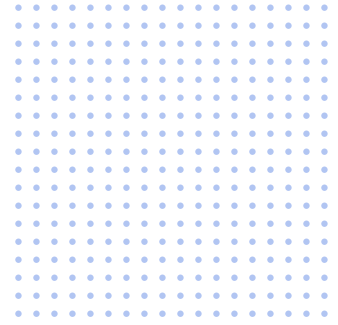




FOR KUET EXAM PREPARATION

KUET 2024

Question Paper · M.A. M.Sc. Statistics

EXAM	YEAR	TYPE	SUBJECT
KUET	2024	Question Paper	M.A. M.Sc. Statistics

Sr. No. **081****ENTRANCE TEST-2024****SCHOOL OF PHYSICAL & MATHEMATICAL SCIENCES****MATH FOR STATISTICS**

Question Booklet Series

A

Total Questions : 60

Time Allowed : 70 Minutes

Roll No. :

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Instructions for Candidates :

1. Write your Entrance Test Roll Number in the space provided at the top of this page of Question Booklet and fill up the necessary information in the spaces provided on the OMR Answer Sheet.
2. OMR Answer Sheet has an Original Copy and a Candidate's Copy glued beneath it at the top. While making entries in the Original Copy, candidate should ensure that the two copies are aligned properly so that the entries made in the Original Copy against each item are exactly copied in the Candidate's Copy.
3. All entries in the OMR Answer Sheet, including answers to questions, are to be recorded in the Original Copy only.
4. Choose the correct / most appropriate response for each question among the options A, B, C and D and darken the circle of the appropriate response completely. The incomplete darkened circle is not correctly read by the OMR Scanner and no complaint to this effect shall be entertained.
5. Use only blue/black ball point pen to darken the circle of correct/most appropriate response. In no case gel/ink pen or pencil should be used.
6. Do not darken more than one circle of options for any question. A question with more than one darkened response shall be considered wrong.
7. There will be '**Negative Marking**' for wrong answers. Each wrong answer will lead to the deduction of 0.25 marks from the total score of the candidate.
8. Only those candidates who would obtain positive score in Entrance Test Examination shall be eligible for admission.
9. Do not make any stray mark on the OMR sheet.
10. Calculators and mobiles shall not be permitted inside the examination hall.
11. Rough work, if any, should be done on the blank sheets provided with the question booklet.
12. OMR Answer Sheet must be handled carefully and it should not be folded or mutilated in which case it will not be evaluated.
13. Ensure that your OMR Answer Sheet has been signed by the Invigilator and the candidate himself/herself.
14. At the end of the examination, hand over the OMR Answer Sheet to the invigilator who will first tear off the original OMR sheet in presence of the Candidate and hand over the Candidate's Copy to the candidate.

SP-4475-A

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[Turn over

1. Given that $f(x) = (x^2 - 4)(x - 1)^2$ and $g(x) = x^2$ and $h(x) = \frac{f'(x)}{g'(x)}$, then for what value of k , $\lim_{x \rightarrow 1} h(x) = k$?
- (A) 1
(B) 0
(C) -1
(D) 4
2. The value of $\lim_{x \rightarrow 0} \frac{\sin(x^3)}{x^2 \sin x}$ is equal to :
- (A) ∞
(B) 0
(C) 1
(D) Can't say
3. For the function $f(x) = -x + \frac{1}{x^2}$; for what value of k ; $f'(-1) + f'(-\frac{1}{2}) = 2^k$?
- (A) 4
(B) -4
(C) 1
(D) 0
4. If $f(x) = a^x$, then $f^n(0)$ is equal to :
- (A) 0
(B) 1
(C) $\frac{(\log a)^n}{n}$
(D) None of these
5. The angle between the radius vector and the tangent is given by :
- (A) $\tan^{-1} \phi = r \frac{d\theta}{dr}$
(B) $\tan \phi = r \frac{d\theta}{dr}$
(C) $\tan \phi = \frac{r}{\theta} \frac{d\theta}{dr}$
(D) $\tan \phi = r \frac{dr}{d\theta}$
6. The curvature of the circle of radius α is :
- (A) α
(B) $\frac{1}{\alpha^2}$
(C) $\frac{1}{\alpha}$
(D) α^2
7. A double point on a curve is said to be cusp, if two tangents of the curve are :
- (A) real and distinct
(B) imaginary and distinct
(C) real and coincident
(D) none of these
8. The asymptotes to the hyperbola $9x^2 - 16y^2 = 144$ are given by :
- (A) $y = \pm \frac{3}{4}x$
(B) $y = \pm \frac{5}{4}x$
(C) $y = \pm \frac{7}{4}x$
(D) None of these

9. For what value of α and β , the following is a Maclaurin's series?

$$a^x = 1 - \alpha \log a + \frac{x^2}{2} (\log a)^2 - \beta \frac{x^3}{6} (\log a)^3 + \dots$$

- (A) $\alpha = 1, \beta = 1$
 (B) $\alpha = x, \beta = 1$
 (C) $\alpha = -1, \beta = -1$
 (D) $\alpha = -x, \beta = -1$
10. If f and g are two differentiable functions in $(0,1)$ satisfying $f(0) = 2 = g(1)$, $g(0) = 0$ and $f(1) = 6$, then for some $c \in (0,1)$, the following holds:

- (A) $2f'(c) = g'(c)$
 (B) $2f'(c) = 3g'(c)$
 (C) $f'(c) = g'(c)$
 (D) $f'(c) = 2g'(c)$

11. Given $f(0) = 4$ and $f'(x) = \frac{3}{x^2 + 2}$, the lower bound of $f(2)$ estimated by Mean value theorem is:

- (A) 0
 (B) 5
 (C) 7
 (D) 12

12. The function $f(x)$ with $f'(k) = 0$ attains its maximum value at $x = k$ if:

- (A) $f''(k) = 0$
 (B) $f''(k) > 0$
 (C) $f''(k) < 0$
 (D) None of these

13. Using method of partial fractions while integrating

$$\frac{x}{(x-1)(x^2+4)} = \frac{A}{(x-1)} + \frac{Bx+C}{x^2+4}, \text{ the value of } B \text{ is:}$$

- (A) $-\frac{1}{5}$
 (B) $\frac{1}{5}$
 (C) $\frac{2}{5}$
 (D) $\frac{4}{5}$

14. The value of $\int \cos^2 x \, dx = ?$

- (A) $\frac{x}{2} + \frac{\sin 2x}{2} + c$
 (B) $\frac{x}{2} + \frac{\sin 2x}{4} + c$
 (C) $\frac{x}{2} - \frac{\sin 2x}{4} + c$
 (D) $\frac{x}{2} + \frac{\cos 2x}{4} + c$

15. The value of the integral $\int_0^2 \frac{dx}{x^2+4} = ?$

- (A) $\frac{\pi}{2}$
 (B) $\frac{\pi}{4}$
 (C) $\frac{\pi}{8}$
 (D) None of these

16. The value of $\int \frac{dx}{e^x - 1} = ?$

(A) $\log \left| \frac{e^x - 1}{e^x} \right| + c$

(B) $\log \left| \frac{e^x + 1}{e^x} \right| + c$

(C) $-\log \left| \frac{e^x - 1}{e^x} \right| + c$

(D) None of these

17. The integrating factor for the differential equation

$$\frac{dy}{dx} + 2xy = 2e^{-x^2} \text{ is :}$$

(A) x^2

(B) e^{x^2}

(C) e^{-x^2}

(D) None of these

18. Which of the following is Bernoulli's type differential equation ?

(A) $\frac{dx}{dy} + Px = Qx^n$

(B) $\frac{dx}{dy} + Py = Qy^n$

(C) $\frac{dx}{dy} - \frac{P}{x} = Qy^n$

(D) All of them

19. The solution of $(D^3 + 6D^2 + 11D + 6)y = 0$ is :

(A) $y = c_1 e^x + c_2 e^{2x} + c_3 e^{3x}$

(B) $y = c_1 e^{-x} + c_2 e^{-2x} + c_3 e^{-3x}$

(C) $y = (c_1 + c_2 x) e^x + c_3 e^{2x}$

(D) $y = (c_1 + c_2 x + c_3 x^2) e^{6x}$

20. The value of $\int_0^a \phi(x) dx = ?$

(A) $-\int_0^a \phi(a-x) dx$

(B) $\int_0^a \phi(2x+a) dx$

(C) $-\int_0^a \phi(a+x) dx$

(D) $\int_0^a \phi(a-x) dx$

21. The miscellaneous forms of differential equations mainly deals with :

(A) first order and higher degrees

(B) first degree and higher orders

(C) first order and first degree

(D) none of these

22. The solution of $\left(\frac{dy}{dx} \right)^2 - \frac{dy}{dx} = 2$ is given by :

(A) $(y-x-a)(y-2x-a)$

(B) $(y+2x-a)(y-x-a)$

(C) $(y+x-a)(y+2x-a)$

(D) $(y+x-a)(y-2x-a)$

23. Which of the following is the complete primitive of $y = px + 2\sqrt{1+p^2}$?
- (A) $\frac{(y-cx)^2}{2} = 1 + c^2$
- (B) $\frac{(y-cx)^2}{4} = c^2$
- (C) $\frac{(y-cx)}{4} = 1 + c^2$
- (D) $\frac{(y-cx)^2}{4} = 1 + c^2$
24. The solution of $y = 3xp + 6y^2p^2$ by using $u = y^3$ is given by :
- (A) $y^3 = cx + \frac{1}{3}c^2$
- (B) $y^3 = cx + \frac{2}{3}c^2$
- (C) $y^3 = x - \frac{1}{3}c^2$
- (D) $y^3 = cx - \frac{2}{3}c^2$
25. The value of $J_{-\frac{1}{2}}^2(x) + J_{\frac{1}{2}}^2(x) = ?$
- (A) $\frac{2}{\pi x}$
- (B) $\sqrt{\frac{2}{\pi x}}$
- (C) 1
- (D) None of these
26. The value of k , for which $J_0'(x) = k$?
- (A) $J_{-1}(x)$
- (B) $-J_1(x)$
- (C) 0
- (D) None of these
27. Which of the following is a Legendre differential equation of order n ?
- (A) $x^2y_2 + xy + (x^2 - n^2)y = 0$
- (B) $(1 - x^2)y_2 - 2xy_1 + n(n+1)y = 0$
- (C) $y_2 - 2xy_1 + n(n+1)y = 0$
- (D) $(1 + x^2)y_2 + 2xy_1 + n(n+1)y = 0$
28. The Wronskian $W(\sin x, \sin x - \cos x)$ is :
- (A) 0
- (B) -1
- (C) 1
- (D) None of these
29. The partial differential equation formed by eliminating arbitrary constants a and b from $z = ax + by + ab$, is given by :
- (A) $z = px + qy$
- (B) $z = px + qy + pq$
- (C) $z = \frac{x}{p} + \frac{y}{q} + \frac{1}{pq}$
- (D) None of these

30. The complete solution of the partial differential equation $q = 3p^2$ is given by :
- (A) $z = ax + 3a^2y + c$
 (B) $z = 3a^2x + ay + c$
 (C) $z = ax + (1-3a)y + c$
 (D) None of these
31. The partial differential equation $\frac{\partial^2 z}{\partial x^2} + 3x \frac{\partial^2 z}{\partial x \partial y} - y \frac{\partial^2 z}{\partial y^2} = 0$ is parabolic if :
- (A) $9x^2 = 4y$
 (B) $9x^2 + 4y = 0$
 (C) $9x^2 + 4y > 0$
 (D) $9x^2 + 4y < 0$
32. For the partial differential equation $p^2 + q^2 = 1$, the singular solution :
- (A) exists and is given by $x^2 + y^2 = 1$
 (B) exists and is given by $x^2 - y^2 = 1$
 (C) exists and is given by $x^2 = y^2$
 (D) does not exist
33. Choose the incorrect statement from the following :
- (A) The Set A is denumerable if it is equivalent to the set of positive integers $\mathbb{N}$
 (B) Every infinite set has a denumerable subset
 (C) Every infinite set is equivalent to one of its proper subsets
 (D) None of them
34. The interval $[0,1]$ is :
- (A) countable
 (B) uncountable
 (C) proper subset of Cantor's set
 (D) none of these
35. Which of the following is a consequence of Archimedean property in $\mathbb{R}$?
- (A) For every real number x , $\exists$ an integer $n > 0$, such that $n > x$
 (B) For every real number x , $\exists$ an integer m such that $m < x$
 (C) For every positive real number x , $\exists$ a natural number n such that $\frac{1}{n} < x$
 (D) All of them
36. Which of the following is not a field ?
- (A) set of rational numbers
 (B) set of real numbers
 (C) set of irrational numbers
 (D) set of complex numbers
37. For which of the sequence limit does not exist ?
- (A) $\{(-1)^n\}$
 (B) $\left\{n - \frac{1}{n}\right\}$
 (C) $\{n\}$
 (D) All of them

38. Which of the following sequence does not oscillate?
- (A) $\left\{2 - \frac{1}{2^{n-1}}\right\}$
- (B) $\{\cos n\pi\}$
- (C) $\left\{\sin \frac{n\pi}{2}\right\}$
- (D) $\left\{\frac{(-1)^n}{5}\right\}$
39. Every bounded sequence of real numbers has :
- (A) a finite subsequence
- (B) divergent subsequence
- (C) convergent subsequence
- (D) none of these
40. The value of $\lim_{n \rightarrow \infty} \left(1 + \frac{k}{n}\right)^n = ?$ is :
- (A) 0
- (B) 1
- (C) e^n
- (D) e^k
41. Find the value of k for which $\sum_{n=1}^{\infty} \frac{1}{n^2} = k$:
- (A) 0
- (B) 1
- (C) $\frac{\pi^2}{6}$
- (D) k does not exist
42. Which of the following is a divergent series ?
- (A) $\sum \frac{1}{\sqrt{n}}$
- (B) $\sum \frac{1}{2^n}$
- (C) $\sum \frac{1}{n!}$
- (D) $\sum_{n=1}^{\infty} \frac{1}{n^2}$
43. The series $\sum_{n=0}^{\infty} \frac{n^{1-3n}}{4^{2n}}$:
- (A) oscillates finitely
- (B) oscillates infinitely
- (C) diverges
- (D) converges
44. The radius of convergence of the geometric series $1 + x + x^2 + x^3 + \dots$ is :
- (A) 0
- (B) 1
- (C) 2
- (D) 3
45. If the radius of convergence of $\sum a_n x^n$ is 5, then the radius of convergence of $\sum a_n (x+2)^n$ is :
- (A) -2
- (B) 2
- (C) 1
- (D) 3

46. Let k be a positive integer, the radius of convergence of the series $\sum_{n=0}^{\infty} \frac{(n!)^k}{(kn)!} z^n$ is :
- (A) k
 (B) k^k
 (C) k^{-k}
 (D) ∞
47. Let R denotes the radius of converges of power series $\sum_{k=1}^{\infty} kx^n$, then
- (A) $R > 0$ and the series is convergent on $[-R, R]$
 (B) $R > 0$ and the series converges at $x = -R$ but does not converge at $x = R$
 (C) $R > 0$ and the series does not converge outside $(-R, R)$
 (D) $R = 0$
48. The product of two odd permutations is :
- (A) odd
 (B) even
 (C) even or odd
 (D) neither even nor odd
49. For a group G , if $a, b \in G$ such that $(ab)^{-1} = a^{-1}b^{-1}$, then G is a/an :
- (A) commutative semigroup
 (B) abelian group
 (C) non-abelian group
 (D) none of these
50. The number of odd permutations in a symmetric group S_4 is :
- (A) 2
 (B) 4
 (C) 8
 (D) 12
51. The order of w^2 in a group $G = \{1, w, w^2\}$;
 (where $w = \frac{-1+i\sqrt{3}}{2}$) is :
- (A) 1
 (B) 2
 (C) 3
 (D) None of these
52. If $C(G)$ and $N(a)$ respectively denote the centre of a group G and normalizer of an element $a \in G$, then which of the following is correct ?
- (A) $N(a) = C(G)$
 (B) $N(a) \subseteq C(G)$
 (C) $C(G) \subseteq N(a)$
 (D) None of these
53. Choose the incorrect statement from the following :
- (A) Every homomorphic image of a group is isomorphic to some quotient group
 (B) The kernel of a homomorphism is a normal subgroup
 (C) Intersection of two subgroups is always a subgroup
 (D) None of them

54. Choose the incorrect statement from the following :
- (A) If the index of a normal subgroup in a group is 2, then it is normal
 - (B) Intersection of two normal subgroups is a normal subgroup
 - (C) Every subgroup of an abelian group is normal
 - (D) None of these
55. The number of proper subgroups in a group of order 19 is :
- (A) 18
 - (B) 9
 - (C) 2
 - (D) zero
56. The non-abelian group exists for which of the following first odd integer ?
- (A) 21
 - (B) 23
 - (C) 27
 - (D) 33
57. The minimum number of elements required in a ring to qualify for a field is :
- (A) 1
 - (B) 2
 - (C) 3
 - (D) any finite number
58. The ideal (2) in the ring $\mathbb{Z}$ of integers is :
- (A) maximal
 - (B) prime
 - (C) principal
 - (D) all of these
59. An integral domain comprising of _____ elements is a field.
- (A) two
 - (B) three
 - (C) finite
 - (D) infinite
60. Which of the following is a zero divisor of an elements $\bar{2}$ in a ring $\langle \mathbb{Z}_6, +, \cdot \rangle$?
- (A) $\bar{3}$
 - (B) $\bar{2}$
 - (C) $\bar{0}$
 - (D) $\bar{4}$