Total No. of Printed Pages : 06 **Roll No. .....**

Ph.D. Entrance Examination
November - 2022
Part - C
(Mathematics)
Time : 50 Minutes
Maximum Marks : 50

Note :

(i) This question booklet comprises of 50 questions.

(ii) All questions are compulsory.

(iii) The question booklet along with answer sheet is to be handed over by the candidate to the Invigilator at the end of the examination.

(iv) There is no negative marking.

(v) Each question carries one mark.

Multiple Choice Questions -

1. What is not true about number zero
   (a) Even (b) Positive
   (c) Additive identity (d) Additive inverse of zero
2. Which one of them is not interval
   (a) (1, 2) (b) (12, 13)
   (c) $[3.\pi]$ (d) $(2\pi, 180)$
3. A number which is neither even nor odd is
   (a) 0 (b) 2
   (c) 2n such that $n \in Z$ (d) 2π
4. A number which is neither positive nor negative is
   (a) 0 (b) 1
   (c) π (d) None of these
5. If a real number is not rational then it is ……
   (a) Integer (b) Algebraic number
   (c) Irrational number (d) Complex numbers
6. Which of the following numbers is not irrational?
   (a) π (b) $\sqrt{2}$
   (c) $\sqrt{3}$ (d) 7
7. A convergent sequence has only ……. limit(s).
   (a) One (b) Two
   (c) Three (d) None of these

P.T.O.

8. A sequence $\{1^n\}$ is

(a) Bounded (b) Unbounded.

(c) Divergent. (d) None of these.

9. A sequence $\{(-1)^n\}$ is

(a) Convergent. (b) Unbounded.

(c) Divergent. (d) Bounded.

10. If the sequence is decreasing, then it …….

(a) Converges to its infimum. (b) Diverges.

(c) May converges to its infimum (d) Is bounded.

11. If the sequence is increasing, then it …….

(a) Converges to its supremum. (b) Diverges.

(c) May converges to its supremum. (d) Is bounded.

12. The inverse of the matrix is possible only for

(a) Singular matrix (b) Zero matrix

(c) Symmetric matrix (d) Non-singular matrix

13. $A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix}$ The trace of the matrix is

(a) 0 (b) 4

(c) 7 (d) 5

14. If Rank(A)=2 and Rank (B)=3 then Rank(AB)=

(a) 6 (b) 5

(c) 3 (d) Data inadequate

15. The condition for which Eigen values of the matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & K \end{bmatrix}$ are positive is

(a) K>1/2 (b) K>-2

(c) K>0 (d) K<-1/2

16. If the following system has non trivial solution,

px+qy+rz=0 qx+ry+pz=0

rx+py+qz=0 Then which of the following is true

(a) p-q+r=0 or p=q=-r (b) p+q-r=0 or p=-q=r

(c) p+q+r=0 or p=q=r (d) p-q+r=0 or p=-q=-r

17. The relation $|3 - Z| + |3 + Z| = 5$ represents

(a) A circle (b) A parabola

(c) An ellipse (d) A Hyperbola

18. If a determinant of a matrix A is -12 then the determinant of matrix 2A is

(a) -96 (b) -24

(c) 24 (d) 96

19. If A is mxn matrix such that AB and BA both are defined, then B is a matrix of order

(a) nxn (b) mxm

(c) mxn (d) nxm

20. The value of the determinant $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix}$ is

(a) 0 (b) 1

(c) a+b+c (d) 3

21. A matrix X has a dimension of 2x2 . If the eigen values of the matrix is 5 and 6. What would be the eigen values of X^2 is

(a) 2.5 and 3 (b) 5 and 6

(c) 10 and 12 (d) 25 and 36

22. Eigen values of a real symmetric matrix are always

(a) Positive (b) Negative

(c) Real (d) Complex

23. Which of the following is true?

(a) Differentiability does not imply continuity

(b) Differentiability implies continuity

(c) Continuity implies differentiability

(d) There is no relation between continuity and differentiable

24. Which of the following is true about $f(z)=z^2$?

(a) Continuous and differentiable (b) Continuous but not differentiable

(c) Neither continuous nor differentiable (d) Differentiable but not continuous

25. Which of the following is true about f(z)=z+iz?

(a) Continuous and differentiable (b) Continuous but not differentiable

(c) Neither continuous nor differentiable (d) Differentiable but not continuous

26. The function $f(z) = |z|^2$ has

(a) One singular point (b) Two singular points

(c) Three singular points (d) No singular point

27. If $f(z)$ is an analytic function whose real part is constant then $f(z)$ is

(a) function of z (b) function of x only

(c) Function of y only (d) Constant

28. A function which is analytic everywhere in a complex plane is known as

(a) Harmonic function (b) Differentiable function

(c) Regular function (d) Entire function

29. The value of $\left|e^{i\theta}\right|$ is

(a) 1 (b) 0

(c) -1 (d) π

30. The function $f(z) = xy+iy$ is

(a) Nowhere analytic (b) Analytic every where

(c) Analytic only at origin (d) Analytic except at the origin

31. Complex plane is also known as

(a) Gaussian plane (b) X-Y plane

(c) X plane (d) Y-plane

32. A domain that is not simply connected is said to be

(a) Contour (b) Multiply connected

(c) Connected (d) None of these

33. If a function f is analytic throughout a simple connected domain D, then $\int f(z)\,dz =$

(a) 0 (b) $2\pi i$

(c) $2\pi \mathrm{i}(\mathrm{z})$ (d) 1

34. If f is continuous in a domain D and if $f(z)\,\mathrm{dz} = 0$ for every simple closed positively oriented contour C in D, then

(a) f is analytic in D (b) f is real valued in D

(c) f is constant in D (d) f is imaginary in D

35. The converse of Cauchy- integral theorem is

(a) Euler's theorem (b) Liouville's theorem

(c) Morera's theorem (d) Goursat's theorem

36. Piecewise smooth curve is also known as

(a) contour (b) smooth curve

(c) circle (d) regular curve

Cont..5

37. If the principal part of $f(z)$ at z_0 is zero, then the point z_0 is known as

(a) Pole (b) Removable singular point

(c) Simple pole (d) None of these

38. The zero of the function z / cos z is

(a) 1 (b) 0

(c) -1 (d) π

39. The order of the zeros of the function sinz / (z+4) is

(a) 1 (b) 2

(c) 3 (d) 4

40. The principal part of $f(z)$ at z_0 consists of infinite number of terms, then z_0 is known as

(a) Pole (b) Essential singular point

(c) Removable singular point (d) Simple pole

41. Numerical techniques more commonly involve _____

(a) Elimination method (b) Reduction method

(c) Iterative method (d) Direct method

42. Which of the following is an iterative method?

(a) Gauss Seidel (b) Gauss Jordan

(c) Factorization (d) Gauss Elimination

43. Which of the methods is a direct method for solving simultaneous algebraic equations?

(a) Relaxation method (b) Gauss seidel method

(c) Jacobi's method (d) Cramer's rule

44. If EF exists, then $(EF)^{-1}$ will be equal to which of the following?

(a) $F^{-1} E^{-1}$ (b) $E^{-1} F^{-1}$

(c) EF (d) FE

45. Matrix which does not have an inverse by solving it, is classified as which of the following?

(a) Singular matrix (b) Non-singular matrix

(c) Linear matrix (d) Unidentified matrix

46. Cramer's Rule fails for _____

(a) Determinant = 0 (b) Determinant = non-real

(c) Determinant < 0 (d) Determinant > 0

47. What is the condition applied in the factorization method?

(a) There must exist a diagonal matrix form of the given matrix

(b) Matrix should not be singular

(c) All principal minors of the matrix should be non-singular

(d) Back substitution should be done

48. A and B are two events such that $P(A) = 0.4$ and $P(A \cap B) = 0.2$ Then $P(A \cap B)$ is equal to _____

(a) 0.4 (b) 0.2

(c) 0.6 (d) 0.8

49. Let A and B be two events such that the occurrence of A implies occurrence of B, But not vice- versa, then the correct relation between P(a) and P(b) is?

(a) $P(A) < P(B)$ (b) $P(B) \geq P(A)$

(c) $P(A) = P(B)$ (d) $P(A) \geq P(B)$

50. What is the probability of an impossible event?

(a) 0 (b) 1

(c) Not defined (d) Insufficient data

****