

- 20) In the set  $Q$  define  $a + b = a + b + ab$ , Then the inverse of 1 is
- a)  $\frac{1}{3}$       b)  $\frac{1}{\sqrt{3}}$       c)  $\frac{2}{\sqrt{3}}$       d)  $\frac{\sqrt{3}}{2}$   
 a)  $\frac{2}{3}$       b)  $\frac{-2}{3}$       c)  $\frac{1}{2}$       d)  $\frac{-1}{2}$

**PART - II**

Answer any 7 questions. Q.No. 30 is compulsory.

7×2=14

- 21) If  $A$  is symmetric, then prove that  $\text{adj } A$  is also symmetric  
 22) Which one of the points  $i$ ,  $-2 + i$  and  $3$  is farthest from the origin?  
 23) If  $\alpha, \beta, \gamma$  are the roots of the polynomial equation  $ax^3 + bx^2 + cx + d = 0$ , find  $\sum \frac{\alpha}{\beta\gamma}$   
 24) Find the principal value of  $\cot^{-1}(-\sqrt{3})$   
 25) Find the angle between the line  $\vec{r} = (2\hat{i} - \hat{j} + \hat{k}) + t(\hat{i} + 2\hat{j} - 2\hat{k})$  and the plane  $\vec{r} \cdot (6\hat{i} + 3\hat{j} + 2\hat{k}) = 8$   
 26) Solve  $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$   
 27) Find the asymptotes of the curve  $f(x) = \frac{1}{x}$   
 28) In the algebraic structure, prove that the identity element is unique  
 29) Find the constant  $C$  such that  $f(x) = \begin{cases} Cx^2 & 1 < x < 4 \\ 0 & \text{otherwise} \end{cases}$   
 30) Evaluate  $\int_0^{\pi} \cos^7 x \, dx$

**PART - III**

Answer any 7 questions. Q.No. 40 is compulsory.

7×3=21

- 31) If  $k$  is real, discuss the nature of the roots of the polynomial equation  $2x^2 + kx + k = 0$ , in terms of  $k$   
 32) For what value of  $x$ , the inequality  $\frac{\pi}{2} < \cos^{-1}(3x - 1) < \pi$  holds?  
 33) Find the equations of tangent and normal to the parabola  $x^2 + 6x + 4y + 5 = 0$  at  $(1, -3)$   
 34) Solve the following system of linear equations, using matrix inversion method  
 $5x + 2y = 3, 3x + 2y = 5$   
 35) If  $|z| = 3$ , show that  $7 \leq |z + 6 - 8i| \leq 13$   
 36) Find the angle made by the straight line  $\frac{x+3}{2} - \frac{y-1}{2} = -z$  with coordinate axes.  
 37) Find the angle between the curve  $y = x^2$  and  $x = y^2$  at their point of intersection  $(0, 0)$   
 38) Find the volume of the right circular cone of radius  $r$  and height  $h$ .  
 39) Show that  $p \rightarrow q = \neg p \vee q$   
 40) If  $f(x, y, z) = xy + yz + zx$  find  $f_x + f_y + f_z$

**PART - IV**

7×5=35

Answer all the questions

- 41) a) Investigate the value of  $\lambda$  and  $\mu$  the system of linear equations.  
 $x + 2y + z = 7, x + y + \lambda z = \mu, x + 3y - 5z = 5$  have  
 i) no solution    ii) a unique solution    iii) an infinite number of solutions  
 (OR)  
 b) Verify (i) closure property (ii) commutative property (iii) associative property (iv) existence of identity (v) existence of inverse on the set  $C = \{1, -1, i, -i\}$  where  $i^2 = -1$ , under usual multiplication.  
 42) a) If  $z = x + iy$  and  $\arg\left(\frac{z-i}{z+2}\right) = \frac{\pi}{4}$ , show that  $x^2 + y^2 + 3x - 3y + 2 = 0$   
 (OR)  
 b) A random variable  $x$  has the following probability mass function
- |        |               |                |                |                |                |                 |
|--------|---------------|----------------|----------------|----------------|----------------|-----------------|
| $x$    | 1             | 2              | 3              | 4              | 5              | 6               |
| $f(x)$ | $\frac{1}{k}$ | $\frac{2}{2k}$ | $\frac{3}{6k}$ | $\frac{4}{5k}$ | $\frac{5}{6k}$ | $\frac{6}{10k}$ |
- Find (i)  $P(2 < X < 6)$  (ii)  $P(2 \leq X < 5)$  (iii)  $P(X \leq 4)$  (iv)  $P(3 < X)$   
 43) a) Solve  $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$   
 (OR)  
 b) Find the angle between the curve  $y^2 = v$  and the curve  $y = |x|$

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