

SPACE FOR ROUGH USE

This booklet contains 10 printed pages.

ARUNACHAL PRADESH UNIVERSITY
COMMON ENTRANCE TEST-2025
(APUCET-2025)

Test Booklet No.

MASTER OF SCIENCE IN MATHEMATICS

OMR Sheet No.

Subject Code

Roll No.

Series

A

Day and Date of Examination: _____

Signature of Candidate: _____

Signature of Invigilator(s): _____

Full Marks: 100

Time: 1 Hours

INSTRUCTIONS

1. Do not open this test booklet until you are told to do so.
2. Candidate must write his/her Roll Number in the space provided.
3. This Test Booklet comprises One Section which consists of 50 Multiple Choice Questions (MCQs) and appropriate option should be marked as answers in the OMR sheet provided. All questions carry 2 marks each.
4. There will be no negative marking for a wrong answer.
5. No candidate shall be permitted to enter the Examination Hall after the commencement of the Entrance test and leave the examination hall before the expiry of the examination time.
6. Making any identification mark both in the Test Booklet and the OMR Sheet anywhere other than the specified places will lead to disqualification of the candidate.
7. Handover OMR Sheet at the end of the examination to the invigilators.
8. Candidates shall maintain silence inside and outside the examination hall. If candidates are found violating the instructions mentioned herein or announced in the examination hall, they will be summarily disqualified from the entrance test.
9. The use of any electronic items, log table, etc. is prohibited inside the examination hall.
10. Use only **Black Ball Point Pen**.
11. In case of any dispute, the decision of the University Authority shall be final and binding.

SECTION – A
(Each Question Carries ONE Mark)

SPACE FOR ROUGH USE

1. If $f(x)=x^2 \sin x$, then $f'(x) = ?$
A) $2x \sin x + x^2 \cos x$
B) $2x \sin x - x^2 \cos x$
C) $x^2 \cos x$
D) $2x \sin x$
2. In a group, which property is not necessarily true?
A) Closure
B) Identity exists
C) Commutativity
D) Inverse exists
3. Sequence $a_n = 1/n$ converges to:
A) 0
B) 1
C) ∞
D) Does not converge
4. For $f(z) = u + iv$, Cauchy–Riemann equations are:
A) $u_x = v_y, u_y = v_x$
B) $u_x = v_y, u_y = -v_x$
C) $u_x = -v_y, u_y = v_x$
D) None
5. A continuous everywhere but nowhere differentiable function:
A) Polynomial
B) Weierstrass function
C) Sine
D) Exponential
6. Determinant of a singular matrix is:
A) Zero
B) One
C) Negative
D) Undefined
7. $\int_0^1 x^n dx = 1/(n+1)$. For large n , integral tends to:
A) 1
B) 0
C) ∞
D) $\frac{1}{2}$

32. A graph with no cycles is called:
 A) Complete graph
 B) Cyclic graph
 C) Acyclic graph
 D) Connected graph
33. Newton–Raphson method is:
 A) Root-finding algorithm
 B) Sorting algorithm
 C) Graph traversal
 D) Differential equation solver
34. In boundary value problems, solution must satisfy at:
 A) Endpoints only
 B) Interior only
 C) Both endpoints
 D) Nowhere
35. Find the order and degree of the given differential equation
 $dy = (y + \sin x) dx$:
 A) Order =1, Degree=1
 B) Order =1, Degree=2
 C) Order =2, Degree=1
 D) Order =1, Degree=Not defined
36. Graph where every pair of vertices is connected by unique edge is:
 A) Path graph
 B) Complete graph
 C) Tree
 D) Cycle graph
37. Which of the following is not order-complete
 A) \mathbb{Q}
 B) \mathbb{N}
 C) \mathbb{R}
 D) \mathbb{C}
38. Interior point on \mathbb{N} is:
 A) 1
 B) ϕ
 C) \mathbb{N}
 D) \mathbb{R}
39. In graph theory, a vertex with degree 1 is:
 A) Leaf or pendant vertex
 B) Isolated vertex
 C) Internal vertex
 D) Cut-vertex
8. Radius of convergence of $\sum n! x^n$:
 A) 0
 B) 1
 C) ∞
 D) Undefined
9. Cauchy–Schwarz inequality in inner product spaces is:
 A) $|\langle u, v \rangle| \leq \|u\| \|v\|$
 B) $|\langle u, v \rangle| = \|u\| \|v\|$
 C) $\langle u, v \rangle \leq \|u\| \|v\|$
 D) $\|u+v\|^2 = \|u\|^2 + \|v\|^2$
10. Normal distribution curve is:
 A) Uniform
 B) Skewed
 C) Bell-shaped
 D) Triangular
11. General solution of $dy/dx = k y$ is:
 A) $y = Ce^{kx}$
 B) $y = kx + C$
 C) $y = C x^k$
 D) $y = k/x + C$
12. Existence of partial derivatives does not guarantee:
 A) Continuity
 B) Differentiability
 C) Both A and B
 D) Neither
13. Function on $[a, b]$ with single max and min must be:
 A) Integrable
 B) Non-differentiable
 C) Undefined
 D) Neither
14. Solution of a homogeneous linear ODE with constant coefficients is:
 A) Polynomial
 B) Exponential (or combinations)
 C) Trigonometric
 D) Always exponential or combinations thereof
15. Every bounded sequence in \mathbb{R} has a:
 A) Unique limit
 B) Convergent subsequence
 C) Cauchy subsequence
 D) Divergent subsequence

16. By Mean Value Theorem, a function must have:
 A) $f'(c) = (f(1) - f(0))$ for some $c \in (0,1)$
 B) Max at end points
 C) Min at end points only
 D) No extremum
17. Limit point of a set of rational number (\mathbb{Q}) is:
 A) \mathbb{Q}
 B) \emptyset
 C) \mathbb{R}
 D) \mathbb{C}
18. A function is Riemann integrable if set of discontinuities has measure:
 A) Zero
 B) One
 C) Finite
 D) Infinite
19. If f is uniformly continuous on closed interval, then it is:
 A) Differentiable
 B) Integrable
 C) Bounded
 D) Both B and C
20. $f(x) = 1/x$ is not integrable on $[0,1]$ due to:
 A) Oscillation
 B) Discontinuity at $x = 0$
 C) Not bounded
 D) Not defined
21. If $Z = r e^{i\theta}$, then $\bar{Z} =$:
 A) $r e^{-i\theta}$
 B) $-r e^{i\theta}$
 C) $r + i\theta$
 D) $r - i\theta$
22. A ring where every non-zero element is invertible is a:
 A) Field
 B) Integral domain
 C) Division ring
 D) Ring with unity
23. What does MATLAB stand for:
 A) MathWorks.
 B) Matrix Laboratory.
 C) Math Laboratory.
 D) None of the above
24. LATEX was invented by:
 A) Donald Knuth
 B) Leslie Lamport
 C) Cleve Moler
 D) None
25. A closed and bounded subset in \mathbb{R}^n is:
 A) Compact
 B) Open
 C) Neither
 D) Only bounded
26. A simply connected open subset of \mathbb{C} without holes is:
 A) Domain
 B) Region
 C) Simply connected region
 D) None
27. Fundamental theorem of algebra:
 A) Every real polynomial has real roots
 B) Every non-constant real polynomial has ≥ 1 real root
 C) Every non-constant complex polynomial has ≥ 1 complex root
 D) Real and imaginary parts are integrable
28. A subspace of a topological space that's both open and closed is:
 A) Clopen
 B) Dense
 C) Compact
 D) Connected
29. In group theory, the identity element is:
 A) Unique
 B) Non-unique
 C) May not exist
 D) Group dependent
30. Triangle inequality in \mathbb{C} :
 A) $|z + w| = |z| + |w|$
 B) $|z + w| \leq |z| + |w|$
 C) $|z + w| \geq |z| + |w|$
 D) None
31. Laplace transform of 1 is:
 A) $1/s$
 B) s
 C) e^{-s}
 D) Undefined

40. Fourier transform is useful in:
- A) Solving ODEs in frequency domain
 - B) Sorting data
 - C) Computing integrals only
 - D) Graph traversal
41. Which of the following is a necessary condition for a matrix to be invertible?
- A) Its determinant is zero.
 - B) Its determinant is non-zero.
 - C) It has more rows than columns.
 - D) It has more columns than rows.
42. The eigen values of a matrix are:
- A) The solutions to the characteristic equation.
 - B) The entries on the main diagonal.
 - C) The determinants of the matrix.
 - D) The traces of the matrix.
43. Which of the following is true for a diagonalizable matrix?
- A) It has a full set of linearly independent eigenvectors.
 - B) It has no eigen values.
 - C) It cannot be represented by a diagonal matrix.
 - D) It is always symmetric
44. The characteristic polynomial of a matrix is:
- A) The determinant of $\mathbf{A} - \lambda \mathbf{I}$.
 - B) The trace of $\mathbf{A} - \lambda \mathbf{I}$.
 - C) The inverse of $\mathbf{A} - \lambda \mathbf{I}$.
 - D) The adjoint of $\mathbf{A} - \lambda \mathbf{I}$.
45. Which of the following methods is used to solve linear differential equations?
- A) Separation of variables.
 - B) Method of undetermined coefficients.
 - C) Euler's method.
 - D) All of the above.
46. Which of the following methods is used to find the root of an equation?
- A) Newton-Raphson method.
 - B) Euler's method.
 - C) Simpson's rule.
 - D) Gaussian elimination.
47. Which of the following methods is used to solve ordinary differential equations?
- A) Euler's method.
 - B) Runge-Kutta method.
 - C) Finite difference method.
 - D) All of the above.
48. Which of the following is an iterative method for solving systems of linear equations?
- A) Gaussian elimination.
 - B) Jacobi method.
 - C) LU decomposition.
 - D) None of the above.

49. Which of the following is true about a compact subset of a metric space?
- A) It is always open.
 - B) It is always closed.
 - C) It is always bounded and closed.
 - D) It is always connected.
50. Which of the following is a necessary condition for a function to be analytic at a point?
- A) The function must be continuous at the point.
 - B) The function must have a derivative at the point.
 - C) The function must satisfy the Cauchy-Riemann equations at the point.
 - D) The function must be bounded at the point.