

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 of questions carrying two mark each.
Q. No. 2 contains 4 very short answer type of questions carrying one mark each.
 - Section - B : Q. No. 3 to Q. No. 14 contains 12 short answer type of questions carrying two marks each. (Attempt any Eight)
 - Section - C : Q. No. 15 to Q. No. 26 contains 12 short answer type of questions carrying Three marks each. (Attempt any Eight)
 - Section - D : Q. No. 27 to Q. No. 34 contains 8 long answer type of questions carrying Four marks each. (Attempt any Five)
- Figures to the right indicate full marks.
- Start answer to each section on new page.
- For each MCQ, the correct answer must be written along with its alphabet:
e.g. a)...../b)..... / c) /d).....
- Evaluation of each MCQ would be done for the first attempt only.
- Use of graph 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 A) Select and write the most appropriate answer from the given alternatives for each sub - question. (16)

- If $p \wedge q$ is F, $p \rightarrow q$ is F then the truth value of p and q are
(a) T,T ☒ (b) T, F (c) F,T (d) F,F
- If $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ and $A(\text{adj } A) = K.I$ then the value of K is
(a) 1 (b) -1 (c) 0 (d) -3
- $\tan \left(2 \cdot \tan^{-1} \left(\frac{1}{5} \right) - \frac{\pi}{4} \right) = \dots\dots\dots$
(a) $\frac{17}{7}$ (b) $-\frac{17}{7}$ (c) $\frac{7}{17}$ (d) $-\frac{7}{17}$

- iv) The difference between the slopes of the lines represented by $3x^2 - 4xy + y^2 = 0$ is
 (a) 2 (b) 1 (c) 3 (d) 4
- v) Let $f(x) = x^3 - 6x^2 + 9x + 18$ then $f(x)$ is strictly decreasing in
 (a) $(-\infty, 1)$ (b) $(3, \infty)$ (c) $(-\infty, 1)$ (d) $(1, 3)$
- vi) If a random variable X has the following probability distribution.

X	-2	-1	0	1	2	3
$P(X)$	0.1	k	0.2	$2k$	0.3	k

then $p(X = -1) = \dots\dots\dots$

- (a) $\frac{1}{10}$ (b) $\frac{2}{10}$ (c) $\frac{3}{10}$ (d) $\frac{4}{10}$
- vii) If the mean and variance of a binomial distribution are 18 and 12 respectively then $n = \dots\dots\dots$
 (a) 36 (b) 54 (c) 18 (d) 27
- viii) The mean and the variance of a binomial distribution are 4 and 2 respectively then the probability of 2 success is
 (a) $\frac{128}{256}$ (b) $\frac{219}{256}$ (c) $\frac{37}{256}$ (d) $\frac{28}{256}$

Q.2 Answer the following questions.

(4)

- i) Find the joint equation of co-ordinate axes.
- ii) If $y = e^{\log x}$, find $\frac{dy}{dx}$.
- iii) The displacement S of a particle at time t seconds is given by $S = t^2(t - 3)$, then find the velocity of the particle at $t = 2$ sec.
- iv) Write the range of "no of students present in classroom of 25 students."

SECTION - B

Attempt any Eight of the following questions :

(16)

Q.3 Without using truth table prove that

$$\sim(p \vee q) \vee (\sim p \wedge q) \equiv \sim p$$

Q.4 If $A = \begin{bmatrix} 2 & -2 \\ 4 & 3 \end{bmatrix}$ then find A^{-1} by adjoint Method.

Q.5 Find the general solution of the equation $4 \cdot \cos^2 x = 1$.

- Q.6 With usual notation, in $\triangle ABC$, prove that
 $a(b \cdot \cos C - c \cdot \cos B) = b^2 - c^2$.
- Q.7 Find 'k' if the equation $kxy + 10x + 6y + 4 = 0$ represents a pair of straight lines.
- Q.8 Find the angle between the lines represented by $3x^2 + 4xy - 3y^2 = 0$
- Q.9 If $y = \cos^{-1}(1 - 2 \cdot \sin^2 x)$, find $\frac{dy}{dx}$.
- Q.10 If $y = x \cdot \log x$ then find $\frac{d^2 y}{dx^2}$.
- Q.11 Find the approximate value of $\sqrt{8.95}$.
- Q.12 Obtain the probability distribution of the number of sixes in two tosses of a fair die.
- Q.13 Find the mean of number randomly selected from 1 to 15.
- Q.14 A fair coin is tossed five times. Find the probability that it shows exactly three times head.

SECTION - C

(24)

Attempt any eight of the following questions.

- Q.15 Construct the switching circuit for the following statement :
 $[p \vee (\sim p \wedge q)] \vee [(\sim q \wedge r) \vee \sim p]$
- Q.16 Write the truth values of the following statements :
 (i) 2 is a rational number and $\sqrt{2}$ is an irrational number.
 ii) $2 + 3 = 5$ or $\sqrt{2} + \sqrt{3} = \sqrt{5}$
- Q.17 Express the following equations in matrix form and solve them by the method of reduction.

$$x + y + z = 6$$

$$3x - y + 3z = 6$$

$$5x + 5y - 4z = 3$$

- Q.18 If A, B and C are the measures of the angles of a $\triangle ABC$ and a, b and c are the lengths of the sides opposite to the angles A, B and C respectively then prove that

$$a^2 = b^2 + c^2 - 2bc \cos A$$

- Q.19 Prove that every homogeneous equation of second degree in x and y ie.
 $ax^2 + 2hxy + by^2 = 0$ represents a pair lines through the origin, if $h^2 - ab \geq 0$.

- Q.20 Solve the following L.P.P. graphically

$$\text{Maximize } z = 10x + 25y$$

$$\text{subject to } x \leq 3, y \leq 3, x + y \leq 5, \quad x \geq 0, y \geq 0$$

- Q.21 If $x^p \cdot y^q = (x + y)^{p+q}$ then prove that $\frac{dy}{dx} = \frac{y}{x}$ ✓

- Q.22 If $x = a \cdot \cos^3 t$, $y = a \cdot \sin^3 t$, show

$$\text{that } \frac{dy}{dx} = -\left(\frac{y}{x}\right)^{\frac{1}{3}}$$

- Q.23 Find the equation of tangent to the curve $y = 3x^2 - x + 1$ at $P(1, 3)$.
- 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 Find the variance and standard deviation of the random variable x whose probability distribution is given below.

X	0	1	2	3
$P(X)$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{8}$

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

SECTION - D

(20)

Attempt any Five of the following questions.

- Q.27 Use truth table, prove that $p \leftrightarrow q \equiv (p \wedge q) \vee (\sim p \wedge \sim q)$
- Q.28 Solve the following system of equation by method of inversion.
- $$\begin{aligned} x + y + z &= -1 \\ y + z &= 2 \\ x + y - z &= 3 \end{aligned}$$
- Q.29 Prove that $\sin^{-1}\left(\frac{3}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \sin^{-1}\left(\frac{56}{65}\right)$
- Q.30 Solve the following L.P.P. graphically.
- Minimize $Z = 6x + 2y$
- Subject to $5x + 9y \leq 90$,
- $$\begin{aligned} x + y &\geq 4 \\ y &\leq 8, \\ x &\geq 0, \quad y \geq 0. \end{aligned}$$
- Q.31 If $y = f(u)$ is a differentiable function of u and $u = g(x)$ is a differentiable function of x such that the composite function $y = f[g(x)]$ is a differentiable function of x then prove that $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$.
- Q.32 Find the maximum and minimum value of the function $f(x) = x^3 - 9x^2 + 24x$.
- Q.33 Find k if the function $f(x)$ is defined by
- $$\begin{aligned} f(x) &= kx(1-x), & \text{for } 0 < x < 1. \\ &= 0, & \text{otherwise.} \end{aligned}$$
- is the probability density function (p.d.f.) of a random variable X . Also find $P\left(X < \frac{1}{2}\right)$.
- Q.34 Given $X \sim B(n, p)$
- (i) If $n = 10$ and $p = 0.4$ find $E(X)$ and $\text{var}(X)$.
- (ii) If $n = 25$, $E(X) = 10$. Find p and $S.D(X)$.