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 marks is allotted for right answer and 1 marks is allotted for correct explanation of the answer. However, no marks will be given for wrong explanation of the answer of each MCQ type question.

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) $2 \times 10 = 20$

i) The cofactor of the element '3' of the Determinant, $\begin{vmatrix} 1 & -1 & 3 \\ 0 & 2 & 6 \\ 1 & 5 & 2 \end{vmatrix}$ is (a) 2 (b) -2 (c) 0 (d) 1

ii) If $2\begin{bmatrix} x & 2 \\ 7 & y+5 \end{bmatrix} + \begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 15 & 14 \end{bmatrix}$, then find the value of (x, y) is – (a) (0, 0) (b) (1, 0) (c) (1, 1) (d) (0, 1).

iii) The value of the Determinant, $\begin{vmatrix} 1 & -1 & 3 \\ 1 & -1 & 3 \\ 1 & 5 & 2 \end{vmatrix}$ is – (a) 3 (b) 0 (c) 6 (d) None of these.

iv) If $A = \begin{bmatrix} 2 & m-3 \\ 3 & 6 \end{bmatrix}$ is singular, then the value of m is (a) 3 (b) -3 (c) 7 (d) -7.

v) The value of p for which the points (1, 2), (3, 6), (p, 4) are collinear is (a) 2 (b) 3 (c) 1 (d) -1

vi) The Cartesian co-ordinates of a point are $(-\sqrt{3}, 1)$, its polar co-ordinates are (a) $(2, \frac{\pi}{6})$ (b) $(2, -\frac{\pi}{6})$ (c) $(2, \frac{5\pi}{6})$ (d) $(2, -\frac{5\pi}{6})$.

vii) The value of $\int_0^{\frac{\pi}{2}} \text{Sin}x \, dx$ is (a) 1 (b) 0 (c) -1 (d) None of these.

viii) 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.

ix) $\int \frac{\text{Sin}x \, dx}{\text{Cos}x}$ is equal to (a) $\log \text{Sin}x + c$ (b) $\log x + c$ (c) $\text{Sin}x + c$ (d) None of these.

x) The order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^2 + \left(\frac{dy}{dx}\right)^5 + y = 3\text{Sin}x$ are – (a) 3 and 2 (b) and 5 (c) 2 and 3 (d) None of these.

xi) Complementary Function of the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x$ is – (a) $(c_1.c_2)e^x$ (b) $(c_1+c_2x)e^x$ (c) $(c_1+c_2)e^{-x}$ (d) $(c_1+c_2x)e^{-x}$.

xii) If $f(x,y) = \frac{x}{y}$, then find the value of $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y}$ is equal to (a) f (b) $-f$ (c) 1 (d) 0

xiii) An urn contains 12 white balls and 6 black balls. A ball is drawn at random. What is the probability of being it to be a white? (a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{4}{9}$ (d) 1.

xiv) If Var(X) = 3 and Y = 2X + 3 then Var(Y) is equal to (a) 6 (b) 12 (c) 15 (d) 9

xv) Let 'A' be any event then P(A) is always (a) $0 \le P(A) \le 1$ (b) $1 \le P(A) \le 0$ (c) $-1 \le P(A) \le 1$ (d) $1 \le P(A) \le 2$.

2. a) Evaluate by Chio's method
$$\begin{vmatrix} 0 & -1 & 2 & 3 \\ 1 & 2 & -1 & 1 \\ 1 & 1 & 2 & 3 \\ 3 & 2 & 1 & 0 \end{vmatrix}$$

b) 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. $AA^T = A^T A = I_3$.

$$4 + 4$$

3. a) Solve the following system of linear equations by Cramer's Rule.

$2x + y + z = -2$

$x + 2y + z = 1$

$x - 2y - 3z = 1$

b) Show that the matrix $A = \begin{bmatrix} 2 & 0 & 2 \\ 4 & 6 & 0 \\ 0 & 2 & 4 \end{bmatrix}$ satisfies the equation $A = \frac{1}{2}(A + A^T) + \frac{1}{2}(A - A^T)$.

$$4 + 4$$

4. a) Find the St. Line passes through the point $(1, 0)$ and parallel to the St. Line $2x + 3y = 6$

b) Prove the triangle formed by the lines $x + y = 0$, $3x + y = 4$ and $x + 3y = 4$ is an isosceles triangle.

$$4 + 4$$

5. a) Evaluate: $\int \frac{(x-1)}{(x-3)(x+2)} dx$.

b) Show that $\int_0^{\frac{\pi}{2}} \frac{\sin x \, dx}{\sin x + \cos x} = \frac{\pi}{4}$.

c) Evaluate: $\int_0^1 e^{2x} dx$.

$$3 + 3 + 2$$

6. a) Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\cos x \cdot dx}{(1 + \sin x)(2 + \sin x)}$.

b) Find the area bounded by the circle $x^2 + y^2 = 4$ and the st. line $x = y$ in the first quadrant and x-axis.

$$4 + 4$$

7. a) If $u = Cos^{-1}\left(\frac{x+y}{\sqrt{x} + \sqrt{y}}\right)$, then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + \frac{1}{2}Cot u = 0$.

b) If $u = log(x^3 + y^3 + z^3 - 3xyz)$ then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = \frac{3}{x+y+z}$.

$$3 + 3 + 2$$

8. a) Solve the differential equation: $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = 0$.

b) Solve the differential equation $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = e^{5x}$.

$$4 + 4$$

9. a) There are two identical urns containing 4 white and 3 red balls; 3 white and 7 red balls. An urn is chosen at random and a ball is drawn from it. Find the probability that the ball is white. What is the probability that it is from the first urn if the ball drawn is white?

b) Two dice are rolled. What is the probability that the sum total of the points on the dice is 6?

c) If $P(A) = u$, $P(B^C) = 0.7$, $P(A \cup B) = 0.8$ and $P(A \cap B) = 1 - u$, then find the value of u.

$$3 + 3 + 2$$

10. a) The table below given the weights of 50 school students nearest to kilogram. Calculate mean and standard deviation from the following data:

Wt. in kg (x)	40-42	43-45	46-48	49-51	52-54	55-57	58-60
No. of boys (f)	3	6	9	13	8	7	4

b) P can hit a target 4 times in a 5 shots, Q 3 times in 4 shots and R twice in 3 shots. They fire a volley. What is the probability that two shots at least hit the target?

$$4 + 4$$