Seat No.

Total No. of Pages : 13

Ph.D. Entrance Examination 2024-25

MATHEMATICS

Subject Code : 58796

Day and Date : Wednesday, 13/11/2024 **Total Marks : 100**
Time : 04.00 pm to 06.00 pm

Instruction :

1) All questions are compulsory.
2) Each question carries 2 marks.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
5) Follow the instructions given on OMR Sheet.
6) Rough work shall be done on the sheet provided at the end of question paper.
7) Only non-programmable calculators are allowed.

Choose the correct answer

1) What does the torin "peer-reviewed journal" mean?

A) A journal edited by colleagues

C) A journal with no editorial board

B) A journal that only publishes positive findings

D) A journal with biased reviews

2) Research is .....

A) Searching again and again

B) Finding solution to any problem

C) Working in a scientific way to search for truth

D) None of the Above

3) In which of the following does the format of thesis writing closely reserable?

A) Writing of Seminar representation

B) Preparation of research paper/article

C) A research dissertation

D) Presenting a workshop/conference paper

4) Why do you need to review the existing literature?

A) To make sure you have a long list of references

B) Because without it, you could never reach the required word-count

C) To find out what is already known about your area of interest

D) To help in your general studying

5) The authors other than the corresponding author are listed in order of their the research project.

A) Age

B) Soniority

C) Contributions

D) Affection

6) Bibliography given in a research report:

A) shows vast knowledge of the researcher

B) helps those interested in further research

C) has no relevance to research

D) all the above

7) Research is basically

A) a methodology of enquiry

B) search of truth

C) a systematic exploration of facts

D) All of the above

8) If AIRLINE is written as ENILRIA7, then RAILWAY will be written as -

A) YAWLIAR7

B) YAWLIAR8

C) YAWILAR7

D) YAWILAR8

9) Which of the following acts constitute plagiarism?

A) Presenting other's work as own

B) Paraphrasing without citation

C) Quoting other's work without quotation marks

D) All of these

10) Tuberculosis: Lungs:: Cataract:?

A) Ear
B) Throat
C) Skin
D) Eye

11) $|-4| + |4| - 4+4 = ?$

A) 0
B) 2
C) 4
D) 8

12) The issue of 'research ethics' may be considered pertinent at which stage of research?

A) At the stage of problem formulation and its definition
B) AT the stage of defining the population of research
C) AT the stage of data collection and interpretation
D) At the stage of reporting the findings

13) Which of the following are frozen symbols?

e, A, $\prod$, $\in$, x, $\propto$

A) e, A, $\prod$
B) $\prod$, $\in$, x
C) $\prod$, $\in$, $\propto$
D) e, $\prod$, $\in$

14) The correct abbreviation for limit is .....

A) *lim*
B) lim
C) Lim
D) Lt.

15) In the kernel-index notation, if the size of the kernel letter is an *m*-pt font, then the size of the index letter is .....

A) (m−2)−pt
B) (m+2)− pt
C) 2m − pt
D) (m−1)−pt

16) Which of the following is/are Principle(s) of professional writing?

i) Abbreviate units of measurement when used with numerical values.

ii) Use the same abbreviation (of an unit of measurement) for the singular and the plural.

A) only (i)

B) only (ii)

C) both (i) and (ii)

D) none of (i) and (ii)

17) Which of the following is an example of professional writing?

A) This is a Toeplitz matrix.

B) Newton is unstable.

C) This matrix is a Toeplitz.

D) This matrix is the Toeplitz.

18) Which of the following is an example of professional writing?

A) Let X is a set.

B) Let *f, g* are functions.

C) Let 'e' be the exponential number.

D) Let 'e' denote the exponential number.

19) How do you write $\sqrt{x}$ in LaTeX?

A) $sqr{x}$

B) ${1/2}\root{x}$

C) ${2}\root{x}$

D) $\sqrt{x}$

20) What LaTeX command is used for the infinity symbol?

A) ∞

B) $\infinity$

C) $\infinite$

D) $\inf$

21) How do you write a in LaTeX?

A) $\dot{a}$

B) ${a}\dots

C) $ {\cdot}^{a}$

D) ${a}^{\cdot}$

22) To write $\begin{pmatrix} u & v \\ w & x \end{pmatrix}$ the Latex command is

A) $\begin{bmatrix} u & v \\ w & x \end{bmatrix}$

B) $\begin{pmatrix} u & v \\ w & x \end{pmatrix}$

C) $\begin{vmatrix} u & v \\ w & x \end{vmatrix}$

D) $\begin{Vmatrix} u & v \\ w & x \end{matrix}$

23) The statement i=5:1:8 produces i.....

A) 5. 6. 7. 8.

B) 5. 6. 7.

C) 1. 2. 3.

D) 3.

24) To configure the ttitle of our plot, we use the .....function.

A) xtitle

B) title

C) X axis

D) Y axis

25) We use..... statement in loops where, if some condition is satisfied, the loops should not be continued further.

A) continue
B) break
C) end
D) exit

26) If {f} and $\{g_n\}$converges uniformly on some set E then $\{f_n g_n\}$ converges uniformly on E if

A) $\{f_n\}$ or $\{g_n\}$ is sequence of bounded functions

B) $\{f_n\}$ and $\{g_n\}$ are sequences of bounded functions

C) $\{f_n\}$ or $\{g_n\}$ are sequences of continuous functions

D) $\{f_n\}$ and $\{g_n\}$ are sequences of continuous functions

27) $\int_a^b \lim_{n\to\infty} f_n(x)dx = \lim_{n\to\infty} \int_a^b f_n(x)dx$ if

A) The sequence $\{f_n\}$ is a sequence of Riemann integrable functions and $f_n \longrightarrow f$

B) $f_n \longrightarrow f$ uniformly

C) $f_n \longrightarrow f$ uniformly and each f_n is Riemann integrable.

D) The sequence {f}is a sequence of Riemann integrable functions, $f_n \longrightarrow f$ and f is Riemann intrgrable.

28) If the constraint relations are independent of velocity then constraints are classified as .....

A) Scleronomic

B) rheonomic.

C) holonomic

D) dissipative

29) If the Hamiltonian of the dynamical system is given by $H = -pq$ then as $t \longrightarrow \infty$

A) $q \longrightarrow \infty, p \longrightarrow 0$ B) $q \longrightarrow 0, p \longrightarrow 0$

C) $q \longrightarrow \infty, p \longrightarrow \infty$ D) $q \longrightarrow 0, p \longrightarrow \infty$

30) Basis element of k-topolgy of $\mathbb{R}$ is

A) [a, b] B) [a, b)

C) (a, b] D) (a, b)

31) Consider the following two statements:

A) Every second countable space is first countable space

B) Every first countable space is second countable space

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

32) The harmonic conjugate of $u\ (x,y) = x^2 - y^2, x, y \in \mathbb{R}$ is

A) $x^2 + y^2$ B) 4xy

C) 2xy D) $x^2 - y$

33) $\Upsilon\ (t) = a + r\, e^{it}, t \in [0, 2\pi]$ then $\int_{\Upsilon} \frac{dz}{z-a} =$

A) $2\pi i$ B) πi

C) 0 D) $\frac{\pi i}{2}$

34) The solution of integral equation $y(s) = \frac{5}{6}s - \frac{1}{9} + \frac{1}{3}\int_0^1 (s+t)y(t)dt$ is

A) $y(s)=0$ B) $y(s) = s^2$

C) $y(s) = s$ D) $y(s) = s^3$

35) Eigen functions g(s) and Ψ(x) corresponding to distinct eigen values of the homogenous integral equations and it's transpose are.....

A) Orthogonal
B) Linearly Independent
C) Orthonormal
D) Linearly dependent

36) Let N be normed linear space and N* is its conjugate space.

Consider the statements

I) If N* is separable ⇒ N is separable.

II) N* is reflexive N ⇔ is reflexive.

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

37) Consider the statements

I) If T is positive operator on Hilbert space H then 1+T is non-singular.

II) If T is an operator on Hilbert space H then I+T*T and I+TT* are Non-singular.

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.

38) If $A=\left\{\frac{1}{n}:n\in\mathbb{N}\right\}$ is

A) 0
B) $\frac{1}{n}$
C) ∞
D) 1

39) f' = g a.e. if f and g have same domain and

A) $m\{x: f'(x) = g(x)\} \neq 0$

B) $m\{x: f'(x) \neq g(x)\} \neq 0$

C) $m\{x: f'(x) = g(x)\} = 0$

D) $m\{x: f'(x) = g(x)\} = 0$

40) A Sylow 3-subgroup of a group of order 54 has order .....

A) 9 B) 6

C) 27 D) 3

41) Let p be a prime number. Consider the following statements:

I) Any group of order p^2 is abelian.

II) If $|G| = p$ then $G' = \{e\}$.

A) Both I) and II) are true

B) Both I) and II) are false

C) Only II) is true

D) Only I) is true

42) If p and q be distinct prime numbers, then ..... is the basis of $\mathbb{Q}(\sqrt{p}, \sqrt{q})$ over $\mathbb{Q}$?

A) {1, p, q} B) {1, p, q, pq)

C) $\{1, \sqrt{p}, \sqrt{q}, \sqrt{p}\sqrt{q}\}$ D) $\{\sqrt{p}, \sqrt{q}, \sqrt{p}\sqrt{q}\}$

43) $\mathbb{Q}(\sqrt{-2})$ is ..... extension of $\mathbb{Q}$.

A) finite but not normal B) finite and normal

C) normal but not finite D) neither finite nor normal

44) If N is a positive real number, then X_{k+1} = ..., k= 0, 1, 2,..... is the iterative method based on the Newton-Raphson method for finding $\sqrt{N}$.

A) $\frac{1}{2}\left(X_k - \frac{N}{X_k}\right)$

B) $\frac{1}{2}\left(X_k + \frac{N}{X_k}\right)$

C) $X_k\left(2 - NX_k\right)$

D) $\frac{1}{2}\left(X_k - NX_k\right)$

45) Let A be a square matrix. Consider the following statements:

I) p(A) > ||A||.

II) If ||A|| 1 then $\lim_{m\to\infty} \mathrm{A}^m = 0$.

A) Both I) and II) are true

B) Both I) and II) are false

C) Only II) is true

D) Only I) is true

46) ..... is the solution of the initial value problem $y''+\frac{1}{x}y'-\frac{1}{x^2}y=0, y(1)=0$ y'(1) = 1 for x > 0?

A) $\phi(x) = x - \frac{1}{x}$

B) $\phi(x) = \frac{1}{2}\left(x + \frac{1}{x}\right)$

C) $\phi(x) = \frac{1}{2}\left(x - \frac{1}{x}\right)$

D) $\phi(x) = x + \frac{1}{x}$

47) Which of the following is the second successive approximation $\emptyset_1(x)$ to the solution of y' = 1+xy, y(0) = 1?

A) $1-x-\frac{x^3}{3}$ B) $1+x+\frac{x^3}{3}$

C) $1-x+\frac{x^2}{2}$ D) $1+x+\frac{x^2}{2}$

48) If V is of dimensions *m*, over F, then Hom(V, F) is of dimension ..... over F

A) 1 B) |F |

C) |V | D) *m*

49) A unitary transformation is one which is one which preserves all the.....

A) structure of V B) structure of F

C) roots of T D) polynomial

50) Any tree with at least two vertices has more than one vertwx of degree.....

A) 2 B) 1

C) 3 D) 4

◆◆◆

-- ROUGH WORK --