CODE : A-M616122-M	**I Semester Exam 2025-26**	4 x 660
Std. : XII	Sub. : MATHEMATICS AND STATISTICS	Marks : 80
Date :	Roll No. _____	Time : 3 hrs.

General Instructions :

*The question paper is divided into **FOUR** sections.*

1) ***Section A** - Q. No 1 contains **Eight** multiple choice type of questions, each carrying Two marks.*
   *Q. No. 2 contains **Four** very short answer type questions, each carrying One mark.*
2) ***Section B** - Q. No. 3 to Q. No. 14 contain **Twelve** short answer type questions each, carrying Two marks. (Attempt any **Eight**).*
3) ***Section C** - Q. No. 15 to Q. No. 26 contain **Twelve** short answer type questions, each carrying Three marks.(Attempt any **Eight**)*
4) ***Section D** - Q. No. 27 to Q. No. 34 contain **Eight** long answer type questions, each carrying Four marks. (Attempt any **Five**)*
5) *Use of log table is allowed. Use of calculator is not allowed.*
6) *Figures to the right indicate full marks.*
7) *Use of graph paper is **not** necessary. Only rough sketch of graph is expected.*
8) *For each multiple choice type of question, it is mandatory to write the correct answer along with its alphabet. e.g. (a) ..... / (b) ..... / (c) ..... / (d)..... No mark (s) shall be given if ONLY the correct answer or the alphabet of the correct answer is written. Only the first attempt will be considered for evaluation.*

SECTION - A

Q. 1 **Select and write the correct answer for the following multiple choice type of questions.** **16**

i) The dual statement of $p \wedge \sim q$ is equivalent to _____

a) $\sim p \wedge q$ b) $p \leftrightarrow q$ c) $\sim p \vee q$ d) $\sim p \rightarrow \sim q$

ii) The inverse of $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is _____

a) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

iii) $\cos\left[\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{2}\right] =$ _____

a) $\frac{1}{\sqrt{2}}$ b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{2}$ d) $\frac{\pi}{4}$

iv) If the equation $4x^2 + hxy + y^2 = 0$ represents two coincident line then $h =$ _____

a) ± 2 b) ± 3 c) ± 4 d) ± 5

v) If $y = \sec(\tan^{-1} x)$ then $\frac{dy}{dx}$ at $x = 1$ is _____

a) $\frac{1}{2}$ b) 1 c) $\frac{1}{\sqrt{2}}$ d) $\sqrt{2}$

vi) The equation of the tangent to the curve $y = 1 - e^{x/2}$ at the point of intersection with y-axis is _____

a) $x + 2y = 0$ b) $2x + y = 0$ c) $x - y = 2$ d) $x + y = 2$

vii) If a p.m.f of a discrete r.v. X is $P(X = x) = \frac{{}^5C_x}{32}$ for $x = 0, 1, 2, 3, 4, 5$ and $= 0$, other wise. If $a = P(X \leq 2)$ and $b = P(X \geq 3)$ then _____

a) $a < b$ b) $a > b$ c) $a = b$ d) $a + b$

viii) For a Binomial distribution, $n = 5$. if $P(X = 4) = P(X = 3)$ then $p =$ _____

a) $\frac{1}{3}$ b) $\frac{3}{4}$ c) 1 d) $\frac{2}{3}$

Q. 2 **Answer the following questions.** 4

1) Write the following Compound Statements Symbolically.
Triangle is equilateral or isosceles.

2) What is the general solution for $\sin\theta = 0$?

3) Differentiate $y = \sin(\log x)$ w.r.t. x.

4) Show that the function.
$f(x) = x^3 + 10x + 7$ for $x \in R$ is strictly increasing.

SECTION - B

ATTEMPT ANY EIGHT OF THE FOLLOWING QUESTIONS. 16

Q. 3 Write the converse and contrapositive of the following statement.
A family becomes literate if the woman in it is literate.

Q. 4 Find the matrix of cofactors for the matrix. $\begin{bmatrix} 1 & 3 \\ 4 & -1 \end{bmatrix}$

Q. 5 Find the general solution of $\sin x = \tan x$.

Q. 6 In ΔABC, prove that $ac\cos B - bc\cos A = a^2 - b^2$.

Q. 7 Find 'k' if the sum of slopes of lines represented by equation $x^2 + kxy - 3y^2 = 0$ is twice their product.

Q. 8 Solve the following inequations graphically and write the corner points of the feasible region.
$2x + 3y \leq 6$, $x + y \geq 2$, $x \geq 0$, $y \geq 0$

Q. 9 Let $f(x) = x^5 + 2x - 3$ find $(f^{-1})'(-3)$.

Q. 10 If $y = \sin^{-1}(3x) + \sec^{-1}\left(\frac{1}{3x}\right)$, find $\frac{dy}{dx}$.

Q. 11 Find the approximate value of $\sqrt{8.95}$.

Q. 12 *The displacement 'S' of a moving particle at time 't' is given ny $S = 5 + 20t - 2t^2$. Find its acceleration when the velocity is zero.*

Q. 13 *Obtain the probability distribution of the number of sixes in two tosses of a fair die.*

Q. 14 *The probability that a bomb will hit a target is 0.8. Find the probability that out of 10 bombs dropped, exactly 4 will hit the target.*

SECTION - C

ATTEMPT ANY EIGHT OF THE FOLLOWING. **24**

Q. 15 *Examine whether the statements pattern $(p \rightarrow q) \leftrightarrow (\sim p \vee q)$ is a tautology contradiction or contingency.*

Q. 16 *Express the following equation in matrix from and solve them by method of reduction.* $x + y + z = 6$, $3x - y + 3z = 6$ *and* $5x + 5y - 4z = 3$

Q. 17 *In ΔABC, prove that* $\sin\left(\frac{B-C}{2}\right) = \left(\frac{b-c}{a}\right)\cos\left(\frac{A}{2}\right)$

Q. 18 *In any ΔABC, with the usual notation prove that* $a^2 = b^2 + c^2 - 2bc\cos A$.

Q. 19 *Prove that the homogeneous equation of degree two in x and y. (i.e $ax^2 + 2hxy + by^2 = 0$) represents a pair of straight lines passing through origin if $h^2 - ab \geq 0$.*

Q. 20 *Find p and q, if the equation $px^2 - 8xy + 3y^2 + 14x + 2y + q = 0$ represents a pair of perpendicular lines.*

Q. 21 *If $y = f(x)$ is a differentiable function of x, such that inverse function of $x = f^{-1}(y)$ exist, then prove that x is a differentiable function of y and*

$$\left(\frac{dx}{dy}\right) = \frac{1}{\left(\frac{dy}{dx}\right)} \quad \text{where} \quad \frac{dy}{dx} \neq 0.$$

Q. 22 *If* $\log_{10}\left(\frac{x^3 - y^3}{x^3 + y^3}\right) = 2$, *show that* $\frac{dy}{dx} = \frac{-99x^2}{101y^2}$.

Q. 23 *The surface area of a spherical balloon is increasing at the rate of 2 cm^2/sec. At what rate, the volume of the balloon in increasing when the radius of the balloon is 6 cm ?*

Q. 24 *A wire of length 36 meters is bent in the form of rectangle. Find its dimensions if the area of the rectangle is maximum.*

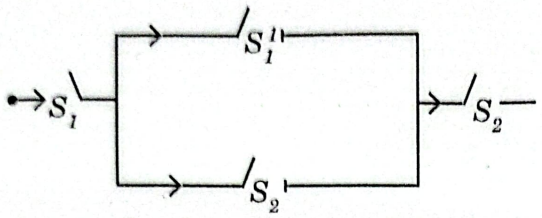
Q. 25 *Find k, if* $f(x) = kx^2(1 - x)$ *for* $0 < x < 1$
$= 0$ *otherwise*
is a p.d.f. of a r.v.X.

Q. 26 *If a fair coin is to tossed 10 times. Find the probability of getting atmost six heads.*

SECTION - D

ATTEMPT ANY FIVE OF THE FOLLOWING QUESTIONS. **20**

Q. 27 *Simplify the given circuit by writing its logical expression. Also write your conclusion.*



Q. 28 *Solve the following system of equations by the method of inversion.*
$x - y + z = 4$, $2x + y - 3z = 0$, $x + y + z = 2$

Q. 29 *If* $\tan^{-1}\left(\frac{x-1}{x+2}\right) + \cot^{-1}\left(\frac{x+2}{x+1}\right) = \frac{\pi}{4}$ *find x.*

Q. 30 *Solve the linear programming problem by graphical method.*

Maximize $z = 3x + 5y$

Subject to $x + 4y \leq 24$

$3x + y \leq 21$

$x + y \leq 9$

$x \geq 0$, $y \geq 0$

Q. 31 *If* $x = f(t)$ *and* $y = g(t)$ *are differentiable function of t, then prove that y is a differentiable function of x and*

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$$ *where* $\frac{dx}{dt} \neq 0$. *Hence find* $\frac{dy}{dx}$ *if* $x = a\cos^2 t$ *and* $y = a\sin^2 t$.

Q. 32 *Verify Rolle's theorem for the following function* $f(x) = x^2 - 4x + 10$ *on* $[0, 4]$.

Q. 33 *Find E(X) , V(X) and S.D(X) of random variable X whose probability mass function is given below.*

$X = x$	1	2	3
$P(X = x)$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{2}{5}$

Q. 34 *If a fair die is thrown 6 times. If 'getting an odd number' is a success, find the probability of*

i) at least 5 success

ii) atmost 2 success.