4 3226

MAY 2025

204(N)

MATHEMATICS-II

Time Allowed: 2.5 Hours *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.

Answer any five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): 2×10=20

i. If A be a square matrix of order 3 and detA is the determinant of A, then det(3A) equals to –
(a) detA (b) 3 detA (c) 9 detA (d) 27 detA.

ii. Let A be any square matrix, then $A + A^T$ is always, (a) symmetric (b) skew-symmetric (c) diagonal (d) Null matrix.

iii. The value of the determinant $\begin{vmatrix} 100 & 101 & 102 \\ 105 & 106 & 107 \\ 110 & 111 & 112 \end{vmatrix}$ is (a) 0 (b) 1 (c) 2 (d) None of these.

iv. The distance between the lines $3x + 4y = 9$ and $6x + 8y = 15$ is (a) $\frac{3}{2}$ (b) $\frac{3}{10}$ (c) 6 (d) None of these.

v. The length of latus rectum of the parabola $y^2 + 48x = 0$ is (a) 12 (b) 24 (c) 48 (d) None of these.

vi. Coordinates of centre of the circle $2x^2 + 2y^2 - 8x - 5 = 0$ is (a) (0,2) (b) (4,0) (c) (2,0) (d) (−4,0).

vii. If $u(x, y) = \frac{x'}{y}$, then the value of $x\frac{\partial u}{\partial x} + y\frac{\delta u}{\delta y}$ (a) $\frac{x_2}{y^2}$ (b) $\frac{x_2}{y}$ (c) 0 (d) None of these

viii. The order and degree of the differential equation $\{1 + (\frac{dy}{dx})^2\}^{\frac{2}{3}} = \frac{d^3y}{dx^3}$ are (a) 3 and 2 (b) 3 and 3 (c) 2 and 3 (d) 3 and 1.

ix. The integrating factor of the differential equation $\frac{dy}{dx} = \frac{y}{x} + x^2$ is – (a) x (b) $\frac{1}{x}$ (c) $\log_e x$ (d) None of these.

x. The median of the following data : 2.5, 2.0, 2.6. 2.2, 2.9 and 2.1 is (a) 2.2 (b) 2.383 (c) 2.35 (d) None of these.

xi. Three coins are tossed at random. The probability of getting at least one tail is (a) $\frac{3}{8}$ (b) $\frac{7}{8}$ (c) $\frac{2}{9}$ (d) None of these.

xii. Let A and B be two event and P(A) =0.3, P(B)= 0.2 and P(A ∩ B) = 0.1, then value of P(A ∪ B) is (a) 0.25 (b) 0.1 (c) 0.6 (d) 0.4

xiii. The value of $\int_{-a}^{a} x^3\,dx$ is – (a) a^3 (b) $2a^3$ (c) 0 (d) None of these.

xiv. The value of the integral is $\int_0^1 \frac{dx}{1+x^2}$ (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) 0 (d) None of these

xv. Area bounded by the straight line $y = 2x$ above x-axis from x = 1 to x = 4 is (a) 16 sq. unit (b) 15 sq. unit (c) 7.5 sq. unit (d) None of these.

GROUP-B

Answer any five (05) questions.

2. (i) Show that $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ bc & ca & ab \end{vmatrix} = (a-b)(b-c)(c-a)$

(ii) Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 5 & 6 & 7 \end{bmatrix}$. 4+4

3. (i)Solve by Cramer's rule, $x + 4y + 3z = 2$, $2x - 6y + 6z = -3$, $5x - 2y + 3z = -5$.

(ii)Show that the matrix $A = \frac{1}{3}\begin{bmatrix} -1 & 2 & -2 \\ -2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ is orthogonal, *i.e.* $AA^T = A^TA = I_3$, hence find A^{-1}.

4+4

4. (i) Find the equation of the straight line which passes through the point of intersection of the straight lines $2x + 3y = 5$ and $3x + 5y = 7$ and makes equal intercepts upon coordinate axes.

(ii) Find the equation of the circles which touches both the axes and passes through (6,3). 4+4

5. (i) Evaluate $\int \frac{e^x(1+x)}{\cos^2(xe^x)}dx$.

(ii) Evaluate: $\int \frac{x-1}{(x-3)(x+2)}dx$ 4+4

6. (i) Find the area bounded by the parabola $y^2 = 4ax$ and its latus rectum.

(ii) Show that $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\tan x}} = \frac{\pi}{12}$. 4+4

7. (i) Solve the differential equation: $(D^2 - 4D + 4)y = e^{-2x}$, where $D \equiv \frac{d}{dx}$.

(ii) Solve $x\,dy - y\,dx = (x^2 + y^2)\,dx$ 4+4

8. (i) If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$, then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$.

(ii) Evaluate $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ where $z = x^2y + xy^2$. 4+4

9.(i) Calculate mean and standard deviation from the following data:

Size of the item	6	7	8	9	10	11	12
Frequency	3	5	9	13	8	5	4

(ii) Find the probability of getting five Sundays in a month of January. 4+4

10. (i) Find the median from the following data:

Class	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
Frequency	7	15	24	31	42	30	26	15	10

(ii) An urn contains 4 black, 5 white, and 6 red balls. A ball is drawn at random. Find the probability that it is
(a) black (b) black or red. 4+2+2