BM-101

MATHEMATICS

GROUP – B

(Short Answer Type Questions)

1. If α, β, ϒ be the roots of the equation $x^3 + 2x^2 + 3x + 4 = 0$,
   Then find the equation whose roots are
   $1 + \frac{1}{\alpha}, 1 + \frac{1}{\beta}$ and $1 + \frac{1}{\gamma}$.

2. Evaluate $\int_0^{\pi/2} x^2 \sin x \, dx$
3. Let $G = \{ a \in R / -1 < a < 1 \}$. Define a binary operation $\otimes$ on G
   by $a \otimes b = \frac{a+b}{1+ab} \; \forall \, a, b \in G$. Show that (G, $\otimes$) is a group.

4. Find the equation of a straight line through the point of intersection of lines $2x - 3y + 4 = 0$ and $3x + 4y - 5 = 0$ and that is perpendicular to the line $6x - 7y + 8 = 0$.
5. In a survey concerning the smoking habits of consumers it was found that 55% smoke cigarette-A, 50% smoke cigarette-B, 42% smoke cigarette-C, 28% smoke cigarette-A & B, 20% smoke cigarette-A & C, 12% smoke cigarette-B & C and 10% smoke all the three cigarette. What percentage does no smoke?

GROUP – C

(Long Answer Type Questions)

6. a) Find the value of 'a' and 'b' for which the system of equations

$$x + 2y + z = 1$$
$$2x + y + 3z = b$$
$$x + ay + 3z = b + 1$$

   has (i) unique solution, (ii) many solutions.

   b) If P = $\begin{pmatrix} 9 & 1 \\ 4 & 3 \end{pmatrix}$ and Q = $\begin{pmatrix} 1 & 5 \\ 7 & 12 \end{pmatrix}$, find the matrix R so that $5P + 3Q + 2R$ is a null matrix.

   c) Find the inverse of the following matrix

$$\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$$

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7. a) If $u = cos^{-1}\{(x+y)/\sqrt{x} + \sqrt{y}\}$, then prove that

$$x.\frac{\partial u}{\partial x} + y.\frac{\partial u}{\partial y} + \frac{1}{2}\cot u = 0$$

b) If PSQ be a focal chord of a conic with focus S and semi locus rectum L, then prove that

$$\frac{1}{SP} + \frac{2}{SQ} = \frac{2}{L}$$

c) Find the point on the conic $\frac{6}{r} = 1 + 4\,cos\theta$ whose vertical angle is π/3.

8. a) Evaluate

$\lim_{n\to\infty}\left[\frac{n}{n^2+1^2} + \frac{n}{n^2+2^2} + \ldots + \frac{n}{n^2+n^2}\right]$.

b) Differentiate n times the following equation:

$(1 + x^2)y_{n+2} + (2x-1)y_1 = 0$

c) If A = {a, b, c, d}, B = {b, c, p, q}, then find out A × B, B × A and A Δ B.

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