This Question Paper contains 4 Printed Pages]

15E(A)

MATHEMATICS, Paper – I

(English version)

Parts A and B

Time : 2½ Hours] ***[Maximum Marks : 50***

Instructions :

1. *Answer the questions under **Part-A** on a separate answer book.*
2. *Write the answers to the questions under **Part-B** on the Question paper itself and attach it to the answer book of **Part-A**.*

Part - A

Time : 2 Hours **Marks : 35**

SECTION - I *(Marks : 5×2=10)*

Note :

1. Answer **ANY FIVE** questions, choosing **at least TWO** from each of the following two Groups, i.e. **A** and **B**.
2. Each question carries **2** marks.

GROUP - A

(Statements and Sets, Functions, Polynomials)

1. Prove $\sim(p \Rightarrow q) \equiv p \wedge (\sim q)$.

2. If A and B are any two sets, show that $A' - B' = B - A$.

3. If $f : R - \{3\} \to R$ is defined by $f(x) = \frac{x+3}{x-3}$,

   show that $f\left[\frac{3x+3}{x-1}\right] = x$ for $x \neq 1$.

4. Find the value of m in order that $x^4 - 2x^3 + 3x^2 - mx + 5$ may be exactly divisible by $x - 3$.

GROUP - B

(Linear Programming, Real numbers, Progressions)

5. Indicate the polygonal region represented by the system of inequations $x \geq 0, \quad x \leq 4, \quad x \geq y$.

6. If $a^x = b,\ b^y = c,\ c^z = a$, show that $xyz = 1$.

7. Solve the absolute value inequation $\left|\frac{2x-1}{3}\right| \leq 5$

8. Which term of the AP 10, 8, 6, ... is -28 ?

SECTION - II

(Marks : 4×1=4)

Note :

1. Answer **ANY FOUR** of the following *Six* questions.
2. Each question carries **1** mark.

9. Write the converse and contrapositive of the following conditional
If in a triangle ABC, $AB > AC$, then $\angle C > \angle B$.

10. If a set A contains 'm' elements and B contains 'n' elements, then find the number of elements in $A \times B$.

11. Find the middle term in the expansion $\left(\frac{x}{a}+\frac{y}{b}\right)^6$.

12. Define 'Objective function.'

13. Simplify and obtain a numerical value $(32)^{-4/5}$

14. Find the sum to infinity of the GP $5, \frac{20}{7}, \frac{80}{49}, \ldots\ldots$

SECTION - III

(Marks : 4×4=16)

Note :

1. Answer **ANY FOUR** questions, choosing **TWO** from each of the following groups, i.e. **A** and **B**.
2. Each question carries **4** marks.

GROUP - A

(Statements and Sets, Functions, Polynomials)

15. Prove that $A-(B\cup C)=(A-B)\cap(A-C)$ for any three sets A, B, C.

16. Let f, g, h are functions defined by $f(x)=x-1$, $g(x)=x^2-2$ and $h(x)=x^3-3$, show that $(fog)oh = fo(goh)$.

17. If a function $f: R \to R$ is defined by $f(x) = 3x + 4$, show that f^{-1} the inverse function of f exists and a rule that defines f^{-1}.

18. Factorise $3x^4 - 10x^3 + 5x^2 + 10x - 8$.

GROUP - B

(Linear Programming, Real Numbers, Progressions)

19. A shopkeeper sells not more than 30 shirts of each colour. Atleast twice as many white ones are sold as green ones. If the profit on each of the white be Rs. 20 and that of green be Rs. 25; then find out how many of each kind be sold to give him a maximum profit. (Graph need not be drawn)

20. If $lmn = 1$, show that

$$\frac{1}{1+l+m^{-1}} + \frac{1}{1+m+n^{-1}} + \frac{1}{1+n+l^{-1}} = 1.$$

21. If the sum of the first 'n' natural numbers is S_1 and that of their squares S_2 and cubes S_3, then show that $9S_2^2 = S_3(1 + 8S_1)$.

22. Find the sum to n terms $0.7 + 0.77 + 0.777 + \ldots\ldots$

SECTION - IV

(Marks : 1×5=5)

(Linear Programming, Quadratic Equations and Inequations)

Note :

1. Answer **ANY ONE** question from the following.
2. This question carries **5** marks.

23. Using graph $y = x^2$, solve the equation $x^2 - x - 2 = 0$.

24. Maximize $f = 4x - y$, subject to the constraints

$7x + 4y \leq 28$, $2y \leq 7$, $x \geq 0$, $y \geq 0$.