CUCET Mathematics MSc Questions Paper

It Contains

- CUCET-2019 Question Paper
- CUCET-2018 Question Paper
- CUCET Sample Paper
- CUCET-2016 *Available Soon*

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Test Paper Series Code **C**

Question Booklet No. : 2276163

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PG-QP–27

Time : 09:00 AM To 11:00 AM

Entrance Test for the Course(s) : M.A./M.Sc. (Mathematics) [CUJAM], [CUKAS], [CUMGB], [CUSBR], M.Sc. (Mathematics) [CUKER], [CUHAR], [CUPUN], [CUKNK], [CURAJ], [CUJHD]. M.Sc. B.Ed. (Mathematics) [CURAJ].

Roll Number : 2 1 8 8 1 3

Test Center Code : 1 8 8

Name of the Candidate : NEHA KUMARI.

Candidate's Signature: Neha Kumari

Invigilator's Signature: ..

SEAL

Instructions to Candidates

1. Do NOT open the Question Booklet until the Hall Superintendent gives the signal for the commencement of the examination.
2. Write your Name, Roll Number and Test Center Code (as given in the Admit Card) and sign in the space provided above.
3. After the commencement of the examination, open the Question Booklet. If the Question Booklet or the OMR Answer Sheet or both are not in good condition, then ask for immediate replacement. No replacement will be made 5 minutes after the commencement of the examination.
4. In the ANSWER SHEET (OMR) fill up/shade the required entries (Roll Number, Test Center Code, Test Paper Code, Question Booklet Number etc. in the space provided) using **black/blue** ball point pen.
5. Part–A of the Question Booklet contains 25 Questions. Part–B of the Question Booklet contains 75 Questions. A candidate is required to answer all the questions.
6. All questions are in MCQ Pattern. There is only **one** most appropriate correct answer for each question.
7. All questions carry equal marks. **There will be negative marking.** Each correct answer carries **01** mark and for each wrong/incorrect answer **0.25** mark will be deducted. Question not attempted will not be assessed.
8. Darken only **one** circle for each question. If you darken more than one circle for the question, it will be deemed as wrong/incorrect answer. Any change in the answer once marked is **NOT** allowed.
9. Use the Answer Sheet (OMR) carefully. No spare Answer Sheet will be given.
10. Do not make stray marks on the OMR Sheet.
11. After completion of examination, a candidate will be allowed to take Question Booklet and Candidate's copy of OMR answer sheet with him/her. However, **each candidate must ensure to handover original copy of OMR sheet to the invigilator.** In case a candidate takes away the original OMR answer sheet, his/her examination will be treated as cancelled.
12. No candidate will be allowed to leave the examination hall before completion of Entrance Test. Total time allowed for the paper is 2 Hours.
13. Calculator, Tables or any other Calculating Devices, Mobiles, Pagers, Booklets, Papers etc. are strictly prohibited.
14. Rough work should be done on the blank space provided in this Question Booklet. No extra paper will be provided.

P.T.O.

PART–A

1. If the difference between simple interests for 3 years and 4 years at 5% annual rate is 42, then the amount will be,
   (A) Rs. 210 (B) Rs 280
   (C) Rs. 750 (D) Rs. 840

2. The sum of three consecutive even integer is 54. What is the smallest number?
   (A) 18 (B) 14
   (C) 16 (D) 12

3. Area of circle and a square is equal. Ratio of one side of the square to radius of the circle will be,
   (A) $1:\sqrt{\pi}$ (B) $\sqrt{\pi}:1$
   (C) $1:\pi$ (D) $\pi:1$

4. Fill in the blank to complete the series: 181, 174, 178, ____, 175, 182.
   (A) 174 (B) 176
   (C) 178 (D) 180

5. 'Tree' is related to 'Forest' in the same way as 'Soldier' is related to
   (A) Battle (B) Army
   (C) Gun (D) General

6. Pointing to a gentleman, Deepak said. "His only brother is the father of my daughter's father." How is that gentleman related to Deepak?
   (A) Father (B) Grandfather
   (C) Brother-in-law (D) Uncle

7. Complete the series BEP, CIQ, DOR, FUS, GAT, ...?
   (A) HEV (B) HIT
   (C) IET (D) IEU

8. Convert 36 km/hr into meters per second.
   (A) 10 (B) 12
   (C) 15 (D) 20

9. 'Wings of Fire' was written by _____.
   (A) APJ Abdul Kalam (B) Salman Rushdie
   (C) Amitav Ghosh (D) Shashi Tharoor

10. 'Chhau' dance is associated with which of the following states?
    (A) Punjab (B) Maharashtra
    (C) Jammu Kashmir (D) Jharkhand

11. Mineral rich 'Jharia' is located in which of the following states?
    (A) Bihar (B) West Bengal
    (C) Utter Pradesh (D) Gujrat

12. Jhansi was annexed by which of the following Governor General?
    (A) Lord Bentinck (B) Lord Dalhausie
    (C) Lord Cornwalis (D) Lord Clive

13. Who among the following personalities stated "Swaraj is my birth right and I am going to have it."
    (A) Bal Gangadhar Tilak
    (B) Subhas Chandra Bose
    (C) Mahatma Gandhi
    (D) Jawahar Lal Nehru

14. Choose the correct word to fill in the blank. The students_____ the teacher on teacher's day for twenty years of dedicated teaching.
(A) Facilitated (B) Felicitated
(C) Fantasized (D) Facillitated

15. Choose the correct word to fill in the blank. Dhoni as well as the other team members of Indian team ____present on the occasion
(A) were (B) was
(C) has (D) have

16. Choose the word most similar in meaning: Awkward
(A) Inept (B) Careful
(C) Suitable (D) Dread full

17. Choose the correct verb to fill in the blank below
Let us _____.
(A) Introvent (B) Alternate
(C) Atheist (D) Altruist

18. Select the most suitable Synonym for the word 'RESILIENT'.
(A) Stretchable (B) Spirited
(C) Rigid (D) Buoyant

19. Select the most suitable Synonym for the word 'ZEST'.
(A) Humour (B) Keen Interest
(C) Attitude (D) Liking

20. Select the most suitable Antonym for the word 'ROBUST'.
(A) Sturdy (B) Ridiculous
(C) Muscular (D) Feeble

21. Select the most suitable Antonym for the word 'DULL'.
(A) Monstrous (B) Horrid
(C) fascinating (D) Ghastly

22. Select the pair which shows the same relationship as CANE : BAMBOO
(A) Wood : Woodpecker
(B) Timber : Tree
(C) Rubber : Malaysia
(D) South Africa : Apartheid

23. Why were you absent _____ your dance classes yesterday?
(A) for (B) from
(C) in (D) to

24. A man is facing towards South. He take 135° anticlock wise, 180° clockwise rotation then what was facing side of the man?
(A) North-East (B) North-West
(C) South-East (D) South-West

25. If the value of "x" is 25% less than the value of "y". How much % y's is more than that of x's ?
(A) $33\frac{1}{3}\%$ (B) 25%
(C) 75% (D) $66\frac{2}{3}\%$

PART - B

26. Solution of the differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is

(A) $e^y = x + e^x + c$ (B) $e^y = x^2/2 + e^x + c$

(C) $e^y = x^3/3 + e^x + c$ (D) $e^y = x^4/4 + e^x + c$

27. The integrating factor of the differential equation $(1-x^2)dy/dx + 2xy = x\sqrt{1-x^2}$ is

(A) $\frac{1}{1-x}$ (B) $\frac{1}{1-x^2}$ (C) $1-x^2$ (D) $1-x$

28. The solution of differential equation $\frac{d^2y}{dx^2} + 4y = 0$ with initial conditions $y = 2$ and $dy/dx = 0$ when $x = 0$ is

(A) $y = 2\sin 2x$ (B) $y = 2\cos 2x$ (C) $y = \sin 4x$ (D) $y = \tan x$

29. Which of the following is a particular integral of $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{5x}$?

(A) $\frac{1}{12}e^{5x}$ (B) e^{-5x} (C) e^x (D) e^{x^2}

30. Let $D =: d/dx$. Then the value of $\left\{\frac{1}{xD+1}\right\} x^{-1}$ is

(A) $\log x$ (B) $\frac{\log x}{x}$ (C) $\frac{\log x}{x^2}$ (D) $\frac{\log x}{x^3}$

31. If $y_1(x)$ and $y_2(x)$ are two solutions of $\frac{d^2y}{dx^2} + 4y = 0$, then the value of Wronskian is

(A) 0 (B) 1 (C) 2 (D) 3

32. Differential equation of the family of parabola $y^2 = 4ax$, where a is an arbitrary constant is

(A) $y = 2x(dy/dx)$ (B) $y = dy/dx$ (C) $y = 2x + dy/dx$ (D) $dy/dx + y^2 = x^2$

33. The orthogonal trajectory of the hyperbola $xy = a$ is

(A) $x^2 - y^2 = a$ (B) $x^2 = ay^2$ (C) $x^2 + y^2 = a$ (D) $x = ay^2$

34. The order of differential equation $\frac{dy}{dx} = \sqrt{x} + \sqrt{y}$ is

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

35. Solution of the initial value problem $e^x(\cos y\, dx - \sin y\, dy) = 0$ with $y(0) = 0$ is

(A) $e^x \cos y + 1 = 0$ (B) $e^x \cos y - 1 = 0$

(C) $e^y \cos x + 1 = 0$ (D) $e^y \cos x - 1 = 0$

36. If $F(x, y, z) = xy^2 + 3x^2 - z^3$, then the value of $\nabla F(x, y, z)$ at $(2, -1, 4)$ is equal to

(A) $13i - 4j - 48k$ (B) $i - 4j - k$ (C) $13i + j - 6k$ (D) $-13i + 4j - 6k$

37. The directional derivative of the function $F(x,y,z) = xy^2 - 4x^2y + z^2$ at $(1,-1,2)$ in the direction of $6i + 2j + 3k$ is

(A) 1/7 (B) 2/7 (C) 54/7 (D) 7

38. If $\vec{F} = zi + xj + yk$, then curl $\vec{F}$ is

(A) $i + j + k$ (B) 0 (C) $i - j - k$ (D) $2i + j - 2k$

39. Let F be a finite field. Then which of the following may be the possible cardinality of F?

(A) 15 (B) 20 (C) 25 (D) 30

40. Every subgroup of an abelian group is

(A) abelian (B) cyclic

(C) non abelian (D) none of the above.

41. Le $G = \left\{ \begin{bmatrix} a & a \\ a & a \end{bmatrix} \mid a \in \mathbb{R} \setminus \{0\} \right\}$ be a group with binary operation defined by usual matrix multiplication. Then the inverse of $\begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$ is

(A) $\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$ (B) $\begin{bmatrix} 1/2 & -1/2 \\ -1/2 & 1/2 \end{bmatrix}$ (C) $\begin{bmatrix} 1/4 & 1/4 \\ 1/4 & 1/4 \end{bmatrix}$ (D) $\begin{bmatrix} 1/8 & 1/8 \\ 1/8 & 1/8 \end{bmatrix}$

42. Let H and K be subgroups of G. Then which of the following is necessarily a subgroup of G?

(A) HK (B) KH (C) $H \cap K$ (D) $H \cup K$

43. Let S_5 be the permutation group on five symbols $\{1,2,3,4,5\}$. Then order of permutation $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 3 & 5 & 1 \end{pmatrix}$ is equal to

(A) 5 (B) 4 (C) 3 (D) 6

44. Let G be a group and $a, b, c \in G$ are non-identity elements. Which of the following solves the equation $axb = c$ for x?

(A) acb^{-1} (B) $a^{-1}b^{-1}$ (C) $a^{-1}cb^{-1}$ (D) cb^{-1}

45. Let H be a subgroup of a noncyclic group G. Then which of the following is correct?

(A) H is always noncyclic (B) H is always cyclic

(C) H is always nonabelian (D) None of the above

46. Let S_6 be the permutation group on six symbols $\{1,2,3,4,5,6\}$. Which of the following is not an even permutation?

(A) (1 3 5 6 2) (B) (1 2 3)(4 5)(4 5)

(C) (2 6 3 4 5 1) (D) (1 2)(1 4)(2 3)(4 5)

47. Which of the following is correct?

(A) Every integral domain is a field.

(B) Every finite integral domain is a field.

(C) There is an integral domain with characteristic equal to 10.

(D) None of the above.

48. Let J be an ideal of commutative ring with unity and let u be an unit element of R such that $u \in J$. Then

(A) The multiplicative identity $1 \notin J$

(B) J is a proper ideal of R such that $J \neq R$

(C) $J = R$

(D) There is a minimal ideal M such that $J \subset M \subseteq R$

49. Which of the following is a prime ideal of $(\mathbb{Z}, +, \cdot)$?

(A) $6\mathbb{Z}$ (B) $2\mathbb{Z} \cap 4\mathbb{Z}$ (C) $7\mathbb{Z}$ (D) $4\mathbb{Z} \cap 8\mathbb{Z}$

50. If $Z = 2 - 3i$, then $|Z|$ equals

(A) 13 (B) $\sqrt{13}$ (C) -13 (D) -1

51. $\int_0^1 ze^{2z}\, dz$ equals

(A) $e^2 + 1$ (B) $(e^2 + 1)/4$ (C) $(e^2 - 1)/4$ (D) $e^2 - 1$

52. $\lim_{z \to i} \dfrac{Z^{10} + 1}{Z^6 + 1}$ equals

(A) 3/5 (B) 2/5 (C) 5/3 (D) 1/3

53. The integral $\int_{3i}^{1-i} 4z\, dz$ equals

(A) $18 - 4i$ (B) $-4i$ (C) i (D) $-i$

54. If $f(z)$ is analytic in a simply connected domain D and $f'(z)$ is continuous in D, then $\oint_C f(z)\, dz$ equals

(A) 0 (B) 1 (C) $2\pi i$ (D) $-2\pi i$

55. The value of the integral $\int_{|z-2|=2} \dfrac{5z + 7}{z^2 + 2z - 3}\, dz$ is equal to

(A) πi (B) $2\pi i$ (C) $3\pi i$ (D) $6\pi i$

56. If $f(z) = u(x, y) + iv(x, y)$ is analytic in a domain D, then

(A) $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ and $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} = 0$ (B) $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} = 0$ and $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} \neq 0$

(C) $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} \neq 0$ and $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} = 0$ (D) $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} \neq 0$ and $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} \neq 0$

57. An entire function is

(A) infinitely differentiable (B) finitely differentiable

(C) not differentiable (D) identically zero

58. Which of the following is incorrect statement?

(A) If $f(z)$ is entire and bounded in complex plane, then $f(z)$ is constant.

(B) If $f(z)$ is analytic at z_0, then $f'(z)$ is also analytic at z_0.

(C) Analytic function is entire.

(D) Entire function is analytic.

59. The complex line integral is

(A) path dependent (B) independent of end points

(C) path independent (D) none of these

60. The set of all feasible solutions to a linear programming problem (LPP) is

(A) a concave set (B) a convex set

(C) a bounded set (D) an infinite set only

61. A basic feasible solution to a LPP, in which at least one of the basic variables is zero is

(A) degenerate (B) infeasible (C) non-degenerate (D) unbounded

62. The optimal solution of the LPP: Maximize $Z = 4x_1 + x_2$, such that $x_1 + x_2 \leq 50$, $3x_1 + x_2 \geq 90$, $x_1, x_2 \geq 0$, is

(A) $x_1 = 30, x_2 = 0$ (B) $x_1 = 20, x_2 = 30$

(C) $x_1 = 0, x_2 = 0$ (D) $x_1 = 0, x_2 = 50$

63. Which of the following is incorrect statement?

(A) Arbitrary intersection of convex sets is a convex set.

(B) Hyperplane is a convex set.

(C) Union of two convex sets need not to be a convex set.

(D) Union of two convex sets is a convex set.

64. In a linear programming problem constraints are

(A) nonlinear (B) linear

(C) linear as well as nonlinear (D) none of the above

65. The sequence $\left\{\frac{1}{n}\right\}$ is

(A) convergent (B) divergent (C) oscillatory (D) unbounded

66. $\lim_{n\to\infty} \frac{2n-3}{n+1}$ equals

(A) 0 (B) 1 (C) 2 (D) e

67. The series $\sum_{n=1}^{\infty} \frac{n+1}{n^p}$ is convergent for

(A) $0 < p < 1$ (B) $1 < p < 2$ (C) $p = 2$ (D) $p > 2$

68. The series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{\sqrt{n}}$ is

(A) convergent (B) divergent

(C) conditionally convergent (D) absolutely convergent

69. $\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n$ equals

(A) e (B) $\frac{1}{e}$ (C) 0 (D) 1

70. Which of the following statements is false?

(A) Every bounded sequence is convergent.

(B) Every convergent sequence is bounded.

(C) Every bounded sequence has a limit point.

(D) Every convergent sequence has a unique limit.

71. If a series $\sum_{n=0}^{\infty} a_n$ converges, then

(A) $\lim_{n\to\infty} a_n = 0$ (B) $\lim_{n\to\infty} a_n = \infty$ (C) $\lim_{n\to\infty} a_n = 1$ (D) $\lim_{n\to\infty} a_n = 10$

72. If $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = |x - c|$, for all $x \in \mathbb{R}$; then

(A) f is discontinuous

(B) f is differentiable

(C) f is continuous but not differentiable

(D) f is continuously differentiable

73. The function $f(x) = \begin{cases} x \sin 1/x, & \text{when } x \neq 0 \\ 0, & \text{when } x = 0 \end{cases}$ is

(A) continuous at $x = 0$ (B) derivable at $x = 0$

(C) discontinuous at $x = 0$ (D) infinitely differentiable at $x = 0$

74. If Rolle's theorem holds for $f(x) = x^3 + ax^2 + bx$ on $[-2, 2]$ at $x = 1$, then

(A) $a = 1/2,\ b = -4$ (B) $a = 2,\ b = -4$

(C) $a = -1/2,\ b = 4$ (D) $a = 4,\ b = 1/2$

75. The local maxima of $x^3 - 3x + 3$ is attend at

(A) $x = -1$ (B) $x = 1$ (C) $x = 0$ (D) $x = 3$

76. The function $f(x) = \sin 3x, x \in [0, \pi/2]$ is increasing in the interval

(A) $(0, \pi/6)$ (B) $(\pi/6, \pi/2)$ (C) $(0, \pi/2)$ (D) $(\pi/3, \pi/2)$

77. The function $f(x) = x^2$ is not uniformly continuous on the interval

(A) $[-1, 1]$ (B) $[1, 2]$ (C) $[0, \infty)$ (D) $[0, 1]$

78. Every compact set of real numbers is

(A) open (B) closed

(C) closed and bounded (D) open and bounded

79. The set $\mathbb{R}$ of real real numbers is

(A) closed (B) bounded

(C) countable (D) none of the above

80. The upper limit of the sequence $\{(-1)^n\}$ is

(A) 1 (B) -1 (C) 0 (D) 2

81. If $f(x, y)$ is a homogeneous function of degree n in x and y and has continuous partial derivatives, then $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y}$ is equal to

(A) f (B) nf (C) 0 (D) $n(n-1)f$

82. $\lim_{(x,y)\to(2,1)} (x^2 + 2x - y^2)$ equals

(A) 0 (B) -7 (C) 7 (D) -1

83. The radius of convergence of the series $1 + 2x + 3x^2 + 4x^3 + \ldots$ is

(A) 0 (B) 1 (C) ∞ (D) 2

84. The value of the integral $\int_0^1 \int_0^x e^{y/x}\, dx\, dy$ is

(A) $\frac{(e-1)}{2}$ (B) $\frac{(e+1)}{2}$ (C) e (D) e^2

85. The value of the surface integral $\int\int_S (x^3\, dy\, dz + y^3\, dz\, dx + z^3\, dx\, dy)$ over the sphere $x^2 + y^2 + z^2 = a^2$ is

(A) $\frac{12}{5}\pi a^5$ (B) πa^5 (C) $\frac{5}{12}\pi a^5$ (D) πa^2

86. Which of the following sets forms a basis of $\mathbb{R}^2$?

(A) {(1,1), (3,1)} (B) {(0,1), (0,-3)}

(C) {(2,1), (1,-1), (3,0)} (D) {(1,0), (2,0)}

87. Rank of the matrix $\begin{pmatrix} 2 & 1 & 1 \\ 0 & 3 & 0 \\ 3 & 1 & 2 \end{pmatrix}$ is equal to

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

88. Which of the following functions $F : \mathbb{R}^2 \to \mathbb{R}^2$ is not a linear transformation ?

(A) $F(x, y) = (x + y, x - y)$ (B) $F(x, y) = (x + y, x)$

(C) $F(x, y) = (2x - y, x)$ (D) $F(x, y) = (x, 1 + y)$

89. The dimension of the vector space of all 3×3 real symmetric matrices is

(A) 9 (B) 6 (C) 3 (D) 4

90. The determinant of $\begin{pmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{pmatrix}$ is

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

(C) $(z^2 - x^2)(z^2 - y^2)(y^2 - x^2)$ (D) $(z - x)^2(z - y)^2(y - x)^2$

91. If $M = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$, then M^{2019} equals

(A) $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} 1 & 2019 \\ 0 & 1 \end{pmatrix}$

92. Which of the following matrix is singular?

(A) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 4 \\ 2 & 10 \end{pmatrix}$ (D) $\begin{pmatrix} 2 & 2 \\ 3 & 3 \end{pmatrix}$

93. If $M = \begin{pmatrix} 4 & 0 \\ 2 & 3 \end{pmatrix}$, then the eigenvalues of M are

(A) -4 and -3 (B) 4 and 3 (C) 2 and 0 (D) 3 and -3

94. Let $F : \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation defined by $F(x, y) = (2x + 3y, 4x - 5y)$. Then the matrix representation of the linear transformation relative to basis $B = \{(1, 0), (0, 1)\}$ is

(A) $\begin{pmatrix} 2 & 3 \\ 4 & -5 \end{pmatrix}$ (B) $\begin{pmatrix} 0 & -3 \\ 4 & 5 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$

95. The eigenvalues of a skew-symmetric matrix are

(A) always pure imaginary (B) always zero

(C) either zero or imaginary (D) always real

96. If $M = \begin{pmatrix} 2 & -2 \\ -2 & 5 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, which of the following is a zero matrix ?

(A) $M^2 - 7M - 6I$ (B) $M^2 - 7M + 6I$ (C) $M^2 - 6M - 7I$ (D) $M^2 - 6M - 7I$

97. Let $T : V_n(F) \to V_m(F)$, where $V_n(F)$ and $V_m(F)$ are finite dimensional vector spaces. Then

(A) rank(T)+nullity(T)=dim $(V_n(F))$ (B) rank(T)=nullity(T))

(C) rank(T) - nullity(T)=dim $(V_n(F))$ (D) rank(T) - nullity(T)=dim $(V_n(F))$

98. The singleton set $\{x\}$ is linearly dependent if

(A) $x = 0$ (B) $x \neq 0$ (C) x is a scalar (D) none of these

99. The eigenvalues of an orthogonal matrix are

(A) zero (B) imaginary (C) always negative (D) of unit modulus

100. Degree of the differential equation $dy = (y + \sin x)dx$ is

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

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, $\int_{-2}^{-2+i} (2+z)^2 dz$ is equal to

A) i/3
B) i/2
C) -i/3
D) -i/4

28. The value of $\int_0^{2+i} (\bar{z})^2 dz$ 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^TA^T)
B) rank (AB) = rank(A^TB^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 $\begin{matrix} 2x+y=5 \\ x-3y=-1 \\ 3x+4y=k \end{matrix}$ 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. Theeigen 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 $T: R^3 \to R^2$ 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 $a, b \in G$, $(aob)^2 = a^2ob^2$ 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 the variables 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) $e^{\int nP dx}$ B) $e^{\int P(n-1)dx}$

C) $e^{\int (1-n)P dx}$ D) $e^{\int P dx}$

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], $\oplus$) and the operation $\oplus$ is a binary operation defined by $x \oplus y = xy \bmod(8)$ 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 $\sum a_{ij}x_j \le b_i$ 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 $\vec{A} = (3xz^2)\bar{i} - (yz)\bar{j} + (x+2z)\bar{k}$ then curl (curl $\vec{A}$) =

A) $6x\bar{i} + 6y\bar{j} - 6z\bar{k}$

B) $6x\bar{i} + (6y-1)\bar{j}$

C) $-6x\bar{i} + (6z-1)\bar{k}$

D) none of these

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

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

B) $\nabla.\left(\nabla.\vec{v}\right)$

C) 0

D) none of these

76. The series $\frac{2}{1^2} + \frac{3}{2^2} + \frac{4}{3^2} + \frac{5}{4^2} + \frac{6}{5^2} + \ldots$ 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 $\{a_n\}_1^{\infty}$

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
B) convergent sequence
C) bounded sequence
D) none of these

83. $\lim_{n\to\infty} \frac{1}{n}\left(1+2^{\frac{1}{2}}+3^{\frac{1}{3}}+\ldots\ldots\ldots+n^{\frac{1}{n}}\right)$ is

A) 1
B) 2
C) 0
D) none of these

84. If $f(x)=\begin{cases} -x^{\frac{1}{3}} & , -1\le x\le 0 \\ x^{\frac{1}{3}} & , 0\le x\le 1 \end{cases}$, then

A) Rolle's theorem applies to f in [-1, 1]
B) Rolle's theorem does not apply to f I [-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 $z.\bar{z}=z$ then $\bar{z}=$

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) $\int_C f(z)dz \neq 1$

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

PART–A

1. Choose the correct word to fill in the blank. The students_____ the teacher on teacher's day for twenty years of dedicated teaching.
   (A) Facilitated (B) Felicitated
   (C) Fantasized (D) Facillitated

2. Choose the correct word to fill in the blank. Dhoni as well as the other team members of Indian team ____present on the occasion
   (A) were (B) was
   (C) has (D) have

3. Choose the word most similar in meaning: Awkward
   (A) Inept (B) Careful
   (C) Suitable (D) Dread full

4. Choose the correct verb to fill in the blank below
   Let us _____.
   (A) Introvent (B) Alternate
   (C) Atheist (D) Altruist

5. Select the most suitable Synonym for the word 'RESILIENT'.
   (A) Stretchable (B) Spirited
   (C) Rigid (D) Buoyant

6. Select the most suitable Synonym for the word 'ZEST'.
   (A) Humour (B) Keen Interest
   (C) Attitude (D) Liking

7. Select the most suitable Antonym for the word 'ROBUST'.
   (A) Sturdy (B) Ridiculous
   (C) Muscular (D) Feeble

8. Select the most suitable Antonym for the word 'DULL'.
   (A) Monstrous (B) Horrid
   (C) fascinating (D) Ghastly

9. Select the pair which shows the same relationship as CANE : BAMBOO
   (A) Wood : Woodpecker (B) Timber : Tree
   (C) Rubber : Malaysia (D) South Africa : Apartheid

10. Why were you absent _____ your dance classes yesterday?
    (A) for (B) from
    (C) in (D) to

11. A man is facing towards South. He take 135° anticlock wise, 180° clockwise rotation then what was facing side of the man?
    (A) North-East (B) North-West
    (C) South-East (D) South-West

12. If the value of "x" is 25% less than the value of "y". How much % y's is more than that of x's ?
    (A) $33\frac{1}{3}\%$ (B) 25%
    (C) 75% (D) $66\frac{2}{3}\%$

13. If the difference between simple interests for 3 years and 4 years at 5% annual rate is 42, then the amount will be,
(A) Rs. 210 (B) Rs 280
(C) Rs. 750 (D) Rs. 840

14. The sum of three consecutive even integer is 54. What is the smallest number?
(A) 18 (B) 14
(C) 16 (D) 12

15. Area of circle and a square is equal. Ratio of one side of the square to radius of the circle will be,
(A) $1:\sqrt{\pi}$ (B) $\sqrt{\pi}:1$
(C) $1:\pi$ (D) $\pi:1$

16. Fill in the blank to complete the series: 181, 174, 178, ____, 175, 182.
(A) 174 (B) 176
(C) 178 (D) 180

17. 'Tree' is related to 'Forest' in the same way as 'Soldier' is related to
(A) Battle (B) Army
(C) Gun (D) General

18. Pointing to a gentleman, Deepak said. "His only brother is the father of my daughter's father." How is that gentleman related to Deepak?
(A) Father (B) Grandfather
(C) Brother-in-law (D) Uncle

19. Complete the series BEP, CIQ, DOR, FUS, GAT, ….?
(A) HEV (B) HIT
(C) IET (D) IEU

20. Convert 36 km/hr into meters per second.
(A) 10 (B) 12
(C) 15 (D) 20

21. 'Wings of Fire' was written by _____.
(A) APJ Abdul Kalam (B) Salman Rushdie
(C) Amitav Ghosh (D) Shashi Tharoor

22. 'Chhau' dance is associated with which of the following states?
(A) Punjab (B) Maharashtra
(C) Jammu Kashmir (D) Jharkhand

23. Mineral rich 'Jharia' is located in which of the following states?
(A) Bihar (B) West Bengal
(C) Utter Pradesh (D) Gujrat

24. Jhansi was annexed by which of the following Governor General?
(A) Lord Bentinck (B) Lord Dalhausie
(C) Lord Cornwalis (D) Lord Clive

25. Who among the following personalities stated "Swaraj is my birth right and I am going to have it."
(A) Bal Gangadhar Tilak
(B) Subhas Chandra Bose
(C) Mahatma Gandhi
(D) Jawahar Lal Nehru

PART - B

26. The sequence $\left\{\frac{1}{n}\right\}$ is

(A) convergent (B) divergent (C) oscillatory (D) unbounded

27. $\lim_{n\to\infty} \frac{2n-3}{n+1}$ equals

(A) 0 (B) 1 (C) 2 (D) e

28. The series $\sum_{n=1}^{\infty} \frac{n+1}{n^p}$ is convergent for

(A) $0 < p < 1$ (B) $1 < p < 2$ (C) $p = 2$ (D) $p > 2$

29. The series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{\sqrt{n}}$ is

(A) convergent (B) divergent

(C) conditionally convergent (D) absolutely convergent

30. $\lim_{n\to\infty} \left(1+\frac{1}{n}\right)^n$ equals

(A) e (B) $\frac{1}{e}$ (C) 0 (D) 1

31. Which of the following statements is false?

(A) Every bounded sequence is convergent.

(B) Every convergent sequence is bounded.

(C) Every bounded sequence has a limit point.

(D) Every convergent sequence has a unique limit.

32. If a series $\sum_{n=0}^{\infty} a_n$ converges, then

(A) $\lim_{n\to\infty} a_n = 0$ (B) $\lim_{n\to\infty} a_n = \infty$ (C) $\lim_{n\to\infty} a_n = 1$ (D) $\lim_{n\to\infty} a_n = 10$

33. If $f : \mathbb{R} \to \mathbb{R}$ is defined by $f(x) = |x - c|$, for all $x \in \mathbb{R}$, then

(A) f is discontinuous

(B) f is differentiable

(C) f is continuous but not differentiable

(D) f is continuously differentiable

34. The function $f(x) = \begin{cases} x \sin 1/x, & \text{when } x \neq 0 \\ 0, & \text{when } x = 0 \end{cases}$ is

(A) continuous at $x = 0$ (B) derivable at $x = 0$

(C) discontinuous at $x = 0$ (D) infinitely differentiable at $x = 0$

35. If Rolle's theorem holds for $f(x) = x^3 + ax^2 + bx$ on $[-2, 2]$ at $x = 1$, then
    (A) $a = 1/2,\ b = -4$ (B) $a = 2,\ b = -4$
    (C) $a = -1/2,\ b = 4$ (D) $a = 4,\ b = 1/2$

36. The local maxima of $x^3 - 3x + 3$ is attend at
    (A) $x = -1$ (B) $x = 1$ (C) $x = 0$ (D) $x = 3$

37. The function $f(x) = \sin 3x, x \in [0, \pi/2]$ is increasing in the interval
    (A) $(0, \pi/6)$ (B) $(\pi/6, \pi/2)$ (C) $(0, \pi/2)$ (D) $(\pi/3, \pi/2)$

38. The function $f(x) = x^2$ is not uniformly continuous on the interval
    (A) $[-1, 1]$ (B) $[1, 2]$ (C) $[0, \infty)$ (D) $[0, 1]$

39. Every compact set of real numbers is
    (A) open (B) closed
    (C) closed and bounded (D) open and bounded

40. The set $\mathbb{R}$ of real real numbers is
    (A) closed (B) bounded
    (C) countable (D) none of the above

41. The upper limit of the sequence $\{(-1)^n\}$ is
    (A) 1 (B) -1 (C) 0 (D) 2

42. If $f(x, y)$ is a homogeneous function of degree n in x and y and has continuous partial derivatives, then $x\dfrac{\partial f}{\partial x} + y\dfrac{\partial f}{\partial y}$ is equal to
    (A) f (B) nf (C) 0 (D) $n(n-1)f$

43. $\lim\limits_{(x,y)\to(2,1)}(x^2 + 2x - y^2)$ equals
    (A) 0 (B) -7 (C) 7 (D) -1

44. The radius of convergence of the series $1 + 2x + 3x^2 + 4x^3 + \ldots$ is
    (A) 0 (B) 1 (C) ∞ (D) 2

45. The value of the integral $\displaystyle\int_0^1 \int_0^x e^{y/x}\, dx\, dy$ is
    (A) $\dfrac{(e-1)}{2}$ (B) $\dfrac{(e+1)}{2}$ (C) e (D) e^2

46. The value of the surface integral $\int\int_S (x^3\, dy\, dz + y^3\, dz\, dx + z^3\, dx\, dy)$ over the sphere $x^2 + y^2 + z^2 = a^2$ is
    (A) $\dfrac{12}{5}\pi a^5$ (B) πa^5 (C) $\dfrac{5}{12}\pi a^5$ (D) πa^2

47. Which of the following sets forms a basis of $\mathbb{R}^2$?

(A) {(1,1), (3,1)} (B) {(0,1), (0,-3)}

(C) {(2,1), (1,-1), (3,0)} (D) {(1,0), (2,0)}

48. Rank of the matrix $\begin{pmatrix} 2 & 1 & 1 \\ 0 & 3 & 0 \\ 3 & 1 & 2 \end{pmatrix}$ is equal to

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

49. Which of the following functions $F : \mathbb{R}^2 \to \mathbb{R}^2$ is not a linear transformation ?

(A) $F(x, y) = (x + y, x - y)$ (B) $F(x, y) = (x + y, x)$

(C) $F(x, y) = (2x - y, x)$ (D) $F(x, y) = (x, 1 + y)$

50. The dimension of the vector space of all 3×3 real symmetric matrices is

(A) 9 (B) 6 (C) 3 (D) 4

51. The determinant of $\begin{pmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{pmatrix}$ is

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

(C) $(z^2 - x^2)(z^2 - y^2)(y^2 - x^2)$ (D) $(z - x)^2(z - y)^2(y - x)^2$

52. If $M = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$, then M^{2019} equals

(A) $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} 1 & 2019 \\ 0 & 1 \end{pmatrix}$

53. Which of the following matrix is singular?

(A) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 4 \\ 2 & 10 \end{pmatrix}$ (D) $\begin{pmatrix} 2 & 2 \\ 3 & 3 \end{pmatrix}$

54. If $M = \begin{pmatrix} 4 & 0 \\ 2 & 3 \end{pmatrix}$, then the eigenvalues of M are

(A) -4 and -3 (B) 4 and 3 (C) 2 and 0 (D) 3 and -3

55. Let $F : \mathbb{R}^2 \to \mathbb{R}^2$ be a linear transformation defined by $F(x, y) = (2x + 3y, 4x - 5y)$. Then the matrix representation of the linear transformation relative to basis $B = \{(1, 0), (0, 1)\}$ is

(A) $\begin{pmatrix} 2 & 3 \\ 4 & -5 \end{pmatrix}$ (B) $\begin{pmatrix} 0 & -3 \\ 4 & 5 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$

56. The eigenvalues of a skew-symmetric matrix are

(A) always pure imaginary (B) always zero

(C) either zero or imaginary (D) always real

57. If $M = \begin{pmatrix} 2 & -2 \\ -2 & 5 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, which of the following is a zero matrix ?

(A) $M^2 - 7M - 6I$ (B) $M^2 - 7M + 6I$ (C) $M^2 - 6M - 7I$ (D) $M^2 - 6M - 7I$

58. Let $T : V_n(F) \to V_m(F)$, where $V_n(F)$ and $V_m(F)$ are finite dimensional vector spaces. Then

(A) rank(T)+nullity(T)=dim $(V_n(F))$ (B) rank(T)=nullity(T))

(C) rank(T) - nullity(T)=dim $(V_n(F))$ (D) rank(T) - nullity(T)=dim $(V_n(F))$

59. The singleton set $\{x\}$ is linearly dependent if

(A) $x = 0$ (B) $x \neq 0$ (C) x is a scalar (D) none of these

60. The eigenvalues of an orthogonal matrix are

(A) zero (B) imaginary (C) always negative (D) of unit modulus

61. Degree of the differential equation $dy = (y + \sin x)dx$ is

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

62. Solution of the differential equation $\dfrac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is

(A) $e^y = x + e^x + c$ (B) $e^y = x^2/2 + e^x + c$

(C) $e^y = x^3/3 + e^x + c$ (D) $e^y = x^4/4 + e^x + c$

63. The integrating factor of the differential equation $(1 - x^2)dy/dx + 2xy = x\sqrt{1 - x^2}$ is

(A) $\dfrac{1}{1-x}$ (B) $\dfrac{1}{1-x^2}$ (C) $1 - x^2$ (D) $1 - x$

64. The solution of differential equation $\dfrac{d^2y}{dx^2} + 4y = 0$ with initial conditions $y = 2$ and $dy/dx = 0$ when $x = 0$ is

(A) $y = 2\sin 2x$ (B) $y = 2\cos 2x$ (C) $y = \sin 4x$ (D) $y = \tan x$

65. Which of the following is a particular integral of $\dfrac{d^2y}{dx^2} - 3\dfrac{dy}{dx} + 2y = e^{5x}$?

(A) $\dfrac{1}{12}e^{5x}$ (B) e^{-5x} (C) e^x (D) e^{x^2}

66. Let $D =: d/dx$. Then the value of $\left\{\dfrac{1}{xD+1}\right\} x^{-1}$ is

(A) $\log x$ (B) $\dfrac{\log x}{x}$ (C) $\dfrac{\log x}{x^2}$ (D) $\dfrac{\log x}{x^3}$

67. If $y_1(x)$ and $y_2(x)$ are two solutions of $\dfrac{d^2y}{dx^2} + 4y = 0$, then the value of Wronskian is

(A) 0 (B) 1 (C) 2 (D) 3

68. Differential equation of the family of parabola $y^2 = 4ax$, where a is an arbitrary constant is

(A) $y = 2x(dy/dx)$ (B) $y = dy/dx$ (C) $y = 2x + dy/dx$ (D) $dy/dx + y^2 = x^2$

69. The orthogonal trajectory of the hyperbola $xy = a$ is

(A) $x^2 - y^2 = a$ (B) $x^2 = ay^2$ (C) $x^2 + y^2 = a$ (D) $x = ay^2$

70. The order of differential equation $\dfrac{dy}{dx} = \sqrt{x} + \sqrt{y}$ is

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

71. Solution of the initial value problem $e^x(\cos y\ dx - \sin y\ dy) = 0$ with $y(0) = 0$ is

(A) $e^x \cos y + 1 = 0$ (B) $e^x \cos y - 1 = 0$

(C) $e^y \cos x + 1 = 0$ (D) $e^y \cos x - 1 = 0$

72. If $F(x, y, z) = xy^2 + 3x^2 - z^3$, then the value of $\nabla F(x, y, z)$ at $(2, -1, 4)$ is equal to

(A) $13i - 4j - 48k$ (B) $i - 4j - k$ (C) $13i + j - 6k$ (D) $-13i + 4j - 6k$

73. The directional derivative of the function $F(x, y, z) = xy^2 - 4x^2y + z^2$ at $(1, -1, 2)$ in the direction of $6i + 2j + 3k$ is

(A) 1/7 (B) 2/7 (C) 54/7 (D) 7

74. If $\overrightarrow{F} = zi + xj + yk$, then curl $\overrightarrow{F}$ is

(A) $i + j + k$ (B) 0 (C) $i - j - k$ (D) $2i + j - 2k$

75. Let F be a finite field. Then which of the following may be the possible cardinality of F?

(A) 15 (B) 20 (C) 25 (D) 30

76. Every subgroup of an abelian group is

(A) abelian (B) cyclic

(C) non abelian (D) none of the above.

77. Le $G = \left\{ \begin{bmatrix} a & a \\ a & a \end{bmatrix} \mid a \in \mathbb{R} \setminus \{0\} \right\}$ be a group with binary operation defined by usual matrix multiplication. Then the inverse of $\begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$ is

(A) $\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$ (B) $\begin{bmatrix} 1/2 & -1/2 \\ -1/2 & 1/2 \end{bmatrix}$ (C) $\begin{bmatrix} 1/4 & 1/4 \\ 1/4 & 1/4 \end{bmatrix}$ (D) $\begin{bmatrix} 1/8 & 1/8 \\ 1/8 & 1/8 \end{bmatrix}$

78. Let H and K be subgroups of G. Then which of the following is necessarily a subgroup of G?

(A) HK (B) KH (C) $H \cap K$ (D) $H \cup K$

79. Let S_5 be the permutation group on five symbols $\{1, 2, 3, 4, 5\}$. Then order of permutation $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 3 & 5 & 1 \end{pmatrix}$ is equal to

(A) 5 (B) 4 (C) 3 (D) 6

80. Let G be a group and $a, b, c \in G$ are non-identity elements. Which of the following solves the equation $axb = c$ for x?

(A) acb^{-1} (B) $a^{-1}b^{-1}$ (C) $a^{-1}cb^{-1}$ (D) cb^{-1}

81. Let H be a subgroup of a noncyclic group G. Then which of the following is correct?

(A) H is always noncyclic (B) H is always cyclic

(C) H is always nonabelian (D) None of the above

82. Let S_6 be the permutation group on six symbols $\{1, 2, 3, 4, 5, 6\}$. Which of the following is not an even permutation?

(A) (1 3 5 6 2) (B) (1 2 3)(4 5)(4 5)

(C) (2 6 3 4 5 1) (D) (1 2)(1 4)(2 3)(4 5)

83. Which of the following is correct?

(A) Every integral domain is a field.

(B) Every finite integral domain is a field.

(C) There is an integral domain with characteristic equal to 10.

(D) None of the above.

84. Let J be an ideal of commutative ring with unity and let u be an unit element of R such that $u \in J$. Then

(A) The multiplicative identity $1 \notin J$

(B) J is a proper ideal of R such that $J \neq R$

(C) $J = R$

(D) There is a minimal ideal M such that $J \subset M \subseteq R$

85. Which of the following is a prime ideal of $(\mathbb{Z}, +, \cdot)$?

(A) $6\mathbb{Z}$ (B) $2\mathbb{Z} \cap 4\mathbb{Z}$ (C) $7\mathbb{Z}$ (D) $4\mathbb{Z} \cap 8\mathbb{Z}$

86. If $Z = 2 - 3i$, then $|Z|$ equals

(A) 13 (B) $\sqrt{13}$ (C) -13 (D) -1

87. $\int_0^1 ze^{2z}\, dz$ equals

(A) $e^2 + 1$ (B) $(e^2 + 1)/4$ (C) $(e^2 - 1)/4$ (D) $e^2 - 1$

88. $\lim_{z \to i} \dfrac{Z^{10} + 1}{Z^6 + 1}$ equals

(A) 3/5 (B) 2/5 (C) 5/3 (D) 1/3

89. The integral $\int_{3i}^{1-i} 4z\ dz$ equals

(A) $18 - 4i$ (B) $-4i$ (C) i (D) $-i$

90. If $f(z)$ is analytic in a simply connected domain D and $f'(z)$ is continuous in D, then $\oint_C f(z)\,\mathrm{d}z$ equals

(A) 0 (B) 1 (C) $2\pi i$ (D) $-2\pi i$

91. The value of the integral $\int_{|z-2|=2} \frac{5z+7}{z^2+2z-3}\ dz$ is equal to

(A) πi (B) $2\pi i$ (C) $3\pi i$ (D) $6\pi i$

92. If $f(z) = u(x,y) + iv(x,y)$ is analytic in a domain D, then

(A) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ and $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$ (B) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ and $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \neq 0$

(C) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \neq 0$ and $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$ (D) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \neq 0$ and $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \neq 0$

93. An entire function is

(A) infinitely differentiable (B) finitely differentiable

(C) not differentiable (D) identically zero

94. Which of the following is incorrect statement?

(A) If $f(z)$ is entire and bounded in complex plane, then $f(z)$ is constant.

(B) If $f(z)$ is analytic at z_0, then $f'(z)$ is also analytic at z_0.

(C) Analytic function is entire.

(D) Entire function is analytic.

95. The complex line integral is

(A) path dependent (B) independent of end points

(C) path independent (D) none of these

96. The set of all feasible solutions to a linear programming problem (LPP) is

(A) a concave set (B) a convex set

(C) a bounded set (D) an infinite set only

97. A basic feasible solution to a LPP, in which at least one of the basic variables is zero is

(A) degenerate (B) infeasible (C) non-degenerate (D) unbounded

98. The optimal solution of the LPP: Maximize $Z = 4x_1 + x_2$, such that $x_1 + x_2 \leq 50$, $3x_1 + x_2 \geq 90$, $x_1, x_2 \geq 0$, is

(A) $x_1 = 30, x_2 = 0$ (B) $x_1 = 20, x_2 = 30$

(C) $x_1 = 0, x_2 = 0$ (D) $x_1 = 0, x_2 = 50$

99. Which of the following is incorrect statement?
    (A) Arbitrary intersection of convex sets is a convex set.
    (B) Hyperplane is a convex set.
    (C) Union of two convex sets need not to be a convex set.
    (D) Union of two convex sets is a convex set.

100. In a linear programming problem constraints are
    (A) nonlinear
    (B) linear
    (C) linear as well as nonlinear
    (D) none of the above