GLOBAL SCHOOL OF SCIENCE

First Terminal Examination - 2081

Class : XI | **Subject: Mathematics (0071)** | **Full Marks: 75**

Time: 3 hrs. | **SET 'A'** | **Pass Marks: 30**

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

Group 'A'

Rewrite the best alternative. **[1 × 11 = 11]**

1. If $A \subseteq B$, $x \notin B$ implies that

   a) $x \in A$ b) $x \in B$ c) $x \notin A$ d) $x \in A \cap B$

2. The total number of elements in the power set of the set A = {a, b, c, d} is

   a) 4 b) 8 c) 16 d) 32

3. A compound statement which is always false whatever may be the truth value of it's component is called

   a) tautology b) conjunction

   c) logically equivalent d) contradiction

4. The negation of the compound statement $p \Rightarrow q$ is

   a) $\sim p \Rightarrow \sim q$ b) $(\sim p) \wedge q$

   c) $p \wedge (\sim q)$ d) $q \Rightarrow p$

5. The symmetric difference $A \Delta B$ of two sets A and B is defined as

   a) $(A - B) \cup (B - A)$ b) $(A \cup B) - (A \cap B)$

   c) $(A - B) \cap (B - A)$ d) both (a) & (b)

6. If A is a square matrix, then which of the following is always a symmetric matrix?

a) $A + A^T$ b) $A - A^T$ c) $A\,A^T$ d) A^2

7. For what value of x the matrix $A=\begin{pmatrix} 6 & x-2 \\ 3 & x \end{pmatrix}$ has no inverse?

a) 3 b) 2 c) 0 d) – 2

8. If $\begin{pmatrix} a-b & b \\ a+b & a \end{pmatrix}$ is a lower triangular matrix with determinant 4, then the value of a is

a) 0 b) ± 1 c) ± 2 d) ± 4

9. The value of $\lim_{x \to 0} \frac{\sin x^\circ}{x}$ is

a) 0 b) 1 c) $\frac{\pi}{180}$ d) $\frac{180}{\pi}$

10. $\lim_{x \to -1} (1 + x + x^2 + x^3 + \cdots\cdots + x^{10})$ is

a) 0 b) 1 c) –1 d) 2

11. The limit of $f(x) = x^{\frac{1}{n}}$ as $n \to \infty$ is

a) –1 b) 1 c) 0 d) does not exist

Group 'B'

Short Answer Questions. **[5 × 8 = 40]**

12. Define biconditional statement with one example. Construct the truth table for the compound statement $(q \Rightarrow p) \Leftrightarrow (\sim p \Rightarrow \sim q)$. What conclusion can be drawn about the statement from truth table? [1+3+1]

13. a) If A and B are subsets of U, prove that $A - \overline{B} = A \cap B$.

b) For any non-empty subsets A, B, C of universal set U, prove that:

$A - (B \cup C) = (A - B) \cap (A - C)$ [2+3]

14. a) If $A - 2B = \begin{pmatrix} 2 & 4 \\ -6 & 1 \end{pmatrix}$ and $A + B = \begin{pmatrix} 3 & 1 \\ -5 & 2 \end{pmatrix}$, find the matrices A and B.

b) If $A = \begin{pmatrix} 1 & 3 \\ -4 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -2 & 1 \\ 3 & 2 \end{pmatrix}$ then verify that

$(A + B)^T = A^T + B^T$ and $(AB)^T = B^T A^T$. [2+3]

15. Without expanding the determinant prove that

a) $\begin{vmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{vmatrix} = 0$

b) $\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = \begin{vmatrix} a^2 & bc & a \\ b^2 & ca & b \\ c^2 & ab & c \end{vmatrix}$ [2+3]

16. If $A = \begin{pmatrix} 1 & 2 & -1 \\ 2 & 0 & 1 \\ 0 & 3 & -1 \end{pmatrix}$

i. Find the cofactors of each element of A. [2]

ii. Find adjoint of A. [1]

iii. Does the inverse of matrix A exist? If exists, find it. [1+1]

17. a) Define indeterminate forms. Evaluate $\lim_{x \to 2} \frac{x^2-4x+4}{x^2+3x-10}$

b) Evaluate: $\lim_{x \to \infty} (\sqrt{x} - \sqrt{x-3})$ [3+2]

18. a) Evaluate: $\lim_{x \to a} \frac{\sqrt{2x} - \sqrt{3x-a}}{\sqrt{x} - \sqrt{a}}$

b) Evaluate: $\lim_{x \to 2} \frac{2x-4}{\tan(x-2)}$ [3+2]

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

b) Evaluate: $\lim_{x \to 0} \frac{1-\cos ax}{1-\cos bx}$ [3+2]

Group 'C'

Long Answer Questions. **[8 × 3 = 24]**

20. a) Write the converse, inverse, negation and contrapositive along with their truth values of the statement, "If 5 is not an even number, then 10 is an even number." [4]

    b) Define subset of a set. If M and N be two subsets of a universal set U then prove that:

    i) $\overline{M \cup N} = \bar{M} \cap \bar{N}$

    ii) $M \subseteq N \Rightarrow \bar{N} \subseteq \bar{M}$ [1+1.5+1.5]

21. Prove that:

    a) $\begin{vmatrix} a+x & b & c \\ a & b+y & c \\ a & b & c+z \end{vmatrix} = xyz\left(1+\frac{a}{x}+\frac{b}{y}+\frac{c}{z}\right)$

    b) $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$ [4+4]

22. a) Evaluate: $\lim_{x \to y} \frac{x\cos y - y\cos x}{x-y}$ [4]

    b) If $f(x) = \frac{cx+d}{x-1}$, $\lim_{x \to 0} f(x) = 2$ and $\lim_{x \to \infty} f(x) = 5$, find the value of f(4). [4]

- The End -