MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

BBA-102

MATHEMATICS-I

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. $10\times1 = 10$

(i) The value of x if $\log_4(\log_3 x) = \frac{1}{2}$

(A) 0 (B) –1
(C) 4 (D) –4

(ii) If $R \to R$; $f(x) = (-1)^x$, then R equals

(A) {–1, 1} (B) {1, –1}
(C) {0, –2} (D) {–2, 0}

(iii) If $5^{x+1} + 5^{x-1} = 26$, then the value of x equals to

(A) 0 (B) 2
(C) 1 (D) none of these

(iv) If (α, β) are the roots of the equations $ax^2 + bx + c = 0$, then $\alpha + \beta$ equals

(A) $\frac{a}{c}$ (B) $-\frac{c}{a}$

(C) $-\frac{b}{a}$ (D) $\frac{a}{b}$

(v) If $A = \{4, 5\}$ and $B = \{x, y\}$, then $A \cap B$ is

(A) $\{5, x\}$ (B) $\{4, y\}$

(C) $\{4, 5, x, y\}$ (D) ϕ

(vi) The sixth term of the expansion of $(2x + y)^9$ is

(A) $2016\, x^4 y^5$ (B) $216\, x^4 y^5$

(C) $2016\, x^5 y^4$ (D) $2006\, x^4 y^5$

(vii) The value of $3 + 6 + 9 + \ldots + 3n$ equals to

(A) $\frac{2n(n+1)}{3}$ (B) $\frac{n(n+1)}{2}$ (C) $\frac{3n(n+1)}{2}$ (D) $\frac{n(n+1)}{3}$

(viii) Simple interest of a sum equals to $\frac{1}{4}$ of itself in 4 years. Then the rate of interest will be

(A) 10% (B) 25%

(C) $6\frac{1}{4}\%$ (D) none of these

(ix) If ${}^nC_{10} = {}^nC_{14}$, then the value of n equals

(A) 42 (B) 24 (C) 21 (D) 12

(x) If line $2x + 3y + k = 0$ touches the circle $x^2 + y^2 = 25$, then k equals

(A) $5\sqrt{13}$ (B) $-5\sqrt{13}$ (C) $\pm 5\sqrt{13}$ (D) 0

(xi) The perpendicular distance between the lines $3x - 4y = 8$ and $6x - 8y + 5 = 0$ is

(A) $\frac{3}{7}$ *units* (B) $\frac{7}{3}$ *units* (C) $\frac{21}{10}$ *units* (D) $\frac{10}{21}$ *units*

(xii) In a 60 litres mixture of water and milk, the ratio of water and milk is 7 : 5. How much milk should be added so that the ratio becomes 5 : 8?

(A) 30 liters (B) 31 liters (C) 32 liters (D) 29 liters

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. How many words can be formed from the letters of the word 'DAUGHTER' so that the vowels always come together?

3. If $f : R \to R\ f(x) = e^x$ then find $f\,of(-1)$.

4. A person suffers a loss of 15% by selling an item at Rs. 552.5 per unit. If the item is sold for Rs. 700 then find out the profit percentage.

5. If $x^2 - 6x + a = 0$ has two roots α, β and $3\alpha + 2\beta = 20$, then find the value of a.

6. Find the equation of the circle with centre (2, 3) if it passes through the point of intersection of the lines $3x - 2y - 1 = 0$ and $4x + y - 27 = 0$.

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) If α and β are the roots of the equation $2x^2 - 4x + 1 = 0$, then form such an equation, whose roots are $\alpha + \beta^2$ and $\beta^2 + \alpha$. 5

(b) Find the equation of the circle through the points (4, 3) and (–2, 5) and having its centre on the line $2x - 3y = 4$. 5

(c) A student is to answer 8 out of 10 questions on an examination: 5
(i) How many choice has he?
(ii) How many if he must answer the first three questions?
(iii) How many if he must answer at least four of the first five questions?

8. (a) Find the angle between the straight lines $x - 2y + 1 = 0$ and $x + 3y = 2$. 5
(b) Find the equation of the circle concentric to $x^2 + y^2 - 4x + 6y - 13 = 0$ and passing through the point $(-4, 5)$. 6
(c) In a H.P., the 4^{th} term and the 13^{th} term are respectively $\frac{1}{12}$ and $\frac{1}{42}$; find the series. 4

9. (a) Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ be the universal set, $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{5, 6, 7\}$. Then verify that $(A \cup B)^C = A^C \cap B^C$ and $A - B = A \cap B^C$. 4
(b) In a class of 50 students 15 read physics, 20 read chemistry, 20 read mathematics, 3 read physics and chemistry, 6 read chemistry and mathematics and 5 read physics and mathematics. 7 read none of the three subjects. How many students read all subjects? 5
(c) Find the middle term(s) of (i) $\left(\frac{x}{a} + \frac{a}{x}\right)^{20}$ (ii) $(a + x)^{21}$. 6

10.(a) Find the sum of $6 + 66 + 666 + \ldots\ldots\ldots n$ terms 5
(b) For $\Omega = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$; $A = \{2, 3, 5, 7\}$; $B = \{2, 3, 4, 5, 6\}$; $C = \{2, 4, 6, 8\}$, verify the following results 5
(i) $A - (B \cup C) = (A - B) \cap (A - C)$ (ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
(c) If $x = \frac{\sqrt{a+b} + \sqrt{a-b}}{\sqrt{a+b} - \sqrt{a-b}}$ then show that $bx^2 - 2ax + b = 0$. 5

11.(a) In how many ways can 12 examination papers be arranged so that the best and the worst papers may never come together? 5
(b) Solve for x : $2^{x+2} + 2^{x-1} = 9$. 5
(c) If the distance between the points $(-3, 3)$ and $Q(4, k)$ be $5\sqrt{2}$ units, then find the coordinates of Q. 5