opened at 2:20pm on 27-6-2023
used for uploading on university website

Total No. of Printed Pages : 21

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

A

SET-X

PG-EE-June, 2023

SUBJECT : Mathematics Group

10453

Sr. No. ....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)________________ (in words) ____________________________

Name ________________________ Date of Birth________________________

Father's Name ______________________ Mother's Name ______________________

Date of Examination ________________________

________________________ ________________________

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The general solution of ordinary differential equation of 'n' order contains :

   (1) n-arbitrary constants

   (2) more than n-arbitrary constants

   (3) any number of arbitrary constant

   (4) none of these

2. General solution of $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ is :

   (1) $y = (2x + c)e^{-x^2}$ (2) $y = 2xe^{-x}$

   (3) $y = e^{-x}$ (4) none of these

3. The necessary condition for the equation $M(x, y)dx + N(x, y)dy = 0$, to be exact is :

   (1) $\frac{\partial N}{\partial y} = \frac{\partial M}{\partial x}$ (2) $\frac{\partial N}{\partial y} = -\frac{\partial M}{\partial x}$

   (3) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ (4) $\frac{\partial M}{\partial y} = -\frac{\partial N}{\partial x}$

4. The equation $ydx + xdy = 0$ is :

   (1) Partial differential equation

   (2) Exact differential equation

   (3) Non-exact differential equation

   (4) None of these

5. For the differential equation $x\frac{dy}{dx} - y = 0$, which of the following function is not an - integrating factor ?

   (1) $\frac{1}{x^2}$ (2) $\frac{1}{y^2}$ (3) $\frac{1}{xy}$ (4) $\frac{1}{x+y}$

6. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a} \times \vec{b} = 0$ and $\vec{a} \cdot \vec{b} = 0$, then :

(1) $\vec{a}$ is parallel to $\vec{b}$

(2) $\vec{a}$ is at right angle to $\vec{b}$

(3) either $\vec{a}$ or $\vec{b}$ is a null vector

(4) none of these

7. The unit normal vector to the surface $x^4 - 3xyz + z^2 + 1 = 0$ at the point (1, 1, 1) is :

(1) $\frac{i+3j+k}{\sqrt{\pi}}$ (2) $\frac{i-3j-k}{\sqrt{\pi}}$

(3) $\frac{i+3j-k}{\sqrt{\pi}}$ (4) None of these

8. A vector $\vec{f}$ is called an irrotational vector if :

(1) div curl $\vec{f} = 0$ (2) $\nabla . \vec{f} = 0$

(3) $\nabla \times \vec{f} = 0$ (4) none of these

9. Which of the following is ***not*** true ?

(1) curl (grad ϕ) = 0 (2) div (grad ϕ) = 0

(3) div (curl $\vec{f}$) = 0 (4) curl ($\vec{r}$) = 0

10. Which of the following is related with Stoke's theorem ?

(1) A line integral and a volume integral

(2) A surface integral and a volume integral

(3) A line integral, a surface integral and a volume integral

(4) A line integral and a surface integral

11. The remainder in the divison of 2^{20} by 7 is :

(1) 0 (2) 1 (3) 2 (4) 4

12. Every natural number greater than one has at least :

(1) one prime factor (2) two prime factor

(3) two composite factors (4) none of these

13. Find the highest power of 7 contained in 1000!

(1) 264 (2) 164 (3) 64 (4) none of these

14. If $|\cos(\alpha - i\beta)| = 1$, then $\sin^2 \alpha$ is equal to :

(1) $\cos h^2\beta$ (2) $\sin h^2\beta$

(3) $\tan h^2\beta$ (4) none of these

15. If p is a prime number then $(p-1)! + 1 \equiv 0 \pmod{p}$ is the statement of :

(1) Chinese remainder theorem

(2) Fermat's theorem

(3) Wilson's theorem

(4) Reduced residue theorem

16. If A is a non-singular matrix of order n, then adj (adj A) is equal to :

(1) $|A|^{n+1} A$ (2) $|A|^n A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-2} A$

17. The vectors $\begin{bmatrix} 2 \\ 0 \\ k \end{bmatrix}, \begin{bmatrix} 3 \\ -1 \\ 5 \end{bmatrix}, \begin{bmatrix} 5 \\ -1 \\ 1 \end{bmatrix}$ are linearly dependent, then value of k is equal to :

(1) –4 (2) –2 (3) 0 (4) 4

18. The characteristics roots of a Hermitian matrix are :

(1) Imaginary (2) Real

(3) Complex number (4) None of these

19. Determinant of an idempotent matrix equals :

(1) 1 (2) 0 (3) 1 or 0 (4) none of these

20. The common roots of the equations $x^4+3x^3-5x^2-6x-8=0$ and $x^4+x^3-9x^2+10x-8=0$ are :

(1) 2, 3 (2) 3, 4 (3) 4, 0 (4) −4, 2

21. The value of $\lim_{x\to 0}(1+2x)^{\frac{x+5}{2}}$ is :

(1) $\frac{e}{2}$ (2) e^2 (3) e^5 (4) e^{10}

22. Area bounded by the parabola $2y=x^2$ and the line $x=y-4$ is equal to :

(1) 6 (2) 18 (3) ∞ (4) none of these

23. The radius of curvature at the origin of the curve $x^2+6y^2+2x-y=0$ is :

(1) $\frac{1}{5\sqrt{2}}$ (2) $\frac{1}{3\sqrt{5}}$ (3) $\frac{1}{2\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}}$

24. The nature of double points on the curve $(y-x)^2+x^7=0$:

(1) a cusp (2) a node

(3) conjugate point (4) none of these

25. The asymptotes of the curve $r\cos\theta = a\cos 2\theta$:

(1) $r\cos\theta + a = 0$ (2) $r\sin\theta + a = 0$

(3) $r\tan\theta + a = 0$ (4) none of these

26. What is the nature of the curve $13x^2 - 18xy + 37y^2 + 2x + 14y - 2 = 0$?

(1) circle (2) sphere

(3) hyperbola (4) ellipse

27. The equation of the plane which cuts the paraboloid $x^2 - 2y^2 = z$ in a conic with its centre at the point $\left(2, \frac{3}{2}, 4\right)$ is given by :

(1) $3x + 4y + z = 0$ (2) $2x + 4y - z + 7 = 0$

(3) $4x - 6y - z + 5 = 0$ (4) None of these

28. The latus rectum of the parabola $(a^2 + b^2)(x^2 + y^2) = (bx + ay - ab)^2$ is :

(1) $\frac{2ab}{\sqrt{a^2 + b^2}}$ (2) $ab \cdot \sqrt{a^2 + b^2}$ (3) $\sqrt{a^2 + b^2}$ (4) none of these

29. The equation of circle with radius 'a' and touching the initial line at pole is :

(1) $r = a \tan \theta$ (2) $r = 2a \sin \theta$

(3) $r = 2a \cot \theta$ (4) none of these

30. The points in which the line, $\frac{x+1}{-1} = \frac{y-12}{5} = \frac{z-7}{2}$ cuts the surface $11x^2 - 5y^2 + z^2 = 0$ are :

(1) (3, 2, 1), (2, 0, 1) (2) (1, 2, 3), (2, –3, 1)

(3) (2, 1, 1), (1, 0, –1) (4) None of these

31. If $\lim_{x \to 0} \frac{ae^x - b\cos x + ce^{-x}}{x \sin x} = 2$, then value of b is equal to :

(1) –2 (2) –1 (3) 0 (4) 2

32. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, then value of $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$ is equal to :

(1) $\frac{1}{x^2 + y^2 + z^2}$ (2) $\frac{1}{x^3 + y^3 + z^3}$

(3) $\frac{3}{x + y + z}$ (4) None of these

33. The equation of normal to the surface $xyz = 4$ at the point $(1, 2, 2)$ is equal to :

(1) $\frac{X-1}{2} = \frac{Y-2}{1} = \frac{Z-2}{1}$ (2) $\frac{X-1}{1} = \frac{Y-2}{2} = \frac{Z-2}{1}$

(3) $\frac{X-1}{3} = \frac{Y-2}{2} = \frac{Z-2}{2}$ (4) None of these

34. The necessary and sufficient condition for the curve to be a plane curve is :

(1) $[\vec{r}\ \vec{r}'\ \vec{r}''] = 0$ (2) $[\vec{r}'\ \vec{r}''\ \vec{r}'''] = 0$

(3) $[\vec{r}''\ \vec{r}'''\ \vec{r}] = 0$ (4) none of these

35. The maximum value of the function $\sin x + \sin y + \sin(\sin x + y)$ is :

(1) $\frac{3\sqrt{3}}{2}$ (2) $\sqrt{3}$ (3) $\frac{\sqrt{3}}{2}$ (4) None of these

36. A partial differential equation by eliminating the arbitrary functions from : $z = f(x - ay) + g(x + ay)$ is given by :

(1) $\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial y^2}$ (2) $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$

(3) $\frac{\partial^2 z}{\partial x^2} = a^2 \frac{\partial^2 z}{\partial y^2}$ (4) none of these

37. The particular integral of the differential equation $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$ is :

(1) $\frac{1}{8}e^{x+2y}$ (2) $\frac{1}{2}e^{2y}$ (3) $\frac{1}{27}e^{x+2y}$ (4) none of these

38. The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 7\frac{\partial^2 z}{\partial x \partial y} + 6\frac{\partial^2 z}{\partial y^2} = 0$ is :

(1) Hyperbolic (2) Parabolic

(3) Elliptic (4) None of these

39. The real characteristics of the partial differential equation $\frac{\partial^2 z}{\partial x^2} + 4\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ is :

(1) $4x = y + c$ (2) $3x + y = 0$ (3) $8x - y = 0$ (4) $y - 2x = c$

40. To two dimensional heat equation is given by :

(1) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = \frac{1}{c}\frac{\partial u}{\partial t}$ (2) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 8$

(3) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial u}{\partial y} = \frac{1}{c^2}\frac{\partial^2 u}{\partial x^2}$ (4) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{c^2}\frac{\partial u}{\partial t}$

41. The resolved part of a force f in a direction perpendicular to it is :

(1) Maximum (2) Minimum

(3) F (4) 0

42. Centre of gravity of a thin uniform triangular lamina divides every median in the ratio :

(1) 1 : 2 (2) 2 : 1 (3) 2 : 3 (4) 1 : 4

43. The force of friction called into play when there is equilibrium is called :

(1) Limiting friction

(2) Dynamical friction

(3) Statical friction

(4) None of these

44. Which type of forces from the couple ?

(1) Two equal and unlike parallel forces with same lines of action.

(2) Two equal and unlike parallel forces with different lines of action.

(3) Two unequal and like parallel forces with different lines of action.

(4) Two unequal and unlike parallel forces with different lines of action.

45. The gravitational unit of moment in S.I. system is :

(1) Dyne-centimeter (2) Newton meter

(3) gm. cm (4) kg. m

46. Every non-empty subset of R which is bounded above must have l.u.b. This result is known as :

(1) Law of well ordering

(2) Law of trichotomy

(3) Completeness axiom

(4) Archimedian property of real numbers

47. The g.l.b. of a set :

(1) belongs to the set

(2) does not belong to the set

(3) may or may not belong to the set

(4) none of these

48. If $\sum_{n=1}^{\infty} a_n$ is convergent and the sequence $< b_n >$ is monotonic and bounded, then $\sum_{n=1}^{\infty} a_n b_n$ is convergent. This statement is known as :

(1) Abel's test

(2) Abel's lemma

(3) Dirichlet's test

(4) None of these

49. The series $\sum_{n=1}^{\infty} a_n$, where $a_n = \sqrt{n^4+1} - \sqrt{n^4-1}$ is :

(1) convergent

(2) divergent

(3) oscillating

(4) none of these

50. The infinite product $\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)$..... is :

(1) divergent

(2) convergent

(3) oscillating

(4) none of these

51. Generating function for Bessel function $J_n(x)$ is :

(1) $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$

(2) $e^{\frac{x}{2}\left(\frac{1}{t}-t\right)}$

(3) $e^{x\left(t-\frac{1}{t}\right)}$

(4) None of these

52. Rodrigue formula for Legendre polynomials is :

(1) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$

(2) $P_n(x)=\frac{1}{2^n}\frac{d^n}{dx^n}(x^2-1)^n$

(3) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2+1)^n$

(4) None of these

53. The Laplace transform of $te^{-t}\sin 3t$ is equal to :

(1) $\frac{36}{(s^2+2s+10)^2}$

(2) $\frac{6(s+1)}{(s^2+2s+10)^2}$

(3) $\frac{s+1}{(s^2+2s+6)^2}$

(4) None of these

54. The generating function of Legendre's polynomials is :

(1) $(1+2xt+t^2)^{3/2}$

(2) $(1+2x+t^2)^{1/2}$

(3) $(1-2xt+t^2)^{-1/2}$

(4) None of these

55. The sine Fourier transform of $2e^{-5x}$ is :

(1) $\frac{5s}{s^2+4}$

(2) $\frac{-5s}{s^2+4}$

(3) $\frac{5s}{s^2+25}$

(4) None of these

56. Which of the following keyword is used for the storage class ?

(1) print f

(2) external

(3) auto

(4) none of these

57. What will be the maximum size of a double variable ?

(1) 16 bytes

(2) 8 bytes

(3) 4 bytes

(4) none of these

58. The continue command cannot be used with :

(1) switch (2) for (3) do (4) none of these

59. The bitwise OR operator is used to :

(1) divide number

(2) set the desired bits to 0

(3) set the desired bits to 1

(4) none of these

60. C is which kind of language ?

(1) machine

(2) assembly

(3) objected-oriented

(4) none of these

61. If f is bounded function defined on $[a, b]$ and P be a partition of $f[a, b]$, then which of the following is odd ?

(1) $L(f, P) \leq U(f, P)$

(2) $L(-f, P) = -U(f, P)$

(3) $U(P, -f) = -L(P, f)$

(4) $U(-f, P) = -U(f, P)$

62. Which of the following is ***not*** a bounded metric ?

(1) $d(x, y) = |x - y|$

(2) $d(x, y) = \min\{2, |x - y|\}$

(3) discrete metric

(4) $d^*(x, y) = \dfrac{d(x, y)}{1 + d(x, y)}$

where d is any metric on X.

63. Which one is a dense set ?

(1) the subset $A = \left\{\dfrac{1}{n}, n \in N\right\}$ in R

(2) set of natural number in R

(3) Q in R

(4) none of these

64. If $f(x) = \dfrac{1}{x^2}$ on $[1, 4]$ and $P = [1, 2, 3, 4]$ be the partition of $[1, 4]$, then $L(f, P)$ is equal to :

(1) $\dfrac{70}{144}$ (2) $\dfrac{61}{144}$ (3) $\dfrac{30}{144}$ (4) none of these

65. The integral $\displaystyle\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$ is :

(1) convergent

(2) divergent

(3) conditionally convergent

(4) none of these

66. A sphere (open or closed) is always :

(1) empty

(2) non-empty

(3) singleton set

(4) none of these

67. What is odd against the given statement "A set is closed iff" ?

(1) $A = \overline{A}$ (2) $d(A) \subset A$

(3) A^C is open (4) $A = \mathring{A}$

68. The order of a and x in a group are respectively 3 and 4. Then the order of $x^{-1}ax$ is :

(1) 12 (2) 8 (3) 5 (4) 3

69. Every group is isomorphic to a permutation group. This result is known as :

(1) Lagrange theorem (2) Cauchy theorem

(3) Cayley's theorem (4) Gauss theorem

70. The number of conjugacy classes in a group of order 25 is :

(1) 1 (2) 5 (3) 25 (4) none of these

71. The number of non-isomorphic abelian groups of order 8 is :

(1) 1 (2) 2 (3) 3 (4) none of these

72. The number of prime ideals of Z_{10} is :

(1) 2 (2) 1 (3) 0 (4) none of these

73. The ring of Z, Q, R, C, Z_5 are :

(1) All integral domains

(2) None of them is integral domain

(3) Some of them is integral domain

(4) None of these

74. Which statement is ***wrong*** ?

F is a field, then $F[x]$ is :

(1) Euclidean domain

(2) Principal ideal domain

(3) Unique factorization domain

(4) None of these

75. In S. H. M. the maximum velocity is :

(1) $V_{max} = a$

(2) $V_{max} = \sqrt{\mu}\, a$

(3) $V_{max} = \mu\, a$

(4) None of these

76. The uniform force that will move on kg. mass from rest through one metre in one second is :

(1) 4 Newton

(2) 3 Newton

(3) 2 Newton

(4) None of these

77. At an apse, the radius vector is :

(1) perpendicular to the tangent

(2) parallel to the tangent

(3) perpendicular to the apsidal distance

(4) None of these

78. The radial and transverse acceleration of a particle moving along a plane curve $r = f(\theta)$ are :

(1) $r\frac{dr}{dt}, \frac{d\theta}{dt}$

(2) $\frac{dr}{dt}, r\frac{d\theta}{dt}$

(3) $\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2, \frac{1}{r}\frac{d}{dt}\left[r^2\frac{d\theta}{dt}\right]$

(4) None of these

79. Central force is defined as :

(1) A force whose line of action always passes through variable point.

(2) A force whose line of action always passes through a fixed point.

(3) A force whose line of action does not pass through a fixed point.

(4) None of these

80. Frequency of a simple harmonic motion is :

(1) $\frac{\mu}{\pi}$ (2) $\frac{\pi}{\mu}$

(3) $\frac{\sqrt{\mu}}{\pi}$ (4) $\frac{\sqrt{\mu}}{2\pi}$

81. Co-efficient of the vector $(5, -1, 2)$ w. r. t. basis $(1, 4, 2), (4, 2, 1), (2, 1, 3)$ are :

(1) $(1, 1, 1)$ (2) $(-1, 1, 1)$

(3) $(1, 2, 3)$ (4) None of these

82. Which is an orthogonal set ?

(1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$

(2) $\{(1, 0, 1), (1, 0, -1), (0, 3, 4)\}$

(3) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$

(4) None of these

83. Let $T : R^2 \to R^3$ be linear transformation defined by $T(x_1, x_2) = (x_1 - x_2, x_2 - x_1, -x_1)$. The nullty T is :

(1) 2 (2) 1

(3) 0 (4) None of these

84. Let $F : R^3 \to R^2$ be defined by $F(x, y, z) = (1x, y + z)$, then :

(1) F is linear transformation

(2) F is not a linear transformation

(3) F is invertible

(4) None of these

85. Let $V(F)$ be the vector space of all polynomial in x in which an inner product is defined by $(f, g) = \int_0^1 f(x)g(x)dx$. Then for $f(x) = x + 2$, $g(x) = x^2 - 2x - 3$, $\langle f, g \rangle$ is equal to :

(1) $\frac{5}{2}$ (2) $\frac{5}{8}$ (3) $\frac{37}{4}$ (4) $-\frac{37}{4}$

86. The linear transformation $T : R^2 \to R^2$ defined by $T(1, 0) = (2, 3)$, $T(0, 1) = (5, 6)$ is :

(1) one one and onto (2) one one but not onto

(3) onto but not one one (4) none of these

87. Let $T : R^3 \to R^3$ be defined by $T(x, y, z) = (x, y, 0)$ and $S : R^2 \to R^2$ be defined by $S(x, y) = (2x, 3y)$, are linear transformation on the real vector spaces R^3 and R^2 respectively. Then which of the following is ***correct*** ?

(1) T and S are both singular

(2) T and S are both non-singular

(3) T is singular but S is non-singular

(4) None of these

88. The integral $\int_0^1 x^{m-1}(1-x)^{n-1}dx$ is known as :

(1) Theta function

(2) Zeta function

(3) Gamma function

(4) Beta function

89. Fourier expansion of $f(x) = |x|$ in $[-\pi, \pi]$ is :

(1) $-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(2) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1}+\frac{\cos 3x}{3}+\frac{\cos 5x}{5}+\ldots\ldots\right)$

(3) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(4) None of these

90. If the function $f(z)$ is continuous at z_0, then :

(1) $f(z)$ is differentiable at z_0

(2) $f(z)$ is not necessarily differentiable at z_0

(3) $f(z)$ is analytic at z_0

(4) None of these

91. Polar form of C. R. equations are :

(1) $\frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r}=-\frac{1}{r}\frac{\partial u}{\partial \theta}$

(2) $\frac{\partial u}{\partial \theta}=\frac{1}{r}\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r}=r\frac{\partial v}{\partial \theta}$

(3) $\frac{\partial u}{\partial \theta}=r\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial \theta}$

(4) None of these

92. The fixed points of the mapping $W=\frac{5z+4}{z+5}$ are :

(1) 2, 2 (2) 2, –2

(3) –2, –2 (4) None of these

93. The inverse point of the point z with respect to the circle $|z|=r$ is :

(1) $\frac{r}{\bar{z}}$ (2) $\frac{r^2}{z}$

(3) $\frac{r^2}{\bar{z}}$ (4) None of these

94. Fourier series for the function $f(x)$ in the interval $(c, c + 2\pi)$ is :

(1) $f(x) = \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$

(2) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(3) $f(x) = \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(4) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin x$

95. The value of $\Delta^n(a^x)$ is :

(1) $(a^{nh} + 1)a^x$

(2) $(a^{nh} - 1)a^x$

(3) $(a^h + 1)^n_{a^x}$

(4) $(a^h - 1)^n_{a^x}$

96. The order of convergence of Newton-Raphson method is :

(1) 1

(2) 1.618

(3) 2

(4) None of these

97. Runge-Kutta method is used for :

(1) Interpolation

(2) Numerical differentiation

(3) Numerical Integration

(4) Numerical solution of ordinary differential equation

98. The values of a function $f(x)$ are tabulated below :

x	0	1	2	3
$f(x)$	1	2	1	10

(1) $2x^3 - 7x^2 + 6x + 1$ (2) $x^3 - 7x^2 - 6x + 1$

(3) $2x^3 + 7x^2 - 6x + 2$ (4) None of these

99. In decomposition method, if $u_{ii} = 1$, then the method is called :

(1) Doolittle method (2) Crout's method

(3) Euler's method (4) None of these

100. The quadrature formulae $\int_{-1}^{1} f(x)dx = \frac{1}{3}[f(-1) + 4f(0) + f(1)]$ with step length $h = 1.0$ is exact for polynomial of degree less than or equal to :

(1) Two (2) Three (3) Four (4) None of these

opened at 2:20pm on 27-6-2023
used for uploading on university website

Total No. of Printed Pages : 21

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

B

SET-X

PG-EE-June, 2023

SUBJECT : Mathematics Group

10454

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The number of non-isomorphic'abelian groups of order 8 is :

(1) 1 (2) 2

(3) 3 (4) none of these

2. The number of prime ideals of Z_{10} is :

(1) 2 (2) 1

(3) 0 (4) none of these

3. The ring of Z, Q, R, C, Z_5 are :

(1) All integral domains

(2) None of them is integral domain

(3) Some of them is integral domain

(4) None of these

4. Which statement is *wrong* ?

F is a field, then $F[x]$ is :

(1) Euclidean domain

(2) Principal ideal domain

(3) Unique factorization domain

(4) None of these

5. In S. H. M. the maximum velocity is :

(1) $V_{max} = a$ (2) $V_{max} = \sqrt{\mu}\, a$

(3) $V_{max} = \mu\, a$ (4) None of these

6. The uniform force that will move on kg. mass from rest through one metre in one second is :

(1) 4 Newton
(2) 3 Newton
(3) 2 Newton
(4) None of these

7. At an apse, the radius vector is :

(1) perpendicular to the tangent
(2) parallel to the tangent
(3) perpendicular to the apsidal distance
(4) None of these

8. The radial and transverse acceleration of a particle moving along a plane curve $r = f(\theta)$ are :

(1) $r\frac{dr}{dt}, \frac{d\theta}{dt}$

(2) $\frac{dr}{dt}, r\frac{d\theta}{dt}$

(3) $\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2, \frac{1}{r}\frac{d}{dt}\left[r^2\frac{d\theta}{dt}\right]$

(4) None of these

9. Central force is defined as :

(1) A force whose line of action always passes through variable point.
(2) A force whose line of action always passes through a fixed point.
(3) A force whose line of action does not pass through a fixed point.
(4) None of these

10. Frequency of a simple harmonic motion is :

(1) $\frac{\mu}{\pi}$ (2) $\frac{\pi}{\mu}$

(3) $\frac{\sqrt{\mu}}{\pi}$ (4) $\frac{\sqrt{\mu}}{2\pi}$

11. Generating function for Bessel function $J_n(x)$ is :

(1) $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$ (2) $e^{\frac{x}{2}\left(\frac{1}{t}-t\right)}$

(3) $e^{x\left(t-\frac{1}{t}\right)}$ (4) None of these

12. Rodrigue formula for Legendre polynomials is :

(1) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$

(2) $P_n(x)=\frac{1}{2^n}\frac{d^n}{dx^n}(x^2-1)^n$

(3) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2+1)^n$

(4) None of these

13. The Laplace transform of $te^{-t}\sin 3t$ is equal to :

(1) $\frac{36}{(s^2+2s+10)^2}$ (2) $\frac{6(s+1)}{(s^2+2s+10)^2}$

(3) $\frac{s+1}{(s^2+2s+6)^2}$ (4) None of these

14. The generating function of Legendre's polynomials is :

(1) $(1+2xt+t^2)^{3/2}$ (2) $(1+2x+t^2)^{1/2}$

(3) $(1-2xt+t^2)^{-1/2}$ (4) None of these

15. The sine Fourier transform of $2e^{-5x}$ is :

(1) $\frac{5s}{s^2+4}$ (2) $\frac{-5s}{s^2+4}$

(3) $\frac{5s}{s^2+25}$ (4) None of these

16. Which of the following keyword is used for the storage class ?

(1) print f (2) external

(3) auto (4) none of these

17. What will be the maximum size of a double variable ?

(1) 16 bytes (2) 8 bytes

(3) 4 bytes (4) none of these

18. The continue command cannot be used with :

(1) switch (2) for (3) do (4) none of these

19. The bitwise OR operator is used to :

(1) divide number

(2) set the desired bits to 0

(3) set the desired bits to 1

(4) none of these

20. C is which kind of language ?

(1) machine (2) assembly

(3) objected-oriented (4) none of these

21. If $\lim_{x\to 0}\frac{ae^x - b\cos x + ce^{-x}}{x\sin x} = 2$, then value of b is equal to :

(1) -2 (2) -1 (3) 0 (4) 2

22. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, then value of $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$ is equal to :

(1) $\frac{1}{x^2+y^2+z^2}$ (2) $\frac{1}{x^3+y^3+z^3}$

(3) $\frac{3}{x+y+z}$ (4) None of these

23. The equation of normal to the surface $xyz = 4$ at the point (1, 2, 2) is equal to :

(1) $\frac{X-1}{2} = \frac{Y-2}{1} = \frac{Z-2}{1}$ (2) $\frac{X-1}{1} = \frac{Y-2}{2} = \frac{Z-2}{1}$

(3) $\frac{X-1}{3} = \frac{Y-2}{2} = \frac{Z-2}{2}$ (4) None of these

24. The necessary and sufficient condition for the curve to be a plane curve is :

(1) $[\vec{r}\ \vec{r}'\ \vec{r}''] = 0$ (2) $[\vec{r}'\ \vec{r}''\ \vec{r}'''] = 0$

(3) $[\vec{r}''\ \vec{r}'''\ \vec{r}] = 0$ (4) none of these

25. The maximum value of the function $\sin x + \sin y + \sin(\sin x + y)$ is :

(1) $\frac{3\sqrt{3}}{2}$ (2) $\sqrt{3}$ (3) $\frac{\sqrt{3}}{2}$ (4) None of these

26. A partial differential equation by eliminating the arbitrary functions from : $z = f(x-ay) + g(x+ay)$ is given by :

(1) $\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial y^2}$

(2) $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$

(3) $\frac{\partial^2 z}{\partial x^2} = a^2 \frac{\partial^2 z}{\partial y^2}$

(4) none of these

27. The particular integral of the differential equation $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x \cdot 2y}$ is :

(1) $\frac{1}{8}e^{x+2y}$

(2) $\frac{1}{2}e^{2y}$

(3) $\frac{1}{27}e^{x+2y}$

(4) none of these

28. The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 7\frac{\partial^2 z}{\partial x \partial y} + 6\frac{\partial^2 z}{\partial y^2} = 0$ is :

(1) Hyperbolic

(2) Parabolic

(3) Elliptic

(4) None of these

29. The real characteristics of the partial differential equation $\frac{\partial^2 z}{\partial x^2} + 4\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ is :

(1) $4x = y + c$ (2) $3x + y = 0$ (3) $8x - y = 0$ (4) $y - 2x = c$

30. To two dimensional heat equation is given by :

(1) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = \frac{1}{c}\frac{\partial u}{\partial t}$

(2) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 8$

(3) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial u}{\partial y} = \frac{1}{c^2}\frac{\partial^2 u}{\partial x^2}$

(4) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{c^2}\frac{\partial u}{\partial t}$

31. The remainder in the divison of 2^{20} by 7 is :

(1) 0 (2) 1 (3) 2 (4) 4

32. Every natural number greater than one has at least :

(1) one prime factor (2) two prime factor

(3) two composite factors (4) none of these

33. Find the highest power of 7 contained in 1000!

(1) 264 (2) 164 (3) 64 (4) none of these

34. If $|\cos(\alpha - i\beta)| = 1$, then $\sin^2 \alpha$ is equal to :

(1) $\cos h^2\beta$ (2) $\sin h^2\beta$

(3) $\tan h^2\beta$ (4) none of these

35. If p is a prime number then $(p-1)! + 1 \equiv 0 \pmod{p}$ is the statement of :

(1) Chinese remainder theorem

(2) Fermat's theorem

(3) Wilson's theorem

(4) Reduced residue theorem

36. If A is a non-singular matrix of order n, then adj (adj A) is equal to :

(1) $|A|^{n+1} A$ (2) $|A|^n A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-2} A$

37. The vectors $\begin{bmatrix} 2 \\ 0 \\ k \end{bmatrix}, \begin{bmatrix} 3 \\ -1 \\ 5 \end{bmatrix}, \begin{bmatrix} 5 \\ -1 \\ 1 \end{bmatrix}$ are linearly dependent, then value of k is equal to :

(1) –4 (2) –2 (3) 0 (4) 4

38. The characteristics roots of a Hermitian matrix are :

(1) Imaginary (2) Real

(3) Complex number (4) None of these

39. Determinant of an idempotent matrix equals :

(1) 1 (2) 0 (3) 1 or 0 (4) none of these

40. The common roots of the equations $x^4+3x^3-5x^2-6x-8=0$ and $x^4+x^3-9x^2+10x-8=0$ are :

(1) 2, 3 (2) 3, 4 (3) 4, 0 (4) –4, 2

41. Polar form of C. R. equations are :

(1) $\frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial 0}, \frac{\partial v}{\partial r}=-\frac{1}{r}\frac{\partial u}{\partial 0}$

(2) $\frac{\partial u}{\partial \theta}=\frac{1}{r}\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r}=r\frac{\partial v}{\partial 0}$

(3) $\frac{\partial u}{\partial \theta}=r\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial 0}$

(4) None of these

42. The fixed points of the mapping $W=\frac{5z+4}{z+5}$ are :

(1) 2, 2 (2) 2, –2

(3) –2, –2 (4) None of these

43. The inverse point of the point z with respect to the circle $|z|=r$ is :

(1) $\frac{r}{\bar{z}}$ (2) $\frac{r^2}{z}$ (3) $\frac{r^2}{\bar{z}}$ (4) None of these

44. Fourier series for the function $f(x)$ in the interval $(c, c + 2\pi)$ is :

(1) $f(x) = \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$

(2) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(3) $f(x) = \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(4) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin x$

45. The value of $\Delta^n(a^x)$ is :

(1) $(a^{nh} + 1)a^x$

(2) $(a^{nh} - 1)a^x$

(3) $(a^h + 1)^n_{a^x}$

(4) $(a^h - 1)^n_{a^x}$

46. The order of convergence of Newton-Raphson method is :

(1) 1

(2) 1.618

(3) 2

(4) None of these

47. Runge-Kutta method is used for :

(1) Interpolation

(2) Numerical differentiation

(3) Numerical Integration

(4) Numerical solution of ordinary differential equation

48. The values of a function $f(x)$ are tabulated below :

x	0	1	2	3
$f(x)$	1	2	1	10

(1) $2x^3 - 7x^2 + 6x + 1$

(2) $x^3 - 7x^2 - 6x + 1$

(3) $2x^3 + 7x^2 - 6x + 2$

(4) None of these

49. In decomposition method, if $u_{ii} = 1$, then the method is called :

(1) Doolittle method

(2) Crout's method

(3) Euler's method

(4) None of these

50. The quadrature formulae $\int_{-1}^{1} f(x)dx = \frac{1}{3}[f(-1) + 4f(0) + f(1)]$ with step length $h = 1.0$ is exact for polynomial of degree less than or equal to :

(1) Two (2) Three (3) Four (4) None of these

51. If f is bounded function defined on $[a, b]$ and P be a partition of $f[a, b]$, then which of the following is odd ?

(1) $L(f, P) \leq U(f, P)$

(2) $L(-f, P) = -U(f, P)$

(3) $U(P, -f) = -L(P, f)$

(4) $U(-f, P) = -U(f, P)$

52. Which of the following is ***not*** a bounded metric ?

(1) $d(x, y) = |x - y|$

(2) $d(x, y) = \min\{2, |x - y|\}$

(3) discrete metric

(4) $d^*(x, y) = \frac{d(x, y)}{1 + d(x, y)}$

where d is any metric on X.

B

53. Which one is a dense set ?

(1) the subset $A=\left\{\frac{1}{n}, n \in N\right\}$ in R

(2) set of natural number in R

(3) Q in R

(4) none of these

54. If $f(x)=\frac{1}{x^2}$ on [1, 4] and P = [1, 2, 3, 4] be the partition of [1, 4], then $L(f, P)$ is equal to :

(1) $\frac{70}{144}$

(2) $\frac{61}{144}$

(3) $\frac{30}{144}$

(4) none of these

55. The integral $\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$ is :

(1) convergent

(2) divergent

(3) conditionally convergent

(4) none of these

56. A sphere (open or closed) is always :

(1) empty

(2) non-empty

(3) singleton set

(4) none of these

57. What is odd against the given statement "A set is closed iff" ?

(1) $A = \overline{A}$

(2) $d(A) \subset A$

(3) A^C is open

(4) $A = \mathring{A}$

58. The order of a and x in a group are respectively 3 and 4. Then the order of $x^{-1}ax$ is :

(1) 12 (2) 8 (3) 5 (4) 3

59. Every group is isomorphic to a permutation group. This result is known as :

(1) Lagrange theorem (2) Cauchy theorem

(3) Cayley's theorem (4) Gauss theorem

60. The number of conjugacy classes in a group of order 25 is :

(1) 1 (2) 5

(3) 25 (4) none of these

61. Co-efficient of the vector $(5, -1, 2)$ w. r. t. basis $(1, 4, 2), (4, 2, 1), (2, 1, 3)$ are :

(1) $(1, 1, 1)$ (2) $(-1, 1, 1)$

(3) $(1, 2, 3)$ (4) None of these

62. Which is an orthogonal set ?

(1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$

(2) $\{(1, 0, 1), (1, 0, -1), (0, 3, 4)\}$

(3) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$

(4) None of these

63. Let $T : R^2 \to R^3$ be linear transformation defined by $T(x_1, x_2) = (x_1 - x_2, x_2 - x_1, -x_1)$. The nullty T is :

(1) 2 (2) 1

(3) 0 (4) None of these

64. Let $F : R^3 \to R^2$ be defined by $F(x, y, z) = (1x, y + z)$, then :

(1) F is linear transformation

(2) F is not a linear transformation

(3) F is invertible

(4) None of these

65. Let $V(F)$ be the vector space of all polynomial in x in which an inner product is defined by $(f, g) = \int_0^1 f(x)g(x)dx$. Then for $f(x) = x + 2$, $g(x) = x^2 - 2x - 3$, $\langle f, g \rangle$ is equal to :

(1) $\frac{5}{2}$ (2) $\frac{5}{8}$ (3) $\frac{37}{4}$ (4) $-\frac{37}{4}$

66. The linear transformation $T : R^2 \to R^2$ defined by $T(1, 0) = (2, 3)$, $T(0, 1) = (5, 6)$ is :

(1) one one and onto

(2) one one but not onto

(3) onto but not one one

(4) none of these

67. Let $T : R^3 \to R^3$ be defined by $T(x, y, z) = (x, y, 0)$ and $S : R^2 \to R^2$ be defined by $S(x, y) = (2x, 3y)$, are linear transformation on the real vector spaces R^3 and R^2 respectively. Then which of the following is ***correct*** ?

(1) T and S are both singular

(2) T and S are both non-singular

(3) T is singular but S is non-singular

(4) None of these

68. The integral $\int_0^1 x^{m-1}(1-x)^{n-1}dx$ is known as :

(1) Theta function

(2) Zeta function

(3) Gamma function

(4) Beta function

69. Fourier expansion of $f(x) = |x|$ in $[-\pi, \pi]$ is :

(1) $-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(2) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1}+\frac{\cos 3x}{3}+\frac{\cos 5x}{5}+\ldots\ldots\right)$

(3) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(4) None of these

70. If the function $f(z)$ is continuous at z_0, then :

(1) $f(z)$ is differentiable at z_0

(2) $f(z)$ is not necessarily differentiable at z_0

(3) $f(z)$ is analytic at z_0

(4) None of these

71. The resolved part of a force f in a direction perpendicular to it is :

(1) Maximum

(2) Minimum

(3) F

(4) 0

72. Centre of gravity of a thin uniform triangular lamina divides every median in the ratio :

(1) 1 : 2 (2) 2 : 1 (3) 2 : 3 (4) 1 : 4

73. The force of friction called into play when there is equilibrium is called :

(1) Limiting friction (2) Dynamical friction

(3) Statical friction (4) None of these

74. Which type of forces from the couple ?

(1) Two equal and unlike parallel forces with same lines of action.

(2) Two equal and unlike parallel forces with different lines of action.

(3) Two unequal and like parallel forces with different lines of action.

(4) Two unequal and unlike parallel forces with different lines of action.

75. The gravitational unit of moment in S.I. system is :

(1) Dyne-centimeter (2) Newton meter

(3) gm. cm (4) kg. m

76. Every non-empty subset of R which is bounded above must have l.u.b. This result is known as :

(1) Law of well ordering

(2) Law of trichotomy

(3) Completeness axiom

(4) Archimedian property of real numbers

77. The g.l.b. of a set :

(1) belongs to the set

(2) does not belong to the set

(3) may or may not belong to the set

(4) none of these

78. If $\sum_{n=1}^{\infty} a_n$ is convergent and the sequence $< b_n >$ is monotonic and bounded, then $\sum_{n=1}^{\infty} a_n b_n$ is convergent. This statement is known as :

(1) Abel's test (2) Abel's lemma

(3) Dirichlet's test (4) None of these

79. The series $\sum_{n=1}^{\infty} a_n$, where $a_n = \sqrt{n^4+1} - \sqrt{n^4-1}$ is :

(1) convergent (2) divergent

(3) oscillating (4) none of these

80. The infinite product $\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)$..... is :

(1) divergent (2) convergent

(3) oscillating (4) none of these

81. The value of $\lim_{x\to 0}(1+2x)^{\frac{x+5}{2}}$ is :

(1) $\frac{e}{2}$ (2) e^2 (3) e^5 (4) e^{10}

82. Area bounded by the parabola $2y = x^2$ and the line $x = y - 4$ is equal to :

(1) 6 (2) 18 (3) ∞ (4) none of these

83. The radius of curvature at the origin of the curve $x^2 + 6y^2 + 2x - y = 0$ is :

(1) $\frac{1}{5\sqrt{2}}$ (2) $\frac{1}{3\sqrt{5}}$ (3) $\frac{1}{2\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}}$

84. The nature of double points on the curve $(y-x)^2 + x^7 = 0$:

(1) a cusp (2) a node

(3) conjugate point (4) none of these

85. The asymptotes of the curve $r\cos\theta = a\cos 2\theta$:

(1) $r\cos\theta + a = 0$ (2) $r\sin\theta + a = 0$

(3) $r\tan\theta + a = 0$ (4) none of these

86. What is the nature of the curve $13x^2 - 18xy + 37y^2 + 2x + 14y - 2 = 0$?

(1) circle (2) sphere

(3) hyperbola (4) ellipse

87. The equation of the plane which cuts the paraboloid $x^2 - 2y^2 = z$ in a conic with its centre at the point $\left(2, \frac{3}{2}, 4\right)$ is given by :

(1) $3x + 4y + z = 0$ (2) $2x + 4y - z + 7 = 0$

(3) $4x - 6y - z + 5 = 0$ (4) None of these

88. The latus rectum of the parabola $(a^2 + b^2)(x^2 + y^2) = (bx + ay - ab)^2$ is :

(1) $\frac{2ab}{\sqrt{a^2 + b^2}}$ (2) $ab \cdot \sqrt{a^2 + b^2}$

(3) $\sqrt{a^2 + b^2}$ (4) none of these

89. The equation of circle with radius 'a' and touching the initial line at pole is :

(1) $r = a \tan\theta$

(2) $r = 2a \sin\theta$

(3) $r = 2a \cot\theta$

(4) none of these

90. The points in which the line, $\frac{x+1}{-1} = \frac{y-12}{5} = \frac{z-7}{2}$ cuts the surface $11x^2 - 5y^2 + z^2 = 0$ are :

(1) (3, 2, 1), (2, 0, 1)

(2) (1, 2, 3), (2, –3, 1)

(3) (2, 1, 1), (1, 0, –1)

(4) None of these

91. The general solution of ordinary differential equation of 'n' order contains :

(1) n-arbitrary constants

(2) more than n-arbitrary constants

(3) any number of arbitrary constant

(4) none of these

92. General solution of $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ is :

(1) $y = (2x + c)e^{-x^2}$

(2) $y = 2xe^{-x}$

(3) $y = e^{-x}$

(4) none of these

93. The necessary condition for the equation $M(x, y)dx + N(x, y)dy = 0$, to be exact is :

(1) $\frac{\partial N}{\partial y} = \frac{\partial M}{\partial x}$

(2) $\frac{\partial N}{\partial y} = -\frac{\partial M}{\partial x}$

(3) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$

(4) $\frac{\partial M}{\partial y} = -\frac{\partial N}{\partial x}$

94. The equation $ydx + xdy = 0$ is :

(1) Partial differential equation

(2) Exact differential equation

(3) Non-exact differential equation

(4) None of these

95. For the differential equation $x\frac{dy}{dx} - y = 0$, which of the following function is not an - integrating factor ?

(1) $\frac{1}{x^2}$ (2) $\frac{1}{y^2}$ (3) $\frac{1}{xy}$ (4) $\frac{1}{x+y}$

96. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a} \times \vec{b} = 0$ and $\vec{a} \cdot \vec{b} = 0$, then :

(1) $\vec{a}$ is parallel to $\vec{b}$

(2) $\vec{a}$ is at right angle to $\vec{b}$

(3) either $\vec{a}$ or $\vec{b}$ is a null vector

(4) none of these

97. The unit normal vector to the surface $x^4 - 3xyz + z^2 + 1 = 0$ at the point (1, 1, 1) is :

(1) $\frac{i+3j+k}{\sqrt{\pi}}$ (2) $\frac{i-3j-k}{\sqrt{\pi}}$

(3) $\frac{i+3j-k}{\sqrt{\pi}}$ (4) None of these

98. A vector $\vec{f}$ is called an irrotational vector if :

(1) div curl $\vec{f} = 0$ (2) $\nabla . \vec{f} = 0$

(3) $\nabla \times \vec{f} = 0$ (4) none of these

99. Which of the following is ***not*** true ?

(1) curl (grad ϕ) = 0

(2) div (grad ϕ) = 0

(3) div (curl $\vec{f}$) = 0

(4) curl ($\vec{r}$) = 0

100. Which of the following is related with Stoke's theorem ?

(1) A line integral and a volume integral

(2) A surface integral and a volume integral

(3) A line integral, a surface integral and a volume integral

(4) A line integral and a surface integral

opened at 2:20pm on 27.6.2023
used for uploading on university website
Total No. of Printed Pages : 21

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

C

SET-X

PG-EE-June, 2023

SUBJECT : Mathematics Group

10415

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The resolved part of a force f in a direction perpendicular to it is :

   (1) Maximum (2) Minimum

   (3) F (4) 0

2. Centre of gravity of a thin uniform triangular lamina divides every median in the ratio :

   (1) 1 : 2 (2) 2 : 1 (3) 2 : 3 (4) 1 : 4

3. The force of friction called into play when there is equilibrium is called :

   (1) Limiting friction

   (2) Dynamical friction

   (3) Statical friction

   (4) None of these

4. Which type of forces from the couple ?

   (1) Two equal and unlike parallel forces with same lines of action.

   (2) Two equal and unlike parallel forces with different lines of action.

   (3) Two unequal and like parallel forces with different lines of action.

   (4) Two unequal and unlike parallel forces with different lines of action.

5. The gravitational unit of moment in S.I. system is :

   (1) Dyne-centimeter (2) Newton meter

   (3) gm. cm (4) kg. m

6. Every non-empty subset of R which is bounded above must have l.u.b. This result is known as :

(1) Law of well ordering

(2) Law of trichotomy

(3) Completeness axiom

(4) Archimedian property of real numbers

7. The g.l.b. of a set :

(1) belongs to the set

(2) does not belong to the set

(3) may or may not belong to the set

(4) none of these

8. If $\sum_{n=1}^{\infty} a_n$ is convergent and the sequence $< b_n >$ is monotonic and bounded, then $\sum_{n=1}^{\infty} a_n b_n$ is convergent. This statement is known as :

(1) Abel's test

(2) Abel's lemma

(3) Dirichlet's test

(4) None of these

9. The series $\sum_{n=1}^{\infty} a_n$, where $a_n = \sqrt{n^4+1} - \sqrt{n^4-1}$ is :

(1) convergent

(2) divergent

(3) oscillating

(4) none of these

10. The infinite product $\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)$..... is :

(1) divergent

(2) convergent

(3) oscillating

(4) none of these

11. The value of $\lim_{x\to 0}(1+2x)^{\frac{x+5}{2}}$ is :

(1) $\frac{e}{2}$ (2) e^2 (3) e^5 (4) e^{10}

12. Area bounded by the parabola $2y = x^2$ and the line $x = y - 4$ is equal to :

(1) 6 (2) 18 (3) ∞ (4) none of these

13. The radius of curvature at the origin of the curve $x^2 + 6y^2 + 2x - y = 0$ is :

(1) $\frac{1}{5\sqrt{2}}$ (2) $\frac{1}{3\sqrt{5}}$ (3) $\frac{1}{2\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}}$

14. The nature of double points on the curve $(y-x)^2 + x^7 = 0$:

(1) a cusp

(2) a node

(3) conjugate point

(4) none of these

15. The asymptotes of the curve $r\cos\theta = a\cos 2\theta$:

(1) $r\cos\theta + a = 0$

(2) $r\sin\theta + a = 0$

(3) $r\tan\theta + a = 0$

(4) none of these

16. What is the nature of the curve $13x^2 - 18xy + 37y^2 + 2x + 14y - 2 = 0$?

(1) circle

(2) sphere

(3) hyperbola

(4) ellipse

17. The equation of the plane which cuts the paraboloid $x^2 - 2y^2 = z$ in a conic with its centre at the point $\left(2, \frac{3}{2}, 4\right)$ is given by :

(1) $3x + 4y + z = 0$

(2) $2x + 4y - z + 7 = 0$

(3) $4x - 6y - z + 5 = 0$

(4) None of these

18. The latus rectum of the parabola $(a^2 + b^2)(x^2 + y^2) = (bx + ay - ab)^2$ is :

(1) $\frac{2ab}{\sqrt{a^2 + b^2}}$

(2) $ab \cdot \sqrt{a^2 + b^2}$

(3) $\sqrt{a^2 + b^2}$

(4) none of these

19. The equation of circle with radius 'a' and touching the initial line at pole is :

(1) $r = a \tan \theta$

(2) $r = 2a \sin \theta$

(3) $r = 2a \cot \theta$

(4) none of these

20. The points in which the line, $\frac{x+1}{-1} = \frac{y-12}{5} = \frac{z-7}{2}$ cuts the surface $11x^2 - 5y^2 + z^2 = 0$ are :

(1) (3, 2, 1), (2, 0, 1)

(2) (1, 2, 3), (2, –3, 1)

(3) (2, 1, 1), (1, 0, –1)

(4) None of these

21. The general solution of ordinary differential equation of 'n' order contains :

(1) n-arbitrary constants

(2) more than n-arbitrary constants

(3) any number of arbitrary constant

(4) none of these

22. General solution of $\frac{dy}{dx}+2xy=2e^{-x^2}$ is :

(1) $y=(2x+c)e^{-x^2}$

(2) $y=2xe^{-x}$

(3) $y=e^{-x}$

(4) none of these

23. The necessary condition for the equation $M(x, y)dx + N(x, y)dy = 0$, to be exact is :

(1) $\frac{\partial N}{\partial y}=\frac{\partial M}{\partial x}$

(2) $\frac{\partial N}{\partial y}=-\frac{\partial M}{\partial x}$

(3) $\frac{\partial M}{\partial y}=\frac{\partial N}{\partial x}$

(4) $\frac{\partial M}{\partial y}=-\frac{\partial N}{\partial x}$

24. The equation $ydx + xdy = 0$ is :

(1) Partial differential equation

(2) Exact differential equation

(3) Non-exact differential equation

(4) None of these

25. For the differential equation $x\frac{dy}{dx}-y=0$, which of the following function is not an - integrating factor ?

(1) $\frac{1}{x^2}$ (2) $\frac{1}{y^2}$ (3) $\frac{1}{xy}$ (4) $\frac{1}{x+y}$

26. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}\times\vec{b}=0$ and $\vec{a}\cdot\vec{b}=0$, then :

(1) $\vec{a}$ is parallel to $\vec{b}$

(2) $\vec{a}$ is at right angle to $\vec{b}$

(3) either $\vec{a}$ or $\vec{b}$ is a null vector

(4) none of these

27. The unit normal vector to the surface $x^4 - 3xyz + z^2 + 1 = 0$ at the point (1, 1, 1) is :

(1) $\frac{i+3j+k}{\sqrt{\pi}}$ (2) $\frac{i-3j-k}{\sqrt{\pi}}$

(3) $\frac{i+3j-k}{\sqrt{\pi}}$ (4) None of these

28. A vector $\vec{f}$ is called an irrotational vector if :

(1) div curl $\vec{f} = 0$ (2) $\nabla . \vec{f} = 0$

(3) $\nabla \times \vec{f} = 0$ (4) none of these

29. Which of the following is ***not*** true ?

(1) curl (grad ϕ) = 0 (2) div (grad ϕ) = 0

(3) div (curl $\vec{f}$) = 0 (4) curl ($\vec{r}$) = 0

30. Which of the following is related with Stoke's theorem ?

(1) A line integral and a volume integral

(2) A surface integral and a volume integral

(3) A line integral, a surface integral and a volume integral

(4) A line integral and a surface integral

31. Polar form of C. R. equations are :

(1) $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$ (2) $\frac{\partial u}{\partial \theta} = \frac{1}{r}\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r} = r\frac{\partial v}{\partial 0}$

(3) $\frac{\partial u}{\partial \theta} = r\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$ (4) None of these

32. The fixed points of the mapping $W = \frac{5z+4}{z+5}$ are :

(1) 2, 2

(2) 2, –2

(3) –2, –2

(4) None of these

33. The inverse point of the point z with respect to the circle $|z| = r$ is :

(1) $\frac{r}{\bar{z}}$

(2) $\frac{r^2}{z}$

(3) $\frac{r^2}{\bar{z}}$

(4) None of these

34. Fourier series for the function $f(x)$ in the interval $(c, c + 2\pi)$ is :

(1) $f(x) = \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$

(2) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(3) $f(x) = \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(4) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin x$

35. The value of $\Delta^n(a^x)$ is :

(1) $(a^{nh} + 1)a^x$

(2) $(a^{nh} - 1)a^x$

(3) $(a^h + 1)^n_{a^x}$

(4) $(a^h - 1)^n_{a^x}$

36. The order of convergence of Newton-Raphson method is :

(1) 1 (2) 1.618

(3) 2 (4) None of these

37. Runge-Kutta method is used for :

(1) Interpolation

(2) Numerical differentiation

(3) Numerical Integration

(4) Numerical solution of ordinary differential equation

38. The values of a function $f(x)$ are tabulated below :

x	0	1	2	3
$f(x)$	1	2	1	10

(1) $2x^3 - 7x^2 + 6x + 1$ (2) $x^3 - 7x^2 - 6x + 1$

(3) $2x^3 + 7x^2 - 6x + 2$ (4) None of these

39. In decomposition method, if $u_{ii} = 1$, then the method is called :

(1) Doolittle method (2) Crout's method

(3) Euler's method (4) None of these

40. The quadrature formulae $\int_{-1}^{1} f(x)dx = \frac{1}{3}[f(-1) + 4f(0) + f(1)]$ with step length $h = 1.0$ is exact for polynomial of degree less than or equal to :

(1) Two (2) Three (3) Four (4) None of these

41. If f is bounded function defined on $[a, b]$ and P be a partition of $f[a, b]$, then which of the following is odd ?

(1) $L(f, P) \leq U(f, P)$

(2) $L(-f, P) = -U(f, P)$

(3) $U(P, -f) = -L(P, f)$

(4) $U(-f, P) = -U(f, P)$

42. Which of the following is ***not*** a bounded metric ?

(1) $d(x, y) = |x - y|$

(2) $d(x, y) = \min\{2, |x - y|\}$

(3) discrete metric

(4) $d^*(x, y) = \dfrac{d(x, y)}{1 + d(x, y)}$

where d is any metric on X.

43. Which one is a dense set ?

(1) the subset $A = \left\{\dfrac{1}{n}, n \in N\right\}$ in R

(2) set of natural number in R

(3) Q in R

(4) none of these

44. If $f(x) = \dfrac{1}{x^2}$ on $[1, 4]$ and $P = [1, 2, 3, 4]$ be the partition of $[1, 4]$, then $L(f, P)$ is equal to :

(1) $\dfrac{70}{144}$ (2) $\dfrac{61}{144}$ (3) $\dfrac{30}{144}$ (4) none of these

45. The integral $\displaystyle\int_{-\infty}^{\infty} \frac{dx}{1 + x^2}$ is :

(1) convergent

(2) divergent

(3) conditionally convergent

(4) none of these

46. A sphere (open or closed) is always :

(1) empty (2) non-empty

(3) singleton set (4) none of these

47. What is odd against the given statement "A set is closed iff" ?

(1) $A = \overline{A}$ (2) $d(A) \subset A$

(3) A^C is open (4) $A = \mathring{A}$

48. The order of a and x in a group are respectively 3 and 4. Then the order of $x^{-1}ax$ is :

(1) 12 (2) 8 (3) 5 (4) 3

49. Every group is isomorphic to a permutation group. This result is known as :

(1) Lagrange theorem (2) Cauchy theorem

(3) Cayley's theorem (4) Gauss theorem

50. The number of conjugacy classes in a group of order 25 is :

(1) 1 (2) 5 (3) 25 (4) none of these

51. If $\lim\limits_{x \to 0} \dfrac{ae^x - b\cos x + ce^{-x}}{x \sin x} = 2$, then value of b is equal to :

(1) -2 (2) -1 (3) 0 (4) 2

52. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, then value of $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z}$ is equal to :

(1) $\dfrac{1}{x^2 + y^2 + z^2}$ (2) $\dfrac{1}{x^3 + y^3 + z^3}$

(3) $\dfrac{3}{x + y + z}$ (4) None of these

53. The equation of normal to the surface $xyz = 4$ at the point $(1, 2, 2)$ is equal to :

(1) $\frac{X-1}{2}=\frac{Y-2}{1}=\frac{Z-2}{1}$ (2) $\frac{X-1}{1}=\frac{Y-2}{2}=\frac{Z-2}{1}$

(3) $\frac{X-1}{3}=\frac{Y-2}{2}=\frac{Z-2}{2}$ (4) None of these

54. The necessary and sufficient condition for the curve to be a plane curve is :

(1) $[\vec{r}\,\vec{r}'\,\vec{r}'']=0$ (2) $[\vec{r}'\,\vec{r}''\,\vec{r}''']=0$

(3) $[\vec{r}''\,\vec{r}'''\,\vec{r}]=0$ (4) none of these

55. The maximum value of the function $\sin x + \sin y + \sin(\sin x + y)$ is :

(1) $\frac{3\sqrt{3}}{2}$ (2) $\sqrt{3}$ (3) $\frac{\sqrt{3}}{2}$ (4) None of these

56. A partial differential equation by eliminating the arbitrary functions from : $z = f(x-ay) + g(x+ay)$ is given by :

(1) $\frac{\partial^2 z}{\partial x^2}=\frac{\partial^2 z}{\partial y^2}$ (2) $\frac{\partial^2 z}{\partial y^2}=a^2\frac{\partial^2 z}{\partial x^2}$

(3) $\frac{\partial^2 z}{\partial x^2}=a^2\frac{\partial^2 z}{\partial y^2}$ (4) none of these

57. The particular integral of the differential equation $\frac{\partial^3 z}{\partial x^3}-3\frac{\partial^3 z}{\partial x^2\partial y}+4\frac{\partial^3 z}{\partial y^3}=e^{x+2y}$ is :

(1) $\frac{1}{8}e^{x+2y}$ (2) $\frac{1}{2}e^{2y}$ (3) $\frac{1}{27}e^{x+2y}$ (4) none of these

58. The partial differential equation $\frac{\partial^2 z}{\partial x^2}-7\frac{\partial^2 z}{\partial x\partial y}+6\frac{\partial^2 z}{\partial y^2}=0$ is :

(1) Hyperbolic (2) Parabolic

(3) Elliptic (4) None of these

59. The real characteristics of the partial differential equation $\frac{\partial^2 z}{\partial x^2}+4\frac{\partial^2 z}{\partial x \partial y}+4\frac{\partial^2 z}{\partial y^2}=0$ is :

(1) $4x = y + c$

(2) $3x + y = 0$

(3) $8x - y = 0$

(4) $y - 2x = c$

60. To two dimensional heat equation is given by :

(1) $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=\frac{1}{c}\frac{\partial u}{\partial t}$

(2) $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=8$

(3) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial u}{\partial y}=\frac{1}{c^2}\frac{\partial^2 u}{\partial x^2}$

(4) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=\frac{1}{c^2}\frac{\partial u}{\partial t}$

61. The number of non-isomorphic abelian groups of order 8 is :

(1) 1

(2) 2

(3) 3

(4) none of these

62. The number of prime ideals of Z_{10} is :

(1) 2

(2) 1

(3) 0

(4) none of these

63. The ring of Z, Q, R, C, Z_5 are :

(1) All integral domains

(2) None of them is integral domain

(3) Some of them is integral domain

(4) None of these

64. Which statement is ***wrong*** ?

F is a field, then $F[x]$ is :

(1) Euclidean domain

(2) Principal ideal domain

(3) Unique factorization domain

(4) None of these

65. In S. H. M. the maximum velocity is :

(1) $V_{max} = a$

(2) $V_{max} = \sqrt{\mu}\, a$

(3) $V_{max} = \mu\, a$

(4) None of these

66. The uniform force that will move on kg. mass from rest through one metre in one second is :

(1) 4 Newton

(2) 3 Newton

(3) 2 Newton

(4) None of these

67. At an apse, the radius vector is :

(1) perpendicular to the tangent

(2) parallel to the tangent

(3) perpendicular to the apsidal distance

(4) None of these

68. The radial and transverse acceleration of a particle moving along a plane curve $r = f(\theta)$ are :

(1) $r\frac{dr}{dt}, \frac{d\theta}{dt}$

(2) $\frac{dr}{dt}, r\frac{d\theta}{dt}$

(3) $\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2, \frac{1}{r}\frac{d}{dt}\left[r^2\frac{d\theta}{dt}\right]$

(4) None of these

69. Central force is defined as :

(1) A force whose line of action always passes through variable point.

(2) A force whose line of action always passes through a fixed point.

(3) A force whose line of action does not pass through a fixed point.

(4) None of these

70. Frequency of a simple harmonic motion is :

(1) $\frac{\mu}{\pi}$ (2) $\frac{\pi}{\mu}$

(3) $\frac{\sqrt{\mu}}{\pi}$ (4) $\frac{\sqrt{\mu}}{2\pi}$

71. Co-efficient of the vector (5, –1, 2) w. r. t. basis (1, 4, 2), (4, 2, 1), (2, 1, 3) are :

(1) (1, 1, 1) (2) (–1, 1, 1)

(3) (1, 2, 3) (4) None of these

72. Which is an orthogonal set ?

(1) $\{(1, 0, 1), (1, 0, -1), (0, 1, 0)\}$

(2) $\{(1, 0, 1), (1, 0, -1), (0, 3, 4)\}$

(3) $\{(1, 0, 1), (1, 0, -1), (-1, 0, 1)\}$

(4) None of these

73. Let $T : R^2 \to R^3$ be linear transformation defined by $T(x_1, x_2) = (x_1 - x_2, x_2 - x_1, -x_1)$. The nullty T is :

(1) 2 (2) 1

(3) 0 (4) None of these

74. Let $F : R^3 \to R^2$ be defined by $F(x, y, z) = (1x, y + z)$, then :

(1) F is linear transformation

(2) F is not a linear transformation

(3) F is invertible

(4) None of these

75. Let $V(F)$ be the vector space of all polynomial in x in which an inner product is defined by $(f, g) = \int_0^1 f(x)g(x)dx$. Then for $f(x) = x + 2$, $g(x) = x^2 - 2x - 3$, $\langle f, g \rangle$ is equal to :

(1) $\frac{5}{2}$ (2) $\frac{5}{8}$ (3) $\frac{37}{4}$ (4) $-\frac{37}{4}$

76. The linear transformation $T : R^2 \to R^2$ defined by $T(1, 0) = (2, 3)$, $T(0, 1) = (5, 6)$ is :

(1) one one and onto (2) one one but not onto

(3) onto but not one one (4) none of these

77. Let $T : R^3 \to R^3$ be defined by $T(x, y, z) = (x, y, 0)$ and $S : R^2 \to R^2$ be defined by $S(x, y) = (2x, 3y)$, are linear transformation on the real vector spaces R^3 and R^2 respectively. Then which of the following is ***correct*** ?

(1) T and S are both singular

(2) T and S are both non-singular

(3) T is singular but S is non-singular

(4) None of these

78. The integral $\int_0^1 x^{m-1}(1-x)^{n-1}dx$ is known as :

(1) Theta function

(2) Zeta function

(3) Gamma function

(4) Beta function

79. Fourier expansion of $f(x) = |x|$ in $[-\pi, \pi]$ is :

(1) $-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(2) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1}+\frac{\cos 3x}{3}+\frac{\cos 5x}{5}+\ldots\ldots\right)$

(3) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(4) None of these

80. If the function $f(z)$ is continuous at z_0, then :

(1) $f(z)$ is differentiable at z_0

(2) $f(z)$ is not necessarily differentiable at z_0

(3) $f(z)$ is analytic at z_0

(4) None of these

81. The remainder in the divison of 2^{20} by 7 is :

(1) 0 (2) 1 (3) 2 (4) 4

82. Every natural number greater than one has at least :

(1) one prime factor (2) two prime factor

(3) two composite factors (4) none of these

83. Find the highest power of 7 contained in 1000!

(1) 264 (2) 164 (3) 64 (4) none of these

84. If $|\cos(\alpha - i\beta)| = 1$, then $\sin^2 \alpha$ is equal to :

(1) $\cos h^2\beta$ (2) $\sin h^2\beta$

(3) $\tan h^2\beta$ (4) none of these

85. If p is a prime number then $(p-1)! + 1 \equiv 0 \pmod{p}$ is the statement of :

(1) Chinese remainder theorem (2) Fermat's theorem

(3) Wilson's theorem (4) Reduced residue theorem

86. If A is a non-singular matrix of order n, then adj (adj A) is equal to :

(1) $|A|^{n+1} A$ (2) $|A|^n A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-2} A$

87. The vectors $\begin{bmatrix}2\\0\\k\end{bmatrix}, \begin{bmatrix}3\\-1\\5\end{bmatrix}, \begin{bmatrix}5\\-1\\1\end{bmatrix}$ are linearly dependent, then value of k is equal to :

(1) -4 (2) -2 (3) 0 (4) 4

88. The characteristics roots of a Hermitian matrix are :

(1) Imaginary (2) Real

(3) Complex number (4) None of these

89. Determinant of an idempotent matrix equals :

(1) 1 (2) 0 (3) 1 or 0 (4) none of these

90. The common roots of the equations $x^4+3x^3-5x^2-6x-8=0$ and $x^4+x^3-9x^2+10x-8=0$ are :

(1) 2, 3 (2) 3, 4 (3) 4, 0 (4) -4, 2

91. Generating function for Bessel function $J_n(x)$ is :

(1) $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$ (2) $e^{\frac{x}{2}\left(\frac{1}{t}-t\right)}$

(3) $e^{x\left(t-\frac{1}{t}\right)}$ (4) None of these

92. Rodrigue formula for Legendre polynomials is :

(1) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$ (2) $P_n(x)=\frac{1}{2^n}\frac{d^n}{dx^n}(x^2-1)^n$

(3) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2+1)^n$ (4) None of these

93. The Laplace transform of $te^{-t}\sin 3t$ is equal to :

(1) $\frac{36}{(s^2+2s+10)^2}$ (2) $\frac{6(s+1)}{(s^2+2s+10)^2}$

(3) $\frac{s+1}{(s^2+2s+6)^2}$ (4) None of these

94. The generating function of Legendre's polynomials is :

(1) $(1+2xt+t^2)^{3/2}$ (2) $(1+2x+t^2)^{1/2}$

(3) $(1-2xt+t^2)^{-1/2}$ (4) None of these

95. The sine Fourier transform of $2e^{-5x}$ is :

(1) $\frac{5s}{s^2+4}$ (2) $\frac{-5s}{s^2+4}$

(3) $\frac{5s}{s^2+25}$ (4) None of these

96. Which of the following keyword is used for the storage class ?

(1) print f. (2) external

(3) auto (4) none of these

97. What will be the maximum size of a double variable ?

(1) 16 bytes (2) 8 bytes

(3) 4 bytes (4) none of these

98. The continue command cannot be used with :

(1) switch (2) for (3) do (4) none of these

99. The bitwise OR operator is used to :

(1) divide number

(2) set the desired bits to 0

(3) set the desired bits to 1

(4) none of these

100. C is which kind of language ?

(1) machine

(2) assembly

(3) objected-oriented

(4) none of these

opened at 2:20pm on 27-6-2023
used for uploading on university website

Total No. of Printed Pages : 21

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

D

SET-X

PG-EE-June, 2023

SUBJECT : Mathematics Group

10428

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Date of Birth_____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate) (Signature of the Invigilator)

SEAL

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The remainder in the divison of 2^{20} by 7 is :

(1) 0 (2) 1 (3) 2 (4) 4

2. Every natural number greater than one has at least :

(1) one prime factor (2) two prime factor

(3) two composite factors (4) none of these

3. Find the highest power of 7 contained in 1000!

(1) 264 (2) 164 (3) 64 (4) none of these

4. If $|\cos(\alpha - i\beta)| = 1$, then $\sin^2\alpha$ is equal to :

(1) $\cos h^2\beta$ (2) $\sin h^2\beta$

(3) $\tan h^2\beta$ (4) none of these

5. If p is a prime number then $(p-1)! + 1 \equiv 0 \pmod{p}$ is the statement of :

(1) Chinese remainder theorem

(2) Fermat's theorem

(3) Wilson's theorem

(4) Reduced residue theorem

6. If A is a non-singular matrix of order n, then adj (adj A) is equal to :

(1) $|A|^{n+1} A$ (2) $|A|^n A$

(3) $|A|^{n-1} A$ (4) $|A|^{n-2} A$

7. The vectors $\begin{bmatrix} 2 \\ 0 \\ k \end{bmatrix}, \begin{bmatrix} 3 \\ -1 \\ 5 \end{bmatrix}, \begin{bmatrix} 5 \\ -1 \\ 1 \end{bmatrix}$ are linearly dependent, then value of k is equal to :

(1) –4 (2) –2 (3) 0 (4) 4

8. The characteristics roots of a Hermitian matrix are :

(1) Imaginary (2) Real

(3) Complex number (4) None of these

9. Determinant of an idempotent matrix equals :

(1) 1 (2) 0 (3) 1 or 0 (4) none of these

10. The common roots of the equations $x^4+3x^3-5x^2-6x-8=0$ and $x^4+x^3-9x^2+10x-8=0$ are :

(1) 2, 3 (2) 3, 4 (3) 4, 0 (4) $-4, 2$

11. Polar form of C. R. equations are :

(1) $\frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r}=-\frac{1}{r}\frac{\partial u}{\partial \theta}$

(2) $\frac{\partial u}{\partial \theta}=\frac{1}{r}\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r}=r\frac{\partial v}{\partial \theta}$

(3) $\frac{\partial u}{\partial \theta}=r\frac{\partial v}{\partial r}, \frac{\partial u}{\partial r}=\frac{1}{r}\frac{\partial v}{\partial \theta}$

(4) None of these

12. The fixed points of the mapping $W=\frac{5z+4}{z+5}$ are :

(1) 2, 2 (2) 2, -2

(3) $-2, -2$ (4) None of these

13. The inverse point of the point z with respect to the circle $|z|=r$ is :

(1) $\frac{r}{\bar{z}}$ (2) $\frac{r^2}{z}$

(3) $\frac{r^2}{\bar{z}}$ (4) None of these

14. Fourier series for the function $f(x)$ in the interval $(c, c + 2\pi)$ is :

(1) $f(x) = \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$

(2) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(3) $f(x) = \sum_{n=1}^{\infty} a_n \sin nx + \sum_{n=1}^{\infty} b_n \cos nx$

(4) $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin x$

15. The value of $\Delta^n(a^x)$ is :

(1) $(a^{nh} + 1)a^x$

(2) $(a^{nh} - 1)a^x$

(3) $(a^h + 1)^n_{a^x}$

(4) $(a^h - 1)^n_{a^x}$

16. The order of convergence of Newton-Raphson method is :

(1) 1

(2) 1.618

(3) 2

(4) None of these

17. Runge-Kutta method is used for :

(1) Interpolation

(2) Numerical differentiation

(3) Numerical Integration

(4) Numerical solution of ordinary differential equation

18. The values of a function $f(x)$ are tabulated below :

x	0	1	2	3
$f(x)$	1	2	1	10

(1) $2x^3 - 7x^2 + 6x + 1$ (2) $x^3 - 7x^2 - 6x + 1$

(3) $2x^3 + 7x^2 - 6x + 2$ (4) None of these

19. In decomposition method, if $u_{ii} = 1$, then the method is called :

(1) Doolittle method (2) Crout's method

(3) Euler's method (4) None of these

20. The quadrature formulae $\int_{-1}^{1} f(x)dx = \frac{1}{3}[f(-1) + 4f(0) + f(1)]$ with step length $h = 1.0$ is exact for polynomial of degree less than or equal to :

(1) Two (2) Three (3) Four (4) None of these

21. The number of non-isomorphic abelian groups of order 8 is :

(1) 1 (2) 2 (3) 3 (4) none of these

22. The number of prime ideals of Z_{10} is :

(1) 2 (2) 1 (3) 0 (4) none of these

23. The ring of Z, Q, R, C, Z_5 are :

(1) All integral domains

(2) None of them is integral domain

(3) Some of them is integral domain

(4) None of these

24. Which statement is ***wrong*** ?

F is a field, then $F[x]$ is :

(1) Euclidean domain

(2) Principal ideal domain

(3) Unique factorization domain

(4) None of these

25. In S. H. M. the maximum velocity is :

(1) $V_{max} = a$

(2) $V_{max} = \sqrt{\mu}\, a$

(3) $V_{max} = \mu\, a$

(4) None of these

26. The uniform force that will move on kg. mass from rest through one metre in one second is :

(1) 4 Newton

(2) 3 Newton

(3) 2 Newton

(4) None of these

27. At an apse, the radius vector is :

(1) perpendicular to the tangent

(2) parallel to the tangent

(3) perpendicular to the apsidal distance

(4) None of these

28. The radial and transverse acceleration of a particle moving along a plane curve $r = f(\theta)$ are :

(1) $r\frac{dr}{dt}, \frac{d\theta}{dt}$

(2) $\frac{dr}{dt}, r\frac{d\theta}{dt}$

(3) $\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2, \frac{1}{r}\frac{d}{dt}\left[r^2\frac{d\theta}{dt}\right]$

(4) None of these

29. Central force is defined as :

(1) A force whose line of action always passes through variable point.

(2) A force whose line of action always passes through a fixed point.

(3) A force whose line of action does not pass through a fixed point.

(4) None of these

30. Frequency of a simple harmonic motion is :

(1) $\frac{\mu}{\pi}$ (2) $\frac{\pi}{\mu}$

(3) $\frac{\sqrt{\mu}}{\pi}$ (4) $\frac{\sqrt{\mu}}{2\pi}$

31. Generating function for Bessel function $J_n(x)$ is :

(1) $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$ (2) $e^{\frac{x}{2}\left(\frac{1}{t}-t\right)}$

(3) $e^{x\left(t-\frac{1}{t}\right)}$ (4) None of these

32. Rodrigue formula for Legendre polynomials is :

(1) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$

(2) $P_n(x)=\frac{1}{2^n}\frac{d^n}{dx^n}(x^2-1)^n$

(3) $P_n(x)=\frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2+1)^n$

(4) None of these

33. The Laplace transform of $te^{-t}\sin 3t$ is equal to :

(1) $\frac{36}{(s^2+2s+10)^2}$

(2) $\frac{6(s+1)}{(s^2+2s+10)^2}$

(3) $\frac{s+1}{(s^2+2s+6)^2}$

(4) None of these

34. The generating function of Legendre's polynomials is :

(1) $(1+2xt+t^2)^{3/2}$

(2) $(1+2x+t^2)^{1/2}$

(3) $(1-2xt+t^2)^{-1/2}$

(4) None of these

35. The sine Fourier transform of $2e^{-5x}$ is :

(1) $\frac{5s}{s^2+4}$

(2) $\frac{-5s}{s^2+4}$

(3) $\frac{5s}{s^2+25}$

(4) None of these

36. Which of the following keyword is used for the storage class ?

(1) print f

(2) external

(3) auto

(4) none of these

37. What will be the maximum size of a double variable ?

(1) 16 bytes

(2) 8 bytes

(3) 4 bytes

(4) none of these

38. The continue command cannot be used with :

(1) switch (2) for (3) do (4) none of these

39. The bitwise OR operator is used to :

(1) divide number

(2) set the desired bits to 0

(3) set the desired bits to 1

(4) none of these

40. C is which kind of language ?

(1) machine

(2) assembly

(3) objected-oriented

(4) none of these

41. If $\lim_{x \to 0} \frac{ae^x - b\cos x + ce^{-x}}{x \sin x} = 2$, then value of b is equal to :

(1) -2 (2) -1 (3) 0 (4) 2

42. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, then value of $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z}$ is equal to :

(1) $\frac{1}{x^2 + y^2 + z^2}$

(2) $\frac{1}{x^3 + y^3 + z^3}$

(3) $\frac{3}{x + y + z}$

(4) None of these

43. The equation of normal to the surface $xyz = 4$ at the point $(1, 2, 2)$ is equal to :

(1) $\frac{X-1}{2} = \frac{Y-2}{1} = \frac{Z-2}{1}$

(2) $\frac{X-1}{1} = \frac{Y-2}{2} = \frac{Z-2}{1}$

(3) $\frac{X-1}{3} = \frac{Y-2}{2} = \frac{Z-2}{2}$

(4) None of these

44. The necessary and sufficient condition for the curve to be a plane curve is :

(1) $[\vec{r}\ \vec{r'}\ \vec{r''}] = 0$

(2) $[\vec{r'}\ \vec{r''}\ \vec{r'''}] = 0$

(3) $[\vec{r''}\ \vec{r'''}\ \vec{r}] = 0$

(4) none of these

45. The maximum value of the function $\sin x + \sin y + \sin(\sin x + y)$ is :

(1) $\frac{3\sqrt{3}}{2}$

(2) $\sqrt{3}$

(3) $\frac{\sqrt{3}}{2}$

(4) None of these

46. A partial differential equation by eliminating the arbitrary functions from : $z = f(x - ay) + g(x + ay)$ is given by :

(1) $\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial y^2}$

(2) $\frac{\partial^2 z}{\partial y^2} = a^2 \frac{\partial^2 z}{\partial x^2}$

(3) $\frac{\partial^2 z}{\partial x^2} = a^2 \frac{\partial^2 z}{\partial y^2}$

(4) none of these

47. The particular integral of the differential equation $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x^2 \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$ is :

(1) $\frac{1}{8}e^{x+2y}$ (2) $\frac{1}{2}e^{2y}$ (3) $\frac{1}{27}e^{x+2y}$ (4) none of these

48. The partial differential equation $\frac{\partial^2 z}{\partial x^2} - 7\frac{\partial^2 z}{\partial x \partial y} + 6\frac{\partial^2 z}{\partial y^2} = 0$ is :

(1) Hyperbolic (2) Parabolic

(3) Elliptic (4) None of these

49. The real characteristics of the partial differential equation $\frac{\partial^2 z}{\partial x^2} + 4\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ is :

(1) $4x = y + c$ (2) $3x + y = 0$ (3) $8x - y = 0$ (4) $y - 2x = c$

50. To two dimensional heat equation is given by :

(1) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = \frac{1}{c}\frac{\partial u}{\partial t}$ (2) $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 8$

(3) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial u}{\partial y} = \frac{1}{c^2}\frac{\partial^2 u}{\partial x^2}$ (4) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = \frac{1}{c^2}\frac{\partial u}{\partial t}$

51. The value of $\lim_{x \to 0}(1+2x)^{\frac{x+5}{2}}$ is :

(1) $\frac{e}{2}$ (2) e^2 (3) e^5 (4) e^{10}

52. Area bounded by the parabola $2y = x^2$ and the line $x = y - 4$ is equal to :

(1) 6 (2) 18 (3) ∞ (4) none of these

53. The radius of curvature at the origin of the curve $x^2 + 6y^2 + 2x - y = 0$ is :

(1) $\frac{1}{5\sqrt{2}}$ (2) $\frac{1}{3\sqrt{5}}$ (3) $\frac{1}{2\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}}$

54. The nature of double points on the curve $(y-x)^2+x^7=0$:

(1) a cusp

(2) a node

(3) conjugate point

(4) none of these

55. The asymptotes of the curve $r\cos\theta = a\cos 2\theta$:

(1) $r\cos\theta + a = 0$

(2) $r\sin\theta + a = 0$

(3) $r\tan\theta + a = 0$

(4) none of these

56. What is the nature of the curve $13x^2-18xy+37y^2+2x+14y-2=0$?

(1) circle

(2) sphere

(3) hyperbola

(4) ellipse

57. The equation of the plane which cuts the paraboloid $x^2-2y^2=z$ in a conic with its centre at the point $\left(2,\frac{3}{2},4\right)$ is given by :

(1) $3x+4y+z=0$

(2) $2x+4y-z+7=0$

(3) $4x-6y-z+5=0$

(4) None of these

58. The latus rectum of the parabola $(a^2+b^2)(x^2+y^2)=(bx+ay-ab)^2$ is :

(1) $\frac{2ab}{\sqrt{a^2+b^2}}$

(2) $ab.\sqrt{a^2+b^2}$

(3) $\sqrt{a^2+b^2}$

(4) none of these

59. The equation of circle with radius 'a' and touching the initial line at pole is :

(1) $r=a\tan\theta$

(2) $r=2a\sin\theta$

(3) $r=2a\cot\theta$

(4) none of these

60. The points in which the line, $\frac{x+1}{-1}=\frac{y-12}{5}=\frac{z-7}{2}$ cuts the surface $11x^2-5y^2+z^2=0$ are :

(1) (3, 2, 1), (2, 0, 1)

(2) (1, 2, 3), (2, –3, 1)

(3) (2, 1, 1), (1, 0, –1)

(4) None of these

61. The resolved part of a force *f* in a direction perpendicular to it is :

(1) Maximum

(2) Minimum

(3) F

(4) 0

62. Centre of gravity of a thin uniform triangular lamina divides every median in the ratio :

(1) 1 : 2 (2) 2 : 1 (3) 2 : 3 (4) 1 : 4

63. The force of friction called into play when there is equilibrium is called :

(1) Limiting friction

(2) Dynamical friction

(3) Statical friction

(4) None of these

64. Which type of forces from the couple ?

(1) Two equal and unlike parallel forces with same lines of action.

(2) Two equal and unlike parallel forces with different lines of action.

(3) Two unequal and like parallel forces with different lines of action.

(4) Two unequal and unlike parallel forces with different lines of action.

65. The gravitational unit of moment in S.I. system is :

(1) Dyne-centimeter (2) Newton meter

(3) gm. cm (4) kg. m

66. Every non-empty subset of R which is bounded above must have l.u.b. This result is known as :

(1) Law of well ordering

(2) Law of trichotomy

(3) Completeness axiom

(4) Archimedian property of real numbers

67. The g.l.b. of a set :

(1) belongs to the set

(2) does not belong to the set

(3) may or may not belong to the set

(4) none of these

68. If $\sum_{n=1}^{\infty} a_n$ is convergent and the sequence $< b_n >$ is monotonic and bounded, then $\sum_{n=1}^{\infty} a_n b_n$ is convergent. This statement is known as :

(1) Abel's test (2) Abel's lemma

(3) Dirichlet's test (4) None of these

69. The series $\sum_{n=1}^{\infty} a_n$, where $a_n = \sqrt{n^4+1} - \sqrt{n^4-1}$ is :

(1) convergent (2) divergent

(3) oscillating (4) none of these

70. The infinite product $\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)\ldots\ldots$ is :

(1) divergent (2) convergent

(3) oscillating (4) none of these

71. If f is bounded function defined on $[a, b]$ and P be a partition of $f[a, b]$, then which of the following is odd ?

(1) $L(f, P) \leq U(f, P)$ (2) $L(-f, P) = -U(f, P)$

(3) $U(P, -f) = -L(P, f)$ (4) $U(-f, P) = -U(f, P)$

72. Which of the following is ***not*** a bounded metric ?

(1) $d(x, y) = |x - y|$ (2) $d(x, y) = \min\{2, |x - y|\}$

(3) discrete metric (4) $d^*(x,y) = \frac{d(x,y)}{1+d(x,y)}$

where d is any metric on X.

73. Which one is a dense set ?

(1) the subset $A = \left\{\frac{1}{n}, n \in N\right\}$ in R

(2) set of natural number in R

(3) Q in R

(4) none of these

74. If $f(x)=\frac{1}{x^2}$ on $[1, 4]$ and $P = [1, 2, 3, 4]$ be the partition of $[1, 4]$, then $L(f, P)$ is equal to :

(1) $\frac{70}{144}$ (2) $\frac{61}{144}$ (3) $\frac{30}{144}$ (4) none of these

75. The integral $\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$ is :

(1) convergent (2) divergent

(3) conditionally convergent (4) none of these

76. A sphere (open or closed) is always :

(1) empty (2) non-empty

(3) singleton set (4) none of these

77. What is odd against the given statement "A set is closed iff" ?

(1) $A = \overline{A}$ (2) $d(A) \subset A$

(3) A^C is open (4) $A = \mathring{A}$

78. The order of a and x in a group are respectively 3 and 4. Then the order of $x^{-1}ax$ is :

(1) 12 (2) 8 (3) 5 (4) 3

79. Every group is isomorphic to a permutation group. This result is known as :

(1) Lagrange theorem (2) Cauchy theorem

(3) Cayley's theorem (4) Gauss theorem

80. The number of conjugacy classes in a group of order 25 is :

(1) 1 (2) 5 (3) 25 (4) none of these

81. The general solution of ordinary differential equation of 'n' order contains :

(1) n-arbitrary constants

(2) more than n-arbitrary constants

(3) any number of arbitrary constant

(4) none of these

82. General solution of $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ is :

(1) $y = (2x + c)e^{-x^2}$ (2) $y = 2xe^{-x}$

(3) $y = e^{-x}$ (4) none of these

83. The necessary condition for the equation $M(x, y)dx + N(x, y)dy = 0$, to be exact is :

(1) $\frac{\partial N}{\partial y} = \frac{\partial M}{\partial x}$ (2) $\frac{\partial N}{\partial y} = -\frac{\partial M}{\partial x}$

(3) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ (4) $\frac{\partial M}{\partial y} = -\frac{\partial N}{\partial x}$

84. The equation $ydx + xdy = 0$ is :

(1) Partial differential equation

(2) Exact differential equation

(3) Non-exact differential equation

(4) None of these

85. For the differential equation $x\frac{dy}{dx}-y=0$, which of the following function is not an integrating factor ?

(1) $\frac{1}{x^2}$ (2) $\frac{1}{y^2}$

(3) $\frac{1}{xy}$ (4) $\frac{1}{x+y}$

86. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}\times\vec{b}=0$ and $\vec{a}.\vec{b}=0$, then :

(1) $\vec{a}$ is parallel to $\vec{b}$

(2) $\vec{a}$ is at right angle to $\vec{b}$

(3) either $\vec{a}$ or $\vec{b}$ is a null vector

(4) none of these

87. The unit normal vector to the surface $x^4-3xyz+z^2+1=0$ at the point (1, 1, 1) is :

(1) $\frac{i+3j+k}{\sqrt{\pi}}$ (2) $\frac{i-3j-k}{\sqrt{\pi}}$

(3) $\frac{i+3j-k}{\sqrt{\pi}}$ (4) None of these

88. A vector $\vec{f}$ is called an irrotational vector if :

(1) div curl $\vec{f}=0$ (2) $\nabla.\vec{f}=0$

(3) $\nabla\times\vec{f}=0$ (4) none of these

89. Which of the following is ***not*** true ?

(1) curl (grad ϕ) = 0 (2) div (grad ϕ) = 0

(3) div (curl $\vec{f}$) = 0 (4) curl ($\vec{r}$) = 0

90. Which of the following is related with Stoke's theorem ?

(1) A line integral and a volume integral

(2) A surface integral and a volume integral

(3) A line integral, a surface integral and a volume integral

(4) A line integral and a surface integral

91. Co-efficient of the vector (5, –1, 2) w. r. t. basis (1, 4, 2), (4, 2, 1), (2, 1, 3) are :

(1) (1, 1, 1)

(2) (–1, 1, 1)

(3) (1, 2, 3)

(4) None of these

92. Which is an orthogonal set ?

(1) {(1, 0, 1), (1, 0, –1), (0, 1, 0)}

(2) {(1, 0, 1), (1, 0, –1), (0, 3, 4)}

(3) {(1, 0, 1), (1, 0, –1), (–1, 0, 1)}

(4) None of these

93. Let $T : R^2 \to R^3$ be linear transformation defined by $T(x_1, x_2) = (x_1 - x_2, x_2 - x_1, -x_1)$. The nullty T is :

(1) 2

(2) 1

(3) 0

(4) None of these

94. Let $F : R^3 \to R^2$ be defined by $F(x, y, z) = (1x, y + z)$, then :

(1) F is linear transformation

(2) F is not a linear transformation

(3) F is invertible

(4) None of these

95. Let $V(F)$ be the vector space of all polynomial in x in which an inner product is defined by $(f,g)=\int_0^1 f(x)g(x)dx$. Then for $f(x) = x + 2$, $g(x) = x^2 - 2x - 3$, $\langle f, g\rangle$ is equal to :

(1) $\frac{5}{2}$ (2) $\frac{5}{8}$ (3) $\frac{37}{4}$ (4) $-\frac{37}{4}$

96. The linear transformation $T : R^2 \to R^2$ defined by $T(1, 0) = (2, 3)$, $T(0, 1) = (5, 6)$ is :

(1) one one and onto

(2) one one but not onto

(3) onto but not one one

(4) none of these

97. Let $T : R^3 \to R^3$ be defined by $T(x, y, z) = (x, y, 0)$ and $S : R^2 \to R^2$ be defined by $S(x, y) = (2x, 3y)$, are linear transformation on the real vector spaces R^3 and R^2 respectively. Then which of the following is ***correct*** ?

(1) T and S are both singular

(2) T and S are both non-singular

(3) T is singular but S is non-singular

(4) None of these

98. The integral $\int_0^1 x^{m-1}(1-x)^{n-1}dx$ is known as :

(1) Theta function

(2) Zeta function

(3) Gamma function

(4) Beta function

99. Fourier expansion of $f(x) = |x|$ in $[-\pi, \pi]$ is :

(1) $-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(2) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1}+\frac{\cos 3x}{3}+\frac{\cos 5x}{5}+\ldots\ldots\right)$

(3) $\frac{\pi}{2}-\frac{4}{\pi}\left(\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+\ldots\ldots\right)$

(4) None of these

100. If the function $f(z)$ is continuous at z_0, then :

(1) $f(z)$ is differentiable at z_0

(2) $f(z)$ is not necessarily differentiable at z_0

(3) $f(z)$ is analytic at z_0

(4) None of these

ANSWER KEYS OF COMMON ENTERANCE FOR M.S.C. (MATHS) & (Maths with CS) FOR SESSION 2023-24				
Q. NO.	A	B	C	D
1	1	3	4	4
2	1	1	2	1
3	3	1	3	2
4	2	4	2	2
5	4	2	4	3
6	3	3	3	4
7	2	1	3	1
8	3	3	1	2
9	2	2	1	3
10	4	4	2	4
11	4	1	4	1
12	1	1	2	2
13	2	2	3	3
14	2	3	1	4
15	3	4	1	4
16	4	3	2	3
17	1	2	3	4
18	2	1	1	1
19	3	3	2	2
20	4	4	2	2
21	4	4	1	3
22	2	3	1	1
23	3	1	3	1
24	1	2	2	4
25	1	1	4	2
26	2	2	3	3
27	3	3	2	1
28	1	1	3	3
29	2	4	2	2
30	2	4	4	4
31	4	4	1	1
32	3	1	2	1
33	1	2	3	2
34	2	2	4	3
35	1	3	4	4
36	2	4	3	3
37	3	1	4	2
38	1	2	1	1
39	4	3	2	3
40	4	4	2	4
41	4	1	4	4
42	2	2	1	3
43	3	3	3	1
44	2	4	2	2
45	4	4	1	1
46	3	3	2	2
47	3	4	4	3
48	1	1	4	1
49	1	2	3	4
50	2	2	1	4

27/06/2023.

27-6-23

27/06/2023.

Neha Phogat 27/6/2023

ANSWER KEYS OF COMMON ENTERANCE FOR M.S.C. (MATHS) & (Maths with CS) FOR SESSION 2023-24				
Q. NO.	A	B	C	D
51	1	4	4	4
52	1	1	3	2
53	2	3	1	3
54	3	2	2	1
55	4	1	1	1
56	3	2	2	2
57	2	4	3	3
58	1	4	1	1
59	3	3	4	2
60	4	1	4	2
61	4	2	3	4
62	1	1	1	2
63	3	3	1	3
64	2	2	4	2
65	1	4	2	4
66	2	1	3	3
67	4	3	1	3
68	4	4	3	1
69	3	3	2	1
70	1	2	4	2
71	3	4	2	4
72	1	2	1	1
73	1	3	3	3
74	4	2	2	2
75	2	4	4	1
76	3	3	1	2
77	1	3	3	4
78	3	1	4	4
79	2	1	3	3
80	4	2	2	1
81	2	4	4	1
82	1	2	1	1
83	3	3	2	3
84	2	1	2	2
85	4	1	3	4
86	1	2	4	3
87	3	3	1	2
88	4	1	2	3
89	3	2	3	2
90	2	2	4	4
91	1	1	1	2
92	2	1	1	1
93	3	3	2	3
94	4	2	3	2
95	4	4	4	4
96	3	3	3	1
97	4	2	2	3
98	1	3	1	4
99	2	2	3	3
100	2	4	4	2

27/06/2023

27-6-23

Jaitq 27/06/2023

Neha Phogat 27/06/2023