Seat No.

Total No. of Pages : 15

P.G. Re Entrance Examination 2025
M. Sc. ENTRANCE
M.Sc. Mathematics / M.Sc. (Mathematics with Computer Application)
Subject Code : 58716

Day and Date : Thursday, 10/07/2025 **Total Marks : 100**

Time : 01.00 pm to 02.30 pm

Instructions:

1) All questions are compulsory.

2) Each question carries 1 mark.

3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.

4) Follow the instructions given on OMR sheet.

5) Rough work shall be done on the sheet provided at the end of question paper.

1. If $y = e^{2x}$ then y_n=____________.

A) $2^n e^x$ B) $2^n e^2$ C) $2^n e^{2x}$ D) x^2

2. Rolle's Theorem is not applicable to $f(x) = |x|$ in [-2,2] because_______________.

A) $f(x)$ is not continuous at $x = -2$.

B) $f(x)$ is not differentiable at $x = 0$.

C) $f(x)$ is not continuous at $x = 0$.

D) $f(x)$ is not continuous at $x = 2$.

3. If x is real then $\sin h^{-1} x$ =_______________.

A) $\log\left(x + \sqrt{x^2 - 1}\right)$ B) $\log\left(x + \sqrt{x^2 + 1}\right)$

C) $\frac{1}{2}\log\left(x + \sqrt{x^2 - 1}\right)$ D) $2\log\left(x - \sqrt{x^2 - 1}\right)$

4. If $u = x^2, v = y^2$ then the Jacobian $\frac{\partial(u,v)}{\partial(x,y)}$ =____________.

A) $4xy$ B) $-4xy$ C) $4x^2y^2$ D) $-4x^2y^2$

5. The solution of the linear differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$ is __________.

A) $y = (c_1 + c_2x)e^{2x}$ B) $y = (c_1 + c_2x)e^{4x}$

C) $y = (c_1 + c_2x)e^{-4x}$ D) $y = (c_1 + c_2x)e^{-2x}$

6. The function $f(x) = sin\frac{1}{x}$ at $x = 0$ has a ____________.

A)Discontinuity of first kind
B)Removable discontinuity
C)Discontinuity of second kind
D)Infinite discontinuity

7. If $z = \left(\frac{x-y}{\sqrt{x}+\sqrt{y}}\right)$ then $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} =$______________.

A)$2z$ B)$\frac{1}{2}z$ C)0 D) 3z

8. The P.I. of $(D-a)^2y = e^{ax}$ is ______________.

A) $\frac{e^{ax}}{2a}$ B) $\frac{x^2}{2}e^{ax}$ C) $\frac{x}{2}e^{ax}$ D) $\frac{x^3}{3!}e^{ax}$

9. The value of $\sin h\left(\frac{\pi i}{3}\right)$ is

A)$\frac{1}{\sqrt{2}}$ B)$\frac{\sqrt{3}}{2}i$ C) i D)$\frac{\sqrt{3}}{2}$

10. The solution of the equation $p^2 - 7p + 12 = 0$ is ....

A) $(y-3x-c)(y-4x-c)=0$ B) $(y-6x-c)(y-3x-c)=0$
C) $(y+3x+c)(y-4x-c)=0$ D) $y = 2x + c$

11. By using substitution $x = e^z$ the value of $x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx}$ in homogeneous linear equation is of the form ....

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

12. The complete solution of the differential equations $\frac{dx}{x} = \frac{dy}{y} = \frac{dz}{z}$ is ......

A) $y = c_1x, y = c_2z$
B) $xy = c_1, yz = c_2$
C) $y = c_1x, xz = c_2$
D) $xy = c_1, y = c_2z$

13. If $f(x)$ is continuous in (a,b) and $f(a)$ and $f(b)$ are of opposite signs then there exists .... root of $f(x)$ in (a,b).

A) zero
B) one
C) two
D) atleast one

14. The iterative formula of Euler's method for solving $y' = f(x, y)$ with $y(x_0) = y_0$ is.............

A) $y_n = y_0 + hf(x_0, y_0)$
B) $y_n = y_{n-1} + hf(x_{n-1}, y_{n-1})$
C) $y_n = y_0 + hf(x_{n-1}, y_{n-1})$
D) $y_n = y_{n-1} + hf(x_0, y_0)$

15. The divergence of a vector point function $\bar{f}$ is zero then $\bar{f}$ is called ....

A) solenoidal
B) rotational
C) irrotational
D) conservative

16. Value of curl grad f is..............

A) $\nabla^2 f$
B) 0
C) div grad f
D) grad curl f

17. If the line integral $\int_C \bar{F} \,.\, d\bar{r}$ is independent of the path C joining A and B in a region R where A and B are points in R then vector field $\bar{F}$ is called .... vector field.

A) continuous
B) non continuous
C) conservative
D) non conservative

18. $\int_0^{\infty} e^{-x} x^6 dx =$ ....

A) 100
B) 120
C) 600
D) 720

19. erf (x) + erf$_c$ (x) =...............

A) 1
B) −1
C) 0
D) ∞

20. Value of the integral $\int_1^a \int_1^b \frac{dx\,dy}{xy}$ is.................

A) $\log(ab)$
B) $\log\frac{a}{b}$
C) $\log a \,.\log b$
D) $\frac{\log a}{\log b}$

21. The least upper bound of the set $\left\{\pi + 1,\ \pi + \frac{1}{2},\ \pi + \frac{1}{3},\ \ldots\right\}$ is _______.

A) π
B) $\pi + 1$
C) 1
D) 0

22. _______ is not a countable set.

A) Set of all rational numbers
B) Set of all integers
C) $[0,\ 1]$
D) $\{e,\ e^2,\ e^3,\ e^4,\ \ldots\ldots\}$

23. If $S = \{1, 0, 1, 0, 1, 0, \ldots\}$ and $N = \{n_i\}_{i=1}^{\infty} = \{2i - 1\}_{i=1}^{\infty}$, then $S \circ N =$_________.

A) 1, 0, 1, 0,...
B) 0, 1, 0, 1, ...
C) 1, 1, 1, 1, ...
D) 0, 0, 0, 0,...

24. For the sequence $S_n = (-1)^n,\ \ \forall\, n \in I$, which of the following is correct?

A) limit superior = limit inferior
B) neither limit superior nor limit inferior exists
C) limit superior = 1 and limit inferior = – 1
D) limit superior = 1 and limit inferior = 0

25. A non-increasing sequence which is not bounded below is ________.

A) diverges to ∞
B) diverges to $-\infty$
C) convergent
D) none of these

26. $\lim\limits_{n \to \infty} \left(\dfrac{6n^2 + 15}{2n^2 - 5n + 3} \right) =$ __________.

A) 7.5
B) e
C) 5
D) 3

27. If $s = \{s_n\}_{n=1}^{\infty}$ and $t = \{t_n\}_{n=1}^{\infty}$ are in class ℓ^2, then

$$\left|\sum_{n=1}^{\infty} s_n t_n\right| \leq \left(\sum_{n=1}^{\infty} s_n^2\right)^{\frac{1}{2}} \left(\sum_{n=1}^{\infty} t_n^2\right)^{\frac{1}{2}}$$

. This inequality is known as ________.

A) Minkowski inequality
B) Schwarz inequality
C) Triangle inequality
D) Dirichlet's inequality

28. If $\sum_{n=1}^{\infty} a_n$ is a series of nonzero real numbers and $A = \lim\ \sup_{n\to\infty} \left|\frac{a_{n+1}}{a_n}\right|$, then the series converges if ________.

A) $A < 1$
B) $A > 1$
C) $A = 2$
D) $A = 1$

29. The series $\sum_{n=1}^{\infty} 1$ is__________.

A) convergent to 1
B) convergent to n
C) converges to 0
D) divergent

30. If $0 < x < 1$, then the alternating series $1 - x + x^2 - x^3 + \ldots$ ________.

A) converges to $\frac{1}{1+x}$
B) converges to $\frac{1}{1-x}$
C) converges to 0
D) diverges

31. $O(S_3) =$ _____.

A) 6
B) 1
C) 2
D) 3

32. _____ theorem states that "If G is a finite group and H is a subgroup of G then o(H) divides o(G)".

A) Euler's
B) Fermat's
C) Cayley's
D) Lagrange's

33. Consider the following statements for a cyclic group $G = < a >$.
I) G is abelian.
II) $o(G) = o(a)$.
Then
A) Only I) is true
B) Only II) is true
C) Both I) and II) are true
D) Both I) and II) are false

34. An infinite cyclic group has precisely ____ generators.

A) two
B) one
C) infinitely many
D) $\varphi(1)$

35. An isomorphism from a group G to itself is called _______ of G.

A) endomorphism
B) automorphism
C) epimorphism
D) monomorphism

36 Every group G is isomorphic to a_______.

A) group of order prime
B) infinite group
C) finite group
D) permutation group

37. Consider $S_3 = \{I, (12), (13), (23), (123), (132)\}$. Then alternating group $A_3 =$ ______

A) $\{I, (12), (13), (23)\}$
B) $\{I\}$
C) $\{I, (123), (132)\}$
D) S_3

38. Which of the following value of n gives Z_n modulo n a field?

A) $n = 27$
B) $n = 10$
C) $n = 15$
D) $n = 11$

39. Rings of integers is of characteristic ______
A) p (prime)
B) zero
C) 1
D) infinity

40. A commutative division ring is called ______.

A) an integral domain
B) ideal
C) a Boolean ring
D) a field

41. Let $f(t)$ be a function of class A. Consider the following statements.

I) $f(t)$ is piecewise continuous over every finite interval in the range $t \geq 0$.

II) $f(t)$ is of exponential order as $t \to \infty$.

Then

A) Only I) is true B) Only II) is true C) both I) & II) are true D) both I) & II) are false

42. $L\left\{4t^{\frac{1}{4}}\right\} =$ ________.

A) $\frac{\Gamma\left(\frac{1}{4}\right)}{s^{\frac{1}{4}}}$ B) $\frac{\Gamma\left(\frac{1}{4}\right)}{s^{\frac{5}{4}}}$ C) $\frac{\Gamma\left(\frac{5}{4}\right)}{s^{\frac{5}{4}}}$ D) $\frac{1}{s^{\frac{5}{4}}}$

43. If $L\{t \cos t\} = \frac{s^2-1}{(s^2+1)^2}$ then the value of $\int_0^\infty e^{-3t} t \cos t \, dt =$ ________.

A) $\frac{1}{25}$ B) $\frac{2}{25}$ C) $\frac{3}{25}$ D) $\frac{4}{25}$

44. If $F(t)$ is a periodic function with period ω, then $L\{F(t)\}=$__________.

A) $\int_0^\infty e^{-st} F(t)dt$ B) $\int_0^\omega e^{-st} F(t)dt$ C) $\frac{\int_0^\infty e^{-st} F(t)dt}{1-e^{-s\omega}}$ D) $\frac{\int_0^\omega e^{-st} F(t)dt}{1-e^{-s\omega}}$

45. If $F(x)$ is continuous and $F'(x)$ is piecewise continuous, then $F_s\{F'(x)\} =$ ________

A) $-F_c\{F(x)\}$ B) $F_c\{F(x)\}$ C) $-sF_c\{F(x)\}$ D) $-s^2 F_c\{F(x)\}$

46. $$L^{-1}\left\{\frac{s}{2s^2+32}\right\} = \text{______}.$$

A) $\cos\sqrt{32}\,t$ B) $\cos 4t$ C) $\frac{1}{2}\cos 4t$ D) $\frac{1}{2}\sin 4t$

47. If $L^{-1}\{f(s)\} = \sin t$ then $L^{-1}\{f(3s)\} =$ ____

A) $\frac{1}{3}\sin\left(\frac{t}{3}\right)$ B) $3\sin\left(\frac{t}{3}\right)$ C) $\sin\left(\frac{t}{3}\right)$ D) $\frac{1}{3}\sin(3t)$

48. If $f(s)$ is Fourier transform of $F(X)$ then Fourier transform of $F'(X)$ is _______ where $F\{F(x)\} = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} F(x) e^{isx}\, dx$

A) $is\, f(s)$ B) $s\, f(s)$ C) $-is\, f(s)$ D) $-s\, f(s)$

49. $$L^{-1}\left\{\frac{1}{s^2 - 16}\right\} = \_\_\_\_\_$$

A) $\frac{1}{4}\cosh 4t$ B) $\frac{1}{16}\cos 4t$ C) $\frac{1}{4}\cos 4t$ D) $\frac{1}{4}\sinh 4t$

50. If $L^{-1}\{f(s)\} = F(t)$ and $L^{-1}\{g(s)\} = G(t)$, then $L^{-1}\{f(s) \cdot g(s)\} =$__________

A) $F(t) \cdot G(t)$ B) $F(t) + G(t)$ C) $F(t) - G(t)$ D) $F(t) * G(t)$

51. The inverse of a complex number $z = 1 + i$ is $z^{-1} = \cdots$

A) $(1 - i)/2$ B) $1 + i$ C) $1 - i$ D) $(1 + i)/2$

52. If $f(z) = x^2 + iy^2$, then $f'(z)$ exists at $z = \cdots$

A) i B) $-i$ C) 1 D) $1 + i$

53. For which of the following function $f(z)$, $\bar{f}(z)$ is also analytic?

A) z^2 B) e^z C) $\cos z$ D) $1 + i$

54. If Arg z denotes the principal value of arg$z$, then relation between them is …

A) Arg $z = \arg z + 2n\pi, n = 0, 1, -1, \ldots$ B) Arg $z = \arg z + 2n\pi i, n = 0, 1, -1, \ldots$

C) Arg $z = \arg z + n\pi, n = 0, 1, -1, \ldots$ D) Arg $z = 2\arg z + 2n\pi, n = 0, 1, -1, \ldots$

55. An arc $z = e^{it}, 0 \le t \le 2\pi$ which does not cross itself except $z(0) = z(2\pi)$is…

A) Jordan arc B) Jordan curve C) open arc D) Simple arc

56. $\int_C \frac{z\, dz}{z+1} = \ldots$, where contour C is the circle $|z| = 2$ taken in the positive sense.

A) $2\pi i$ B) $-2\pi i$ C) $4\pi i$ D) $-4\pi i$

57. The series of complex numbers $\sum_{n=0}^{\infty} \left(1 + \frac{i}{3}\right)^n$ is…

A) divergent B) converges to $\frac{3}{2+i}$ C) converges to $\frac{3}{2-i}$ D) converges to $\frac{-1}{\frac{1}{2}+i\frac{1}{2}}$

58. The Laurent series expansion of $z^2 \cos\left(\frac{1}{z^2}\right)$ in the domain $1 < |z| < \infty$ is …

A) $\sum_{n=0}^{\infty} \frac{(-1)^n}{2n!\, z^{4n-2}}$ B) $\sum_{n=0}^{\infty} \frac{1}{2n!\, z^{4n-2}}$ C) $\sum_{n=0}^{\infty} \frac{1}{2n!\, z^{4n-2}}$ D) $\sum_{n=0}^{\infty} \frac{(-1)^{n+1}}{z^{2n+1}}$

59. If $f(z) = \frac{1-\sin z}{z^3}$ then $z = 0$ is … type of singularity of $f(z)$.

A) Removable B) simple Pole C) Pole of order 3 D) essential

60. The value of the integral $\int_C \frac{dz}{z\ (z-4)}$ taken counterclockwise around the circle $|z| = 1$ is …..

A) $\frac{-\pi i}{2}$ B) $2\pi i$ C) $-\frac{\pi i}{9}$ D) $\frac{2\pi i}{3}$

61. A zero vector in vector space V(F) is always ________

A) linearly dependent.

B) linearly independent.

C) both linearly dependent and independent

D) none of these.

62. A non empty subset W of a vector space V(F)is a subspace of V(F) if and only if_________ .

A) $\propto x + \beta y \in W$ for $\propto, \beta \ \in F\ and\ x, y\ \in W$

B) $\propto x - \beta y \in W$ for $\propto, \beta \ \in W\ and\ x, y\ \in F$

C) $\propto x + \beta y \in W$ for $\propto, \beta \ \in W\ and\ x, y\ \in F$

D) $\propto x . \beta y \in W$ for $\propto, \beta \ \in F\ and\ x, y\ \in W$

63. If W is subspace of vector space V(F), then linear span L(W) = ____.

A) W B) V C) {0} D) Ø

64. If T: $R^2 \rightarrow R^2$and $R^2 \rightarrow R^3$defined by $T\ (x, y) = (y,\ x)$ is and $s(x, y) = (x + y,\ x - y,\ y)$, then $S.T(x,\ y) =$ _____.

A)$(x + y, y - x,\ x)$ B)$(x - y,\ x + y,\ x)$

C) $(x - y,\ x + y,\ y)$ D) $(y + 2x,\ y - x,\ x)$

65. If $u = (4,\ -3\ , 0,\ 1)$ then norm of u with respect to Euclidean inner product is _____.

A)30 B) 26 C) $\sqrt{30}$ D) $\sqrt{26}$

66. In an inner product space V, the inequality

$$\|u + v\| \leq \|u\| + \|v\| \qquad \forall\, u, v \in V$$

is called _______.

A) Cauchy Schwarz inequality

B) Minkowski inequality

C) Triangle inequality

D) None of these

67. The number of vectors in any basis of Finite Dimensional Vector Space is called ______.

A) rank of T.

B) norm of V.

C) nullity of V.

D) dimension of V.

68. If $T: U \to V$ isa linear transformation such that dim. U= 4 and nullity of T = 2 then rank of T is _____.

A) 1 B) 2 C) 0 D) 4.

69. If A = $\begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$ then the characteristic polynomial of A is _______.

A) $x^2 - 2x + 3$. B) $x^2 + 3x - 10$.

C) $x^2 - 3x$. D) $x^2 - 3x - 10$.

70. If T(1, 1) =(3, 3) then _______ is an eigen value of T.

A)3 B) 4 C) 2 D)6

71. A general solution of a first-order partial differential equation involves--------------

A) No arbitrary constants or functions
B) One or more arbitrary constants
C) One arbitrary function
D) Two arbitrary constants

72. Which of the following is not a homogeneous partial differential equation ----------

A) $u_{xx} + u_{yy} = 0$
B) $u_{xx} - 3u_{yy} = 0$
C) $u_{xx} + 2u_{xy} + u_{yy} = 0$
D) $u_{xx} + u_{yy} = x^2 + y^2$

73. The partial differential equation formed by eliminating constants from $z = a(x + y)^2 + b(x - y)^2$ is of----

A) First order
B) Second order
C) Third order
D) None of the above

74. For repeated roots in the auxiliary equation, the complementary function includes---------

A) Only exponential terms
B) Multiples of arbitrary functions
C) Constants only
D) Terms multiplied by x or y

75. The Charpit's auxiliary equations are derived by-------------

A) Separation of variables
B) Method of characteristics
C) Using total differential and derivatives of F
D) Integrating directly

76. In the method of characteristics, the characteristic curves are found by solving----------

A) A single ordinary differential equation
B) A pair of partial differential equationS
C) A system of ordinary differential equation derived from auxiliary equations
D) A second-order PDE

77. The solution of the partial differential equation $\frac{\partial u}{\partial x} = 0$ is ------------

A) u=f(y)
B) u=f(x)
C) u=x+y
D) u=constant

78. The complementary function for the equation (D - D')z = 0 is ---------------

A) f(x - y)
B) f(x + y)
C) f(x)g(y)
D) f(xy)

79. The partial differential equation $u_{xx} + u_{yy} = 0$ is----------------

A) Elliptic
B) Parabolic
C) Hyperbolic
D) Mixed type

80. The characteristic equation is obtained from a partial differential equation by------------

A) Replacing derivatives with operators and factoring
B) Taking the Fourier transform
C) Applying separation of variables
D) Replacing $D \rightarrow m$ and $D' \rightarrow 1$

81. In absolute metric space, the distance between two distinct is -------.

A) negative
B) zero
C) complex
D) greater than zero

82. In any metric space the Cauchy sequence ----------.

A) is always convergent sequence
B) need not be convergent sequence
C) is not convergent sequence
D) none of these

83. In any metric space< M, ρ>the condition ρ(x, y) = ρ(y, x) is called ----------.

A) non-negativity
B) symmetric
C) transitive
D) triangle inequality

84. If M is the closed interval [-1, 2] with absolute value metric, then open ball B[0;3] is the interval -----------.

A) [-3, 3]
B) (-3, 3)
C) (-1, 2)
D) [-1, 2]

85. Which of the following is closed subset of an absolute metric space?

A) {1}
B) (1, ∞)
C) (1,2]
D) [1,2)

86. In any metric space image of closed set ----------.

A) need not be closed set
B) is closed set
C) is open set
D) can't say

87. Let < M, ρ>be a metric space. A subset 'A' of M is totally bounded if and only if ----------.

A) there exists a sequence of points of 'A'that contains a Cauchy subsequence
B) there exists a sequence of points of 'A'that contains a convergent subsequence
C) every sequence of points of 'A'contains a convergent subsequence
D) every sequence of points of 'A' contains a Cauchy subsequence

88. For a subset A = (2, 5) of R,
(I) diam(A) = 1 in R_d.
(II) diam(A) = 3 in R^1.
Then ----------.

A) only statement (I) is true
B) only statement (II) is true
C) both statements (I) and (II) are true
D) both statements (I) and (II) are false

89 A subset C = {1, 2,...., 120} in discrete metric space is.........

A) connected
B) open
C) compact
D) need not be open

90. Let < M, ρ> be a metric space. T: M → M is a contraction on M then which of the following is true?

A) $\rho(Tx, Ty) < \frac{4}{3}\,\rho(x, y)$
B) $\rho(Tx, Ty) < \frac{3}{2}\,\rho(x, y)$
C) $\rho(Tx, Ty) < \frac{2}{3}\,\rho(x, y)$
D) $\rho(Tx, Ty) \geq \rho(x, y)$

91. Operations Research is most closely related to:

A) Art and literature

B) Historical studies

C) Dacion science.

D) Pure mathematics

92. The term "feasible solution" in LPP refers to a solution that:

A) Maximizes the objective function
B) Minimizes costs
C) Is obtained using the Simplex method
D) Satisfies all constraints

93. For the transportation problem with supply [30,50], demand [40,20,20] and cost matrix:
| 2 4 3 |
| 3 1 2 |

What is the initial solution cost using Vogel's Approximation Method?

A)₹150
B) ₹190

C) ₹170
D) ₹210

94. The purpose of slack variables in LPP is to:

A) Convert inequalities into equations
B) Replace decision variables
C) Eliminate the objective function
D) Introduce nonlinearity

95 A balanced transportation problem has:

A) Total supply > Total demand
B) Total supply < Total demand
C) Total supply = Total demand
D) No constraints

96 The stepping-stone method is used to :

A) Test the optimality of a transportation solution
B) Find an initial feasible solution
C) Solve an assignment problem
D) Handle degeneracy

97. In an assignment problem, the number of rows and columns must be equal to ensure.

A) Optimality
B) Uniqueness
C) Linearity
D) Feasibility

98. The Hungarian method is also known as:

A) Kuhn's algorithm
B) Vogel's method
C) Flood's technique
D) Dijkstra's algorithm

99. The Travelling Salesman Problem is NP-hard because:

A) It cannot be solved
B) It has no feasible solutions
C) Its solution time grows exponentially with problem size
D) It is a linear problem

100 The MODI method stands for:

A) Modified Distribution Method
B) Matrix Optimization and Distribution Index
C) Minimal Optimal Distribution Index
D) Multi-Objective Decision Index

– ROUGH WORK –