

General Instructions :-

- Question paper consists of **34** questions divided into **FOUR** sections, namely **A, B, C** and **D**.
 - Section-A:** Q.No. 1 contains **8 multiple choice** type questions carrying **two marks** each.
Q.No.2 contains **4 very short answers** type questions carrying **one mark** each.
 - Section-B:** Q.No. 3 to Q.No. 14 are **12 short answer** type questions carrying **two marks** each out of which **any eight** are to be attempted.
 - Section-C:** Q.No.15 to Q.No.26 are **12 short answer** type questions carrying **three marks** each out of which **any eight** are to be attempted.
 - Section-D:** Q.No.27 to Q.No.34 are **8 long answer** type questions carrying **four marks** each out of which **any five** are to be attempted.
- Figures to the right indicate full marks.
- Start each section on new page.
- For each MCQ, the correct answer must be written along with its alphabet.
e.g. (a)/ (b)/ (c)/ (d), etc.
- Evaluation of each MCQ would be done for the first attempt only.
- Use of graph paper is not necessary. Only rough sketch of graph is expected.
- Use log table if necessary. Use of calculator is not allowed.

SECTION - A

Q.1 Select and write the most appropriate answer from the given alternatives for each questions : **16**

- $\sim [p \rightarrow (p \wedge \sim q)] = \dots\dots\dots$
 a) p b) q c) $p \wedge q$ d) $p \vee q$
- If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$, then $A^4 = \dots\dots\dots$
 a) $6 \cdot A$ b) $12 \cdot A$ c) $8 \cdot A$ d) $16 \cdot A$
- If $\sin^{-1}(1-x) - 2 \cdot \sin^{-1}x = \frac{\pi}{2}$ then x is
 a) $-\frac{1}{2}$ b) 1 c) 0 d) $\frac{1}{2}$
- If $2x + y = 0$ is one of the line represented by the equation $3x^2 + kxy + 2y^2 = 0$ then the value of k is
 a) $\frac{1}{5}$ b) $\frac{11}{2}$ c) $\frac{5}{2}$ d) $-\frac{11}{2}$
- If $\sec\left(\frac{x+y}{x-y}\right) = a^2$, then $\frac{d^2y}{dx^2} = \dots\dots\dots$
 a) y b) x c) $\frac{y}{x}$ d) 0
- The equation of tangent to the curve $y = x^2 + 4x + 1$ at $(-1, -2)$ is
 a) $2x - y = 0$ b) $2x + y - 5 = 0$
 c) $2x - y - 1 = 0$ d) $x + y - 1 = 0$

- 7) Let the p.m.f of a random variable X be

$$P(x) = \frac{3-x}{10}, \text{ for } x = -1, 0, 1, 2$$

$$= 0, \text{ Otherwise}$$

then $E(x)$ is

- a) 1 b) 2 c) 0 d) -1
- 8) If $X \sim B(n, p)$ and $E(X) = 12$, $\text{Var}(X) = 4$ then the value of n is
- a) 3 b) 48 c) 18 d) 36

Q.2 Answer the following questions :

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- i) Write the dual of $p \vee \sim p = T$.
- ii) Write the separate equations of lines represented by the equation $5x^2 - 9y^2 = 0$.
- iii) If $y = \sin^{-1}(\sin x^5)$ then find $\frac{dy}{dx}$
- iv) The displacement 's' of a moving particle at time 't' is given by $S = 5 + 20t - 2t^2$. Find the velocity.

SECTION - B

Attempt any **EIGHT** of the following questions :

16

- Q.3** Using truth table prove that $\sim p \wedge q = (p \vee q) \wedge \sim p$.

- Q.4** If p, q, r are the statements with truth values T, F, T respectively then find the truth value of $(r \wedge q) \leftrightarrow \sim p$.

- Q.5** Find the principal value of $\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$

- Q.6** In $\triangle ABC$, prove that $a \cos B - b \cos A = a^2 - b^2$.

- Q.7** Solve graphically
 $2x + y \geq 2$ and $x - y \leq 1$.

- Q.8** In a cattle breeding firm, it is prescribed that the food ration for one animal must contain 14, 22 and 1 units of nutrients A, B and C respectively. Two different kinds of fodder are available. Each unit of these two contains the following amounts of these three nutrients.

Fodder	Fodder 1	Fodder 2
Nutrients		
Nutrients A	2	1
Nutrients B	2	3
Nutrients C	1	1

The cost of fodder 1 is Rs.3 per unit and that of fodder 2 is Rs. 2 per unit. Formulate the L.P.P to minimize the cost.

- Q.9** If $y = e^{ax}$, show that $x \cdot \frac{dy}{dx} = y \cdot \log y$

- Q.10** Find $\frac{dy}{dx}$, if $x \cdot \sin y + y \cdot \sin x = 0$

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

- Q.12** Test whether the function, $f(x) = x - \frac{1}{x}$ $x \in R, x \neq 0$ is increasing or decreasing.

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

- Q.14 Given $X \sim B(n = 10, p = \frac{1}{2})$ Find the value of $\text{Var}(X)$.

SECTION - C

Attempt **any EIGHT** of the following questions :

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- Q.15 Without using truth table show that $\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$.
- Q.16 In $\triangle ABC$, prove that $\tan\left(\frac{B-C}{2}\right) = \left(\frac{b-c}{b+c}\right) \cdot \cot \frac{A}{2}$
- Q.17 Find the general solution of $\cot x + \tan x = 2 \cdot \text{cosec } x$
- Q.18 If Q is the measure of the acute angle between the lines represented by the equation $ax^2 + 2hxy + by^2 = 0$ then prove that $\tan \theta = \left| \frac{2\sqrt{h^2 - ab}}{a+b} \right|$ where $a + b \neq 0$.
- Q.19 Find p and q if the equation $px^2 - 8xy + 3y^2 + 14x + 2y + q = 0$ represents a pair of perpendicular lines.
- Q.20 Solve the following L.P.P by using graphical method.
Maximize $z = 11x + 8y$
subject to $x \leq 4, y \leq 6,$
 $x + y \leq 6, x \geq 0, y \geq 0$.
- Q.21 Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left[\frac{5x+1}{3-x-6x^2}\right]$
- Q.22 If $y = (\tan^{-1}x)^2$ show that $(1+x^2)^2 \frac{d^2y}{dx^2} + 2x \cdot (1+x^2) \frac{dy}{dx} - 2 = 0$
- Q.23 Verify Rolle's theorem for the following function $f(x) = x^2 - 4x + 10$ on $[0, 4]$.
- Q.24 The surface area of a spherical balloon is increasing at the rate of $2 \text{ cm}^2/\text{sec}$. At what rate the volume of the balloon is increasing when the radius of the balloon is 6 cm ?
- Q.25 The probability distribution of X , the number defects per 10 meters of a fabric is given by
- | | | | | | |
|------------|------|------|------|------|------|
| $X = x$ | 0 | 1 | 2 | 3 | 4 |
| $P(X = x)$ | 0.45 | 0.35 | 0.15 | 0.03 | 0.02 |

Find the variance of X .

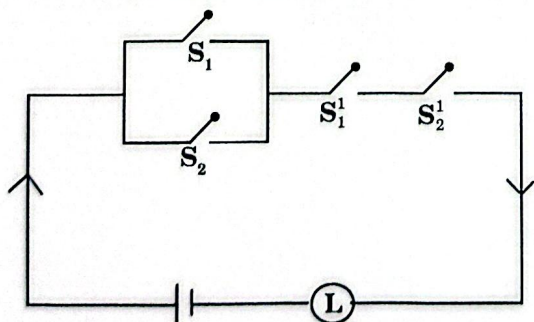
- Q.26 A fair coin is tossed 8 times. Find the probability that it shows heads at least once.

SECTION - D

Attempt **any Five** of the following questions :

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- Q.27 Find the symbolic form of the given switching circuit. Construct its switching table and interpret your result.



P.T.O

Q.28 Express the following equations in the matrix form and solve them by method of reduction

$$2x - y + z = 1$$

$$x + 2y + 3z = 8$$

$$3x + y - 4z = 1$$

Q.29 Find the inverse of the matrix.

$$A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix} \text{ by using transformation method.}$$

Q.30 Prove that $\sin^{-1}\left(\frac{3}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \sin^{-1}\left(\frac{56}{65}\right)$

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

function of x and $\frac{dx}{dt} \neq 0$, then prove that

$$\frac{dy}{dx} = \frac{\left(\frac{dy}{dt}\right)}{\left(\frac{dx}{dt}\right)}, \text{ Hence, find } \frac{dy}{dx} \text{ if } x = \sin t \text{ and } y = \cos t.$$

Q.32 Find the maximum and minimum value of the function $f(x) = 2x^3 - 21x^2 + 36x - 20$.

Q.33 The following is the p.d.f. of a continuous random variable X :

$$f(x) = \frac{x}{32}, 0 < x < 8$$
$$= 0, \text{ otherwise}$$

a) Find the expression for c.d.f.

b) Also find its value at $x = 0.5$ and 9 .

Q.34 The probability that a person who undergoes kidney operation will recover is 0.5 . Find the probability that of the six patients who undergo similar operations.

a) None will recover.

b) Half of them will recover.
