BLUE PRINT FOR THE YEAR 2022-23

II PUC MATHEMATICS (35)

TIME: 3 hours 15 minute   **Max. Mark: 100**

Chapter	CONTENT	Number Teaching hours	PART A		PART B	PART C	PART D	PART E		Total marks
			1 mark MCQ	1 mark FB/ VSA	2 mark VSA	3 mark SA	5 Mark LA	6 mark LA	4 mark LA	
1	RELATIONS AND FUNCTIONS	11	1	1	1	1	1			12
2	INVERSE TRIGONOMETRIC FUNCTIONS	8	1		2	1				8
3	MATRICES	8	1			1	1			9
4	DETERMINANTS	13	1	1	1		1		1	13
5	CONTINUITY AND DIFFERENTIABILITY	19	1	1	2	2	1		1	21
6	APPLICATION OF DAERIVATIVES	11		1	1	1	1			11
7	INTEGRALS	21	1	1	2	2	1	1		23
8	APPLICATION OF INTEGRALS	8				1	1			8
9	DIFFERENTIAL EQUATIONS	9		1	1	1	1			11
10	VECTOR ALGEBRA	11	1	1	2	2				12
11	THREE DIMENSIONAL GEOMETRY	12	1	1	1	1	1			12
12	LINEAR PROGRAMMING	7	1	1				1		8
13	PROBABILITY	12	1	1	1	1	1			12
	TOTAL	**150**	**10**	**10**	**14**	**14**	**10**	**2**	**2**	**160**

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Instructions :

1) *The question paper has five parts namely A, B, C, D and E. Answer all the parts.*

2) *Part A has 10 Multiple choice questions, 5 Fill in the blanks and 5 Very Short Answer questions of 1 mark each.*

3) *Part A should be answered continuously at one or two pages of Answer sheet and Only first answer is considered for the marks in subsection I and II of Part A.*

4) *Use the graph sheet for question on linear programming in PART E.*

PART A

I.   Answer ALL the Multiple Choice Questions   **10 ×1 = 10**

1.   The identity element for the binary operation $*$ if $a * b = \frac{ab}{4}$,$\forall$ a, b $\in$Q

   (A) 0   (B) 4   (C) 1   (D) not exist.

2.   If $\cot^{-1} x = y$, then

   (A) $0 \le y \le \pi$ (B) $0 < y < \pi$ (C) $-\frac{\pi}{2} \le y \le \frac{\pi}{2}$ (D) $-\frac{\pi}{2} < y < \frac{\pi}{2}$

3.   For 2×2 matrix $A = \left[a_{ij} \right]$ whose elements are given by $a_{ij} = \frac{i}{j}$ then A is equal to

   A) $\begin{bmatrix} 2 & 3 \\ \frac{1}{2} & \frac{9}{2} \end{bmatrix}$ B) $\begin{bmatrix} \frac{1}{2} & 1 \\ 2 & \frac{1}{2} \end{bmatrix}$ C) $\begin{bmatrix} 1 & \frac{1}{2} \\ 2 & 1 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

4.   If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ then the value of x is equal to

   (A) 2   (B) 4   (C) 8   (D)$\pm 2\sqrt{2}$.

5.   Left hand derivative of $f(x) = |x|$ at x = 0 is.

   (A) 1   (B) -1   (C) 0   (D)does not exist.

6. $\int e^x \left(\frac{1}{x} - \frac{1}{x^2} \right) dx=$

   (A) $e^x + c$ (B) $\frac{e^x}{x} + c$ (C) $\frac{e^x}{x^2} + c$ (D)$\frac{-e^x}{x} + c$

7. The *projection* of the vector $\overrightarrow{AB}$ on the directed line l, if angle $\theta = \pi$ will be.

   (A) *Zero* vector.   (B) $\overrightarrow{AB}$ (C) $\overrightarrow{BA}$ (D) *Unit* vector.

8. The equation of xy- plane is

   (A) $x = 0$ (B) $y = 0$ (C) $x = 0$ and $y = 0$ (D) $z = 0$

9. The corner points of the feasible region determined by the following system of linear inequalities: $2x + y \leq 10$, $x + 3y \leq 15$, $x, y \geq 0$ are (0, 0), (5, 0), (3, 4) and (0, 5). Let $Z = ax + by$, where $a, b > 0$. Condition on a and b so that the maximum of Z occurs at both (3, 4) and (0, 5) is

   (A) $a = b$ (B) $a = 2b$ (C) $a = 3b$ (D) $b = 3a$

10. If $P(A) = \frac{1}{2}$, P (B) = 0, then P (A|B) is

   (A) 0   (B) $\frac{1}{2}$ (C) not defined   (D) 1

II.   **Fill in the blanks by choosing the appropriate answer from those given in the bracket.**
     ($\frac{5}{2}, \frac{1}{36}, \frac{1}{3}$, 0, 2)   **5×1 = 5**

11. For a square matrix A in matrix equation AX = B. If |A| = 0 and $(adj\ A)\ B \neq 0$, then there exists …… solution.

12. The order of the differential equation. $2x^2 \left(\frac{d^2y}{dx^2}\right) - 3\left(\frac{dy}{dx}\right) + y$ is … …..

13. Sum of the intercepts cut off by the plane $2x + y - z = 5$ is ………

14. The slope of the normal to the curve $y = 2x^2 - 3 \sin x$ at $x = 0$ is ……

15. The probability of obtaining an even prime number on each die, when a pair of dice is rolled is…..

III.   **Answer all the following questions**   **5×1 = 5**

16. Define a bijective function.

17. Find the derivative of the function $\sec(\tan \sqrt{x})$ with respect to x.

18. Define feasible solutions in a linear programming problem.

19. Find $\int \frac{1 - sinx}{cos^2 x}\ dx$.

20. Define Negative of a Vector.

PART B

Answer any NINE questions: **9× 2 = 18**

21. Find gof and fog, if $f : R \rightarrow R$ and $g : R \rightarrow R$ are given by $g(x) = x^{\frac{1}{3}}$ and $f(x) = 8x^3$.

22. Prove that $\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}$, $x \in R$.

23. If $\sin\left\{\sin^{-1}\frac{1}{5} + \cos^{-1} x\right\} = 1$, find x.

24. Find the area of the triangle whose vertices are $(2,7), (1,1)$ and $(10,8)$ using determinants.

25. Find $\dfrac{dy}{dx}$, if $2x + 3y = \sin x$.

26. If $y = x^{\sin x}$, $x > 0$, find $\dfrac{dy}{dx}$.

27. Find the local maximum value of the function $g(x) = x^3 - 3x$.

28. Evaluate $\int \sin 3x \cos 4x\, dx$.

29. Evaluate $\displaystyle\int_{0}^{\pi/2} \cos 2x\, dx$.

30. Form the differential equation representing the family of curves $y = mx$, where, m is arbitrary constant.

31. Find the area of a triangle having the points A(1, 1, 1), B(1, 2, 3) and C(2, 3, 1) as its vertices.

32. Find a vector in the direction of the $\vec{a} = \hat{i} - 2\hat{j}$ that has magnitude 7 units.

33. Find the angle between the line $\dfrac{x+1}{2} = \dfrac{y}{3} = \dfrac{z-3}{6}$ and the plane $10x + 2y - 11z = 3$.

34. Find the probability distribution of number of heads in two tosses of a coin.

PART C

Answer any NINE questions: $9 \times 3 = 27$

35. Show that the relation R in R defined as $R = \{(a,b) : a \le b\}$, is reflexive and transitive but not symmetric.

36. Solve: $\tan^{-1}\left(\dfrac{x-1}{x-2}\right) + \tan^{-1}\left(\dfrac{x+1}{x+2}\right) = \dfrac{\pi}{4}$.

37. Express $\begin{bmatrix} 3 & 5 \\ 1 & -1 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrices.

38. If $y = \cos^{-1}\left(\dfrac{1-x^2}{1+x^2}\right)$, $0 < x < 1$ then find $\dfrac{dy}{dx}$.

39. Verify Rolle's theorem for the function $f(x) = x^2 + 2x - 8$, $x \in [-4, 2]$.

40. Find the intervals in which the function f given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is
    (i) strictly increasing; (ii) strictly decreasing.

41. Find $\int x \cos x\, dx$.

42. Find $\int \dfrac{x}{(x+1)\,(x+2)}\,dx$.

43. Find the area of the region bounded by the curve $y^2 = x$ and the lines $x = 1$, $x = 4$ and the x-axis in the first quadrant.

44. Find the equation of the curve passing through the point $(-2, 3)$, given that the slope of the tangent to the curve at any point (x, y) is $\dfrac{2x}{y^2}$.

45. For any three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ prove that $\left[\vec{a}+\vec{b} \quad \vec{b}+\vec{c} \quad \vec{c}+\vec{d}\right] = 2\left[\vec{a} \quad \vec{b} \quad \vec{c}\right]$.

46. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ find the value of $\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$.

47. Find the vector equation of the plane passing through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 3 = 0$ and the point $(2, 2, 1)$.

48. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

PART D

Answer any FIVE questions: $5 \times 5 = 25$

49. Let $f : N \to R$ be a function defined as $f(x) = 4x^2 + 12x + 15$. Show that $f : N \to S$, where S is the range of function f, is invertible. Find the inverse of f.

50. If $A = \begin{bmatrix} 0 & 6 & 7 \\ -6 & 0 & 8 \\ 7 & -8 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ -2 \\ 3 \end{bmatrix}$, calculate AB, AC and A(B + C). Verify that $A(B+C) = AB + AC$.

51. Solve the following system of equations by matrix method:
    $x - y + z = 4$; $x + y + z = 2$ and $2x + y - 3z = 0$.

52. If $y = 3\cos(\log x) + 4\sin(\log x)$ show that $x^2 y_2 + xy_1 + y = 0$.

53. A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall at the rate of 2 cm/sec. How fast is its height on the wall decreasing when the foot of the ladder is 4m away from the wall?

54. Find the integral of $\dfrac{1}{\sqrt{a^2 - x^2}}$ with respect to x and evaluate $\int \dfrac{dx}{\sqrt{7 - 6x - x^2}}$.

55. Find the smaller area enclosed by the circle $x^2 + y^2 = 4$ and the line $x + y = 2$.

56. Find the particular solution of the differential equation $\dfrac{dy}{dx} + y\cot x = 4x \cdot \operatorname{cosec} x$, $x \neq 0$,

given that $y = 0$ when $x = \dfrac{\pi}{2}$.

57. Derive the equation of the line in space passing through two given points both in vector and Cartesian form.

58. If a fair coin is tossed 10 times, find the probability of

(i) exactly six heads (ii) at least six heads.

PART E

Answer the following questions:

59. Maximize; $z = 4x + y$ subject to constraints $x + y \leq 50$, $3x + y \leq 90$, $x \geq 0$, $y \geq 0$ by graphical method.

OR

Prove that $\displaystyle\int_{a}^{b} f(x)\,dx = \int_{a}^{b} f(a+b-x)\,dx$ and hence evaluate $\displaystyle\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \dfrac{1}{1+\sqrt{\tan x}}\,dx$.   **6**

60. Find the value of k so that the function $f(x) = \begin{cases} kx+1, & if\ \ x \leq 5 \\ 3x-5, & if\ \ x > 5 \end{cases}$, at $x = 5$ is a

continuous function.

OR

Prove that $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.   **4**