. Let (G, *) be an algebraic structure where G is the set of all non-zero real numbers and '*' is a binary operation defined by $a * b = \frac{ab}{4}$ for all $a.b \in G$. Then the inverse of 'a' in G is

A) $\frac{a}{4}$

B) $16a$

C) $\frac{16}{a}$

D) $\frac{4}{a}$

48, If (G, o) be a group and for all $a, b \in G, (aob)^2 = a^2 oh^2$ then (G, o) is a
A) normal sub group
B) abelian group
C) quotient group
D) lagrange group

49. Every sub group of an Abelian group 'G' is a
A) conjugate group
B) associative group
C) normal sub group
D) lagrange group

50. If H, K are two subgroups of a group G then HK is a subgroup of G iff
A) $HK \neq KH$
B) $HK \subset KH$
C) $HK \supset KH$
D) $HK = KH$

51. The inverse of an even permutation is
A) odd permutation
B) even permutation
C) even or odd permutation
D) none of these

52. The product of permutations (1 2 3) (2 4 3) (1 3 4) is
A) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 2 & 1 \end{pmatrix}$
B) $\begin{pmatrix} 1 & 2 & 5 & 3 \\ 1 & 6 & 5 & 4 \end{pmatrix}$
C) $\begin{pmatrix} 1 & 2 & 5 & 3 \\ 1 & 2 & 3 & 4 \end{pmatrix}$
D) I

53. The order of identity element in an additive group of integers is

A) zero

B) infinity

C) one

D) two

54. A ring R is an integral domain if

A) R is a commutative ring

B) R is a commutative ring with zero divisor

C) R is a commutative ring without zero divisor

D) R is a ring with zero divisor

55. If the number of left cosets of a subgroup H in a group G in and the number of right cosets of H in G is m then

A) $m \geq n$

B) $m \leq n$

C) $m = n$

D) $m \neq n$

56. A field is a

A) vector space

B) integral domain

C) division ring

D) commutative ring

57. The homomorphism ϕ from the ring R into ring R is an isomorphism iff the kernel $I(\varphi)$ is

A) $I(\phi) = \{0\}$

B) $I(\phi) = R$

C) $I(\phi) = R'$

D) None of these

58. If F is a field then its only ideals are

A) F only

B) (0) only

C) both F and (0)

D) None of these

59. If R is a commutative ring with unit element and M is a maximal ideal of R then

A) RM is a field

B) R/M is a field

C) R/M is a field

D) None of these

60. The solution of $(D^2 + 1)\, y = 0$ satisfying the initial conditions $y(0) = 1$ and $y'\left(\frac{\pi}{2}\right) = 1$ is

A) $y = 2x + \sin x$

B) $y = \cos x + 2\sin x$

C) $y = \cos x + \sin x$

D) $y = 2\cos x + 2\sin x$

61. The particular integral of the ODE $(D^2 + 1)y = \cos x + 2\sin x$ is

A) $\frac{x\cos 2x}{4}$

B) $-\frac{x\cos 2x}{4}$

C) $\frac{x\sin 2x}{4}$

D) $-\frac{x\sin 2x}{4}$

62. The orthogonal trajectories of the family of curves $x^2 - y^2 = a^2$ is

A) $x^2 + y^2 = c^2$

B) $\frac{x}{y} = c$

C) $xy = c$

D) none of these

63. The homogeneous ODE $M(x, y)dx + N(x, y)dy = 0$ can be reduced to an ODE in which are variable are separated by substitution

A) $x + y = v$

B) $x - y = v$

C) $xy = v$

D) $y = vx$

64. The integrating factor of the differential equation $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right)\frac{dy}{dx} = 1$ is

A) $e^{-2\sqrt{x}}$

B) $e^{2\sqrt{x}}$

C) $e^{-2/\sqrt{x}}$

D) $e^{2/\sqrt{x}}$

65 $I.F.$ of the Bernoulli equation $\frac{dy}{dx} + Py = Qy^n$ is

A) $e^{\int nPdx}$

B) $e^{\int P(n-I)dx}$

D) $e^{\int (I-n)Pdx}$

C) $e^{\int Pdx}$

66. Solving by variation of parameters for the equation $y'' + 4y = \tan 2x$, the value of the Wronskian is

A) 1
B) 2
C) 3
D) 4

67. By changing the order of integration, the integral $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dy\,dx$ changes into

A) $\int_0^{4a} \int_{\frac{y^2}{4a}}^{2\sqrt{ay}} dx\,dy$

B) $\int_0^{4a} \int_{2\sqrt{ay}}^{\frac{y^2}{4}} dx\,dy$

C) $\int_{\frac{y^2}{4a}}^{2\sqrt{ay}} \int_0^{4a} dx\,dy$

D) None of these

68. If an algebraic structure (|0, 1],⊕) and the operation ⊕ is a binary operation defined by $x \oplus y = xy$ mod (8) for all $x, y \in ([0,1], \oplus)$, then $([0,1], \oplus)$ is a

A) monoid
B) semi group
C) group
D) abelian group

69. If a feasible solution of a linear programming problem exists, the reason of feasible solutions is

A) convex set
B) connected set
C) non-convex set
D) none of these

70. If the set of feasible solutions of a LPP is a convex set then the optimal solution occurs at

A) extreme point
B) boundary point
C) interior point
D) none of these

71. To convert $\sum a_{ij} x_j \leq b_i$, into equality we introduce

A) surplus variable
B) slack variable
C) unrestricted variable
D) none of these

72. Every basic feasible solution in the convex set of solutions of an LPP is a

A) boundary point

B) extreme point

C) non-extreme point

D) non-boundary point

73. The directional derivative of the function $\phi = 4xz^3 - 3x^2yz^2$ at $(2, -1, 2)$ along z-axis is

A) 244

B) 240

C) 404

D) 144

74. If $\vec{A} = (3xz^2)i - (yz)j + (x + 2z)k$ then curl (curl $\vec{A}$) =

A) $6x\hat{\imath} + 6y\hat{\jmath} - 6z\hat{k}$

B) $6x\hat{\imath} + (6y - 1)\hat{\jmath}$

C) $-6x\hat{\imath} + (6z - 1)\hat{k}$

D) none of these

75. $\nabla \cdot (\nabla \times \vec{v}) =$

A) $\nabla \times (\nabla \cdot \vec{v})$

B) $\nabla \cdot (\nabla \cdot \vec{v})$

C) 0

D) none of these

76. The series $\frac{2}{1^2} + \frac{3}{2^2} + \frac{4}{3^2} + \frac{5}{4^2} + \frac{6}{5^2} + \cdots$ is

A) conditionally convergent

B) absolutely convergent

C) absolutely convergent

D) none of these

77. The radius of convergence of the series $1 - x^2 + x^4 - x^6 + \ldots$ is

A) 0

B) 1

C) 2

D) none of these

78. If (G, o) is a group 24 the G can have a subgroup order

A) 5

B) 7

C) 8

D) 9

79. PI of the ODE $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$ is

A) $\frac{x^2}{3} + 4x$

B) $\frac{x^3}{3} + 4$

C) $\frac{x^3}{3} + 4x$

D) $\frac{x^2}{3} + 4$

80. The relative cost $z_j - c_j$ for a non-basic variable in a simplex table is zero then there exists an alternate optimal solution, provided
A) it is starting simplex table
B) it is optimal simplex table
C) it can be any simplex table
D) none of these

81. If a series $\sum_{n=0}^{\infty} a_n$ converges then the sequence $\{a_n\}_i^{\infty}$
A) diverges
B) converges to zero
C) converges to any number
D) None of these

82. If a sequence is not a Cauchy sequence then it is a
A) divergent sequence
C) bounded sequence

83. $\lim_{n\to\infty} \frac{1}{n}\left(1 + 2^{\frac{1}{2}} + 3^{\frac{1}{3}} + \cdots + n^{\frac{1}{n}}\right)$ is
A) 1
B) 2
C) 0
D) none of these

84. If $f(x) = \begin{cases} -x^{\frac{1}{3}} & -1 \leq x \leq 0 \\ x^{\frac{1}{3}} & 0 \leq x \leq 1 \end{cases}$, then
A) Rolle's theorem applies to f in [-1, 1]
B) Rolle's theorem does not apply to f 1 [-1, 1]
C) f is not continuous at $x = 0$
D) $f'(0) = 0$

85. The function $f(x) = \frac{|x|}{x}, x \neq 0$ may be continuous at the origin, if
A) $f(0) = 0$
B) $f(0) = -1$
C) $f(0) = \infty$
D) cannot be continuous for any value of $f(0)$

86. The function $f(x) = \frac{1}{x}, x > 0$ is

A) continuous but not uniformly continuous

B) discontinuous everywhere

C) neither continuous nor uniformly continuous

D) uniformly continuous but not continuous

87. The polynomial $2x^3 - 15x^2 + 36x + 1$ is decreasing in the interval

A) $(-\infty, 2)$

B) $(3, \infty)$

C) $(2,3)$

D) none of these

88. For any complex number $z = (x, y)$ in C, if $z.\overline{z} = z$ then $\overline{z} =$

A) $(0, 0)$

B) $(1,0)$

C) $(0,1)$

D) $(1, 1)$

89. An analytic function is

A) infinitely differentiable

B) finitely differentiable

C) not differentiable

D) none of these

90. A non-empty set of real numbers which is bounded below has

A) supremum

B) infimum

C) no upper bound

D) no lower bound

91. If F is an open covering of a closed and bounded set A then

A) There exist an infinite sub collection of A which covers A

B) There exist an uncountable sub collection of A which covers A

C) There exist a finite sub collection of A which covers A

D) None of these

92. Singleton set $\{x_0\}$ of R is

A) open

B) closed

C) neither open nor closed

D) None of these

93. Every compact set of real numbers is

A) closed and bounded

B) open

C) open and bounded

D) closed

94. The whole set $X = R$ and ϕ are both

A) open

B) closed

C) neither open nor closed

D) open and closed

95. Every finite subset R of real numbers has

A) exactly one limit point

B) all its points are limit points

C) no limit point

D) None of these

96. If $f(z)$ is analytic in a simply connected domain D then for every closed path C in D

A) $\oint_C f(z)dz = 0$

B) $\oint_C f(z)dz = 1$

C) $\oint_C f(z)dz \neq 0$

D) $\oint_C f(z)dz \neq 0$

97. The Cauchy-Riemann equations are

A) both necessary and sufficient condition for a complex function to be analytic

B) only a necessary condition for a complex function to be analytic

C) only a sufficient condition for a complex function to be analytic

D) None of these

98. The complex line integral is

A) path dependent

B) path independent

C) independent of end points

D) None of these

99. An analytic function is

A) infinitely differentiable

B) finitely differentiable

C) not differentiable

D) None of these

100. If $f(z)$ is analytic in a simply connected domain D then for any point z_0 in D enclosed by a rectifiable Jordan C and $f(z)$ is continuous on C then for any point z_0 in D, we have $f(z_0)$ is equal to

A) $\frac{1}{2\pi} \oint_C \frac{f(z)}{z-z_0} \, dz$

B) $\frac{1}{2\pi i} \oint_C \frac{f(z)}{z-z_0} \, dz$

C) $2\pi i \oint_C \frac{f(z)}{z-z_0} \, dz$

D) $2\pi \oint_C \frac{f(z)}{z-z_0} \, dz$