M.Sc. MATHEMATICS
FOURTH SEMESTER
GENERAL MATHEMATICS
MSM-406 (MDC)
(Use separate answer scripts for Objective & Descriptive)

Duration: 3 hrs.   **Full Marks: 70**

(**PART-A : Objective**)

Time: 20 min.   Marks: 20

Choose the correct answer from the following: *1x20=20*

1. Which of the following is true?
   a. Determinant of a unit matrix is 1.
   b. If there are two identical rows or columns in a matrix, then determinant of the matrix is 1.
   c. A diagonal matrix whose all the diagonal matrix are unity is called null matrix.
   d. None of these.

2. A function $f : A \to A$ such that $f(x) = x, x \in A$ is called:
   a. Algebraic function   b. Rational function
   c. Identity function   d. None of these

3. Which of the following is true for a set A?
   a. $A \cup A = \emptyset$ b. $A \cap A = \emptyset$
   c. $A \cap A = A$ d. None of these

4. A function which is both one one and onto is called:
   a. Injective function   b. Surjective function
   c. Bijective function   d. None of these

5. A relation R on a set A is called equivalence relation if it is:
   a. Reflexive   b. Symmetric
   c. Transitive   d. All of the above

6. The minor of -1 in $\begin{pmatrix} 2 & -1 \\ 5 & -2 \end{pmatrix}$ is:
   a. 5   b. -5 c. 2   d. -2

7. Which of the following is true for a matrix A?
   a. $A^{-1} = \frac{adjA}{|A|}, |A| = 0$ b. $A^{-1} = \frac{|A|}{adjA}, |A| \neq 0$
   c. $A^{-1} = adjA$ d. $A^{-1} = \frac{adjA}{|A|}, |A| \neq 0$

8. Let $A = \{0,1,2,3\}$. Consider the relation $R = \{(0,0), (1,1), (2,2), (3,3)\}$. Then R is:
   a. Reflexive   b. Symmetric
   c. Transitive   d. All of the above

9. Equation of X-axis is:
   a. $Y = 0$ b. $X = 0$
   c. $Y = K$ d. $X = K$

10. Gradient form of a Straight line is:
   a. $Y = mx$ b. $Y = mx + c$
   c. $Y = 0$ d. $Y = 0$

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7. What is the definition of Continuity? Is $f(x) = \begin{cases} -x, x < 0 \\ x, 0 \leq x \leq 1 \\ 2-x, x > 1 \end{cases}$

   continuous at $x = 0$ and $x = 1$ 3+7=10

8. **a.** Prove that: 6+2+2=10

   $$\frac{\cos^2 A}{\cos A - SinA} + \frac{Sin^2 A}{SinA - \cos A} = \cos A + \sin A$$

   b. What is value of $Sin\ 30^0$, $\cos\ 60^0$, $\tan\ 90^0$

   = = *** = =

11. If two lines of gradient m_1 and m_2 are parallel, then:

a. $m_1 < m_2$ b. $m_1 > m_2$
c. $m_1 = m_2$ d. $m_1 \neq m_2$

12. $\dfrac{d}{dx}(x^n) = ?$

a. x b. x^2 c. x^3 d. nx^{n-1}

13. $\int (x^n)dx = ?$

a. $\dfrac{x^{n+1}}{n+1}$ b. $\dfrac{x^n}{n}$

c. $\dfrac{x^{n+1}}{n-1}$ d. $\dfrac{x^{n+1}}{n}$

14. $\dfrac{d}{dx}(\log x) = ?$

a. $\dfrac{1}{x^2}$ b. $\dfrac{1}{x}$

c. x d. $x - 1$

15. $\dfrac{d}{dx}(f(x) + g(x)) = ?$

a. $\dfrac{d}{dx}f(x) - \dfrac{d}{dx}g(x)$ b. $\dfrac{d}{dx}f(x) = \dfrac{d}{dx}g(x)$

c. $\dfrac{d}{dx}f(x) + \dfrac{d}{dx}g(x)$ d. $\dfrac{d}{dx}f(x) > \dfrac{d}{dx}g(x)$

16. A function f(x) is continuous at a point a if:

a. $\lim\limits_{x \to a} f(x) = f(a)$ b. $\lim\limits_{x \to a} f(x) \neq f(a)$

c. $\lim\limits_{x \to a} f(x) > f(a)$ d. $\lim\limits_{x \to a} f(x) < f(a)$

17. In $\lim\limits_{x \to a} f(x) = f(a)$

a. x fixed point   b. x moving point and a fixed point
c. a moving point   d. none

18. $\int (\cos x)dx = ?$

a. $\sin x$ b. $\cos x$ c. $\tan x$ d. $\cot x$

19. $\int (2)dx = ?$

a. 2 b. -2 c. $3x$ d. $2x$

20. In the equation of a straight line $y = mx + c$, m is

a. slope   b. gradient
c. point   d. none of the above

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(PART-B : Descriptive)

Time : 2 hrs. 40 min.   Marks : 50

[Answer question no.1 & any four (4) from the rest]

1. Find the derivative of the following: 5+5=10

a) $\dfrac{d}{dx}(\sin x + x^2)$

b) $\dfrac{d}{dx}\left(\dfrac{1 - \cos x}{1 + \cos x}\right)$

2. a. Define the following: 2+3+5=10
   (i) Union of two sets   **(ii)** Difference of two sets
   b. Prove the following by using Venn diagram:
   $$A \cup (B \cup C) = (A \cap B) \cup (A \cap C)$$
   c. Define composition of functions. Prove that if f and g are one one
   functions, then fog is also one one function.

3. a. Find the determinant of the following: 4+6=10

(i) $\begin{vmatrix} 0 & -h & g \\ h & 0 & -f \\ -g & f & 0 \end{vmatrix}$ **(ii)** $\begin{vmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{vmatrix}$

b. Show that $\begin{vmatrix} 1+x & y & z \\ x & 1+y & z \\ x & y & 1+z \end{vmatrix} = 1 + x + y + z.$

4. Find the limit of: 4+6=10

a. $\lim\limits_{x \to a} \dfrac{x^3 - 8}{x^2 - 4}$

b. $\lim\limits_{x \to a} \dfrac{\sqrt{1+x} - \sqrt{1+x}}{x}$

5. What is the distance of the point (a,b) from X-axis? Find the locus of the   2+8=10
point which is equidistant from the point (1,1) and (-1,-1).

6. a. If $A = \begin{pmatrix} 2 & 3 & 0 \\ 2 & 2 & 0 \\ 1 & 3 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 & 1 \\ 2 & 2 & -2 \\ 5 & 5 & 5 \end{pmatrix}$, then find AB and BA.   4+6=10

b. Find the inverse of the following matrix:

$$A = \begin{pmatrix} 4 & -5 & -11 \\ 1 & -3 & 1 \\ 2 & 3 & -7 \end{pmatrix}$$

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