

20) In the set Q define $a * b = a + b + ab$. Then the inverse of 1 is
 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.

$7 \times 2 = 14$

21) If A is symmetric, then prove that $\text{adj } A$ is also symmetric
 22) Which one of the points $1, -2 + i$ and 3 is farthest from the origin?
 23) If α, β, γ are the roots of the polynomial equation $ax^3 + bx^2 + cx + d = 0$, find $\sum \frac{a}{\beta\gamma}$
 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
 $\vec{r} \cdot (\hat{i} + 3\hat{j} + 2\hat{k}) = 8$
 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 $\int_0^{\pi} \cos^2 x \, dx$

PART - III

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

$7 \times 3 = 21$

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

$7 \times 5 = 35$

Answer all the questions

41) a) Investigate the value of λ and μ 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
$f(x)$	$\frac{1}{k}$	$\frac{2}{k}$	$\frac{6}{k}$	$\frac{5}{k}$	$\frac{6}{k}$	$\frac{10}{k}$

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 region between the curve $y^2 = x$ and the curve $y = |x|$

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web mar 31 2021 zemax llc thanks dr reinhard voelkel of suss microoptics sa for the experimental data used in this article setting up the initial design this article describes a commercial fiber coupler which couples two pieces of corning smf 28e fiber using suss microoptics fc q 250 microlens arrays the manufacturers data is as follows

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web nov 3 2015 with optical sensor arrays tiny lens systems serve to focus and concentrate the light onto the photodiode surface instead of allowing it to fall on non photosensitive areas of the pixel device fill factor area occupied by the microlens arrays mostly the lens shape is cylindrical or spherical array size strongly depends on the applications

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