

**B.Sc. MATHEMATICS
FIRST SEMESTER
FOUNDATION MATHEMATICS-I
BMT-MDC-913**
(USE OMR FOR OBJECTIVE PART)

2025/12

**SET
A**

Duration : 2 hrs.

Full Marks : 50

Time : 20 mins.

(Objective)

Marks : 15

Choose the correct answer from the following:

1×15=15

1. Let $|A| = n$ and $|B| = m$, then the total number of relations from A to B is
 - a. nm
 - b. $n + m$
 - c. 2^{nm}
 - d. 2^{n+m}
2. For any integer a , the $\gcd(a, 0)$ is
 - a. 0
 - b. $|a|$
 - c. $-a$
 - d. a
3. The remainder of $111^{333} + 333^{111}$ upon divided by 7 is
 - a. 0
 - b. 1
 - c. 2
 - d. None of these
4. When forces act at the same time and at the same point, they are called
 - a. Concurrent force
 - b. Equilibrium force
 - c. Rectilinear force
 - d. None of these
5. The moment of the couple is
 - a. The product of either of the forces of a couple by the parallel distance between them.
 - b. The product of either of the forces of a couple by the equal distance between them.
 - c. The product of either of the forces of a couple by the perpendicular distance between them.
 - d. None of these
6. If $f(x) = x + |x|$, $f(-3) = ?$
 - a. 6
 - b. 0
 - c. -6
 - d. None of these
7. The remainder of $4(29!) + 5!$ divided by 31 is
 - a. 0
 - b. 1
 - c. 2
 - d. None of these
8. If $f(x) = 4x + 5, -5 \leq x \leq 7$, then range of the function is
 - a. $[-15, 33]$
 - b. $] -15, 33]$
 - c. $] -15, 33[$
 - d. None of these

9. The general form of differential equations of first order and degree is
- $M + N \frac{dx}{dy} = 0$, where M and N are some functions of x and y or constant.
 - $Mdx + Ndy = 0$, where M and N are some functions of x and y or constant.
 - $M \frac{dy}{dx} - N = 0$, where M and N are some functions of x and y or constant.
 - None of these
10. Solution of the differential equation $(1+x)ydx + (1-y)xdy = 0$ is
- $xy = c.e^{y-x}$, c arb constant
 - $xy = c.e^{y+x}$, c arb constant
 - $x/y = c.e^{y-x}$, c arb constant
 - None of these
11. The unit vector in the direction of vector $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$ is
- $\frac{\sqrt{14}}{14}(2\hat{i} + 3\hat{j} + \hat{k})$
 - $-2\hat{i} - 3\hat{j} + \hat{k}$
 - $\frac{1}{\sqrt{14}}(2\hat{i} + 3\hat{j} + \hat{k})$
 - None of these
12. Is the function $f(x) = \begin{cases} x, 0 \leq x \leq 1 \\ 2-x, 1 < x \leq 2 \end{cases}$ continuous at $x = 1$
- yes
 - no
 - Does not exist
 - None of these
13. If $f(x) = \frac{1}{1-x}$, $f[f\{f(x)\}] = ?$
- $-x$
 - x
 - $1/x$
 - None of these
14. The direction cosines of $\hat{i} + \hat{j} - 2\hat{k}$
- $(1, 1, -2)$
 - $(-1, -1, 2)$
 - $(\frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, -\frac{2}{\sqrt{6}})$
 - $(-\frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}})$
15. Derivative of e^{2x} is
- e^{2x}
 - $2e^{2x}$
 - $e^{\cos x}$
 - $e^{\sin x} \cos x$
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Time : 2hr. 40mins.

(Descriptive)

Marks : 35

[Answer question no.1 & any three (3) from the rest]

1. a. Find the common solution of 6+4=10
- $$\begin{aligned}x &\equiv 1 \pmod{7} \\x &\equiv 6 \pmod{10} \\x &\equiv 2 \pmod{11}\end{aligned}$$

b. Find the last two digits of 3^{256} .

2. a. Find the perpendicular distance of a point $A(2, 3)$ from the line 2+4+4=10
- $$3x - 4y + 1 = 0.$$

b. Find the angle between the line $2x + y - 3 = 0$ and $x + 3y + 2 = 0$.

c. Prove that the four points of intersection of the lines $2x - y + 1 = 0$ & $x - 2y + 3 = 0$ with the axes lie on a circle. Find its center and radius.

3. Write the definition of Coplanar force, Moments, Couple, Equilibrium of force and Rectilinear motion under uniform acceleration. 2×5=10

4. a. Find the unit vector in the direction of the sum of the vectors 4+3+3=10
- $$\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k} \text{ and } \vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}.$$

b. Show that the points $A(2\hat{i} - \hat{j} + \hat{k})$, $B(\hat{i} - 3\hat{j} - 5\hat{k})$, $C(3\hat{i} - 4\hat{j} - 4\hat{k})$ are the vertices of a right-angled triangle.

c. If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that the vector $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular.

5. What do you mean by Function? Find the domain of following function 2+4+4=10

(a) $f(x) = \sqrt{x^2 - 5x + 6}$

(b) $f(x) = \frac{1}{\sqrt{(2-x)(x-3)}}$

6. a. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively, in the ratio 2:1 (i) Internally (ii) Externally.
- b. Find the unit vector perpendicular to each of the vectors $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$, where $\vec{a} = 3\hat{i} - 7\hat{j} + 7\hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$.
- c. Prove that - For any two vectors $\vec{a}$ and $\vec{b}$, $|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|$.

4+3+3
=10

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