GROUP – A

1. Choose the correct alternative : $1 \times 10 = 10$

i) For any two sets A and B, the value of $(A - B) \cup (B - A) \cup (A \cap B)$ is

a) A b) B

c) $A \cup B$ d) none of these.

ii) Which one is true ?

a) $2 + 3i > 1 + 4i$ b) $3 + 3i > 6 + 2i$

c) $5 + 9i > 5 + 6i$ d) none of these.

iii) If $a_1, a_2, a_3, \ldots\ldots, a_{40}$ are in A.P. and

$a_1 + a_5 + a_{15} + a_{26} + a_{36} + a_{40} = 105$ then sum of the A.P. series is

a) 650 b) 700

c) 1400 d) none of these.

iv) If the n-th term of an A.P. be $(3n - 5)$ then its common difference will be

a) -2 b) -1

c) 3 d) none of these.

v) If $\sin A + \sin B = 2$ then which of the following is the value of $\sin (A + B)$?

a) 2 b) 0

c) -1 d) None of these.

vi) Two lines $ax + by = c$ and $a'x + b'y = c'$ are perpendicular to each other, if

a) $aa' + bb' = 0$ b) $aa' - bb' = 0$

c) $aa' + bb' + cc' = 0$ d) None of these.

vii) The value of $\lim_{x \to 1} \frac{x + x^2 + x^3 + \ldots + x^n - n}{x - 1}$ is

a) n b) $\frac{n(n+1)}{2}$

c) $\frac{n+1}{2}$ d) None of these.

viii) The variance of the numbers 3, 7, 10, 12 and 18 is

a) 12 b) 6·5

c) 49·2 d) None of these.

ix) Five boys and three girls sit in a row. The probability that none of the boy sit between any two girls is

a) $\frac{1}{28}$ b) $\frac{5}{28}$

c) $\frac{3}{28}$ d) None of these.

x) The radius of the circle concentric to the circle $x^2 + y^2 + 4x - 2y = 20$ and passes through the origin is

a) 10 unit b) $\sqrt{20}$ unit

c) $\sqrt{5}$ unit d) None of these.

GROUP – B

2. a) Answer any *two* questions : $2 \times 2 = 4$

i) If $A = \{ x : x^2 - 3x + 2 = 0 \}$ and $B = \{ x : x$ is any digit of 212 $\}$, find the relation between A and B.

ii) Find the range of $f(x) = \frac{x^2}{1 + x^2}$.

iii) If $\tan x = \frac{b}{a}$, then find the value of $a \cos 2x + b \sin 2x$.

iv) If $A + B = \frac{\pi}{2}$, then find the maximum value of $\cos A \cdot \cos B$.

b) Answer any *two* questions : $2 \times 2 = 4$

i) Find the least positive integral value of x, so that

$(1+i)^{2x} = (1-i)^{2x}$.

ii) Prove that ${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$.

iii) Solve : $|x+1| > 4$; $x \in R$.

iv) If $(p+q)$-th term of a G.P. is a and $(p-q)$-th term is b ; find the p-th term of this series.

c) Answer any *one* question : $2 \times 1 = 2$

i) If $2x^2 + pxy + 2y^2 + (p-4)x + 6y - 5 = 0$ be the equation of a circle then find its radius.

ii) One side of an equilateral triangle is the line $3x + 4y + 8 = 0$ and its centroid is at $(1, 1)$, find the length of the side.

d) Answer any *one* question : $2 \times 1 = 2$

i) If $G(x) = -\sqrt{25 - x^2}$; find $\lim\limits_{x \to 1} \dfrac{G(x) - G(1)}{x - 1}$.

ii) If $y = \dfrac{\sin x + \cos x}{\sqrt{1 + \sin 2x}}$, then find $\dfrac{dy}{dx}$.

e) Answer any *one* question : $2 \times 1 = 2$

i) If $P(A)$ represents the probability of an event A, then show that

$0 \leq P(A) \leq 1$.

ii) Find the mean deviation about median of the following data :

36, 72, 46, 42, 60, 45, 53, 46, 49

GROUP – C

3. a) Answer any *two* questions : $4 \times 2 = 8$

i) For any *three* sets A, B and C ; prove that

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C).$$

ii) Evaluate $\sin 18°$ and hence deduce the value of $\cos 36°$.

iii) Prove that $\tan 6° \tan 42° \tan 66° \tan 78° = 1$.

b) Answer any *two* questions : $4 \times 2 = 8$

i) If ${}^{n+r}p_2 = 110$ and ${}^{n-r}p_2 = 20$, find n and r.

ii) Solve : $\frac{2}{|x-3|} > 5$; $x \neq 3$; $x \in R$.

iii) If $x + iy = \frac{2}{3 + \cos\theta + i\sin\theta}$; then prove that $2x^2 + 2y^2 = 3x - 1$.

iv) If S be the sum, P the product and R is the sum of reciprocals of n terms of a G.P. then prove that $P^2 = \left(\frac{S}{R}\right)^n$.

c) Answer any *two* questions : $4 \times 2 = 8$

i) A ray of light start from $P(1, 2)$, reflect on x-axis at A and then passes through the point $Q(5, 3)$; find the co-ordinates of A.

ii) Find the condition so that the lines $x\cos\alpha + y\sin\alpha = p$, $x\cos\beta + y\sin\beta = q$ and $y = x\tan\theta$ be concurrent.

iii) Find the area of an equilateral triangle inscribed in the circle $x^2 + y^2 - 4x + 6y - 3 = 0$.

d) Answer any *two* question : $4 \times 2 = 8$

i) Evaluate : $\lim_{x \to 1} (1 - x)\tan\frac{\pi x}{2}$.

ii) Find from definition, the differential coefficient of $f(x) = x + \frac{1}{x}$ at $x = 1$.

iii) If $y = \frac{\tan x}{x} \log_e \left(\frac{e^x}{x^x} \right)$; find the simplified value of $\frac{dy}{dx}$.

iv) Evaluate : $\lim_{x \to 0} \frac{\tan x - \sin x}{x^3}$.

e) Answer any *one* question : $4 \times 1 = 4$

i) Find the probability that a leap year selected at random will contain 53 Mondays.

ii) Find the Standard Deviation of the following data :

x_i	3	8	13	18	23
f_i	6	10	14	10	10

GROUP – D

4. a) Answer any *one* question : $5 \times 1 = 5$

i) If $\cos\theta = \frac{\cos\alpha - \cos\beta}{1 - \cos\alpha \cos\beta}$, show that one value of $\tan\frac{\theta}{2}$ is $\tan\frac{\alpha}{2} \cot\frac{\beta}{2}$.

ii) Prove that $\frac{\sec 8\theta - 1}{\sec 4\theta - 1} = \frac{\tan 8\theta}{\tan 2\theta}$.

b) Answer any *two* questions : $5 \times 2 = 10$

i) Prove that $(a + b\omega + c\omega^2)^3 + (a + b\omega^2 + c\omega)^3 = 27abc$, if $a + b + c = 0$ and ω is cube root of unity.

ii) In how many ways 10 marbles can be selected among 14 marbles in which 10 marbles are red and other 4 marbles are of different colours ?

iii) If a^2, b^2 and c^2 are in A.P. ; then prove that $\frac{1}{b+c}$, $\frac{1}{c+a}$, $\frac{1}{a+b}$ are in A.P.

iv) Draw the graph of the following inequations and find the solution region :

$$x + 2y \leq 3,\ 3x + 4y \geq 12,\ x \geq 0,\ y \geq 0.$$

(Graph paper not required)

c) Answer any *one* question : $5 \times 1 = 5$

i) If $(at^2,\ 2at)$ be the coordinate of one extremity of a focal chord of the parabola $y^2 = 4ax$, then prove that its other extremity is $\left(\frac{a}{t^2}, -\frac{2a}{t}\right)$.

ii) Find the equation of the ellipse whose vertices are at $(\pm 5,\ 0)$ and foci at $(\pm 4,\ 0)$.

iii) If the vertex of the parabola is $(-1,\ -1)$ and equation of the directrix is $x + y + 4 = 0$; find the equation of the parabola.