MATHEMATICS-1A

MARKS: 75 **(JR.INTER)** **TIME: 3 HOURS**

No. of Questions- 24 **MODEL PAPER-2**

SECTION-A

Note : This question paper consists of three Sections – A, B and C.

SECTION – A **10 × 2 = 20**

I. Very Short Answer Type questions :

(i) Answer all questions.

(ii) Each question carries two marks.

1. If A = { −2, −1, 0, 1, 2} and f : A → B is a surjection defined by $f(x) = x^2 + x + 1$, then find B.

2. Find the domain of the real valued function $f(x) = \frac{1}{6x - x^2 - 5}$.

3. If $\begin{bmatrix} x-1 & 2 & 5-y \\ 0 & z-1 & 7 \\ 1 & 0 & a-5 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 7 \\ 1 & 0 & 0 \end{bmatrix}$

   then find the values of x, y, z and a.

4. Find the determinant of the matrix $\begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$.

5. If $\bar{a} = \bar{i} + 2\bar{j} + 3\bar{k}$ and $\bar{b} = 3\bar{i} + \bar{j}$, then find the unit vector in the direction of $\bar{a} + \bar{b}$.

6. Find the vector equation of the line joining the points $2\bar{i} + \bar{j} + 3\bar{k}$ and $-4\bar{i} + 3\bar{j} - \bar{k}$.

7. If the vectors $2\bar{i} + \lambda\bar{j} - \bar{k}$ and $4\bar{i} - 2\bar{j} + 2\bar{k}$ are perpendicular to each other, find 'λ'.

8. Find cosine function whose period is 7.

9. If $A + B = \frac{\pi}{4}$, then prove that $(1 + \tan A)(1 + \tan B) = 2$.

10. If $\sinh x = \frac{3}{4}$, find $\cosh(2x)$ and $\sinh(2x)$.

SECTION – B

5 × 4 = 20

II. Short Answer Type questions :

(i) Answer any five questions.

(ii) Each question carries four marks.

11. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then show that $A^2 - 4A - 5I = 0$.

12. If $\bar{i}$, $\bar{j}$, $\bar{k}$ are unit vectors along the positive directions of the co-ordinate axes, then show that the four points

$4\bar{i} + 5\bar{j} + \bar{k}$, $-\bar{j} - \bar{k}$, $3\bar{i} + 9\bar{j} + 4\bar{k}$ and $-4\bar{i} + 4\bar{j} + 4\bar{k}$ are coplanar.

13. Prove that the angle 'θ' between any two diagonals of a cube is given by $\cos\theta = \frac{1}{3}$.

14. If $\tan 20^\circ = \lambda$, then show that $\frac{\tan 160^\circ - \tan 110^\circ}{1 + \tan 160^\circ \cdot \tan 110^\circ} = \frac{1-\lambda^2}{2\lambda}$.

15. Show that $\cos^4\left(\frac{\pi}{8}\right) + \cos^4\left(\frac{3\pi}{8}\right) + \cos^4\left(\frac{5\pi}{8}\right) + \cos^4\left(\frac{7\pi}{8}\right) = \frac{3}{2}$.

16. Prove that $\cos 12^\circ + \cos 84^\circ + \cos 132^\circ + \cos 156^\circ = -\frac{1}{2}$.

17. If $\cot\frac{A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2} = 3 : 5 : 7$, then show that $a : b : c = 6 : 5 : 4$.

SECTION – C

5 × 7 = 35

III. Long Answer Type questions :

(i) Answer any five questions.

(ii) Each question carries seven marks.

18. If $f = \{(4, 5), (5, 6), (6, -4)\}$ and $g = \{(4, -4), (6, 5), (8, 5)\}$, then find

(i) $f + g$ (ii) $f + 4$ (iii) fg (iv) $\frac{f}{g}$ (v) $|f|$ (vi) $\sqrt{f}$ (vii) f^2.

19. (i) If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then show that $A^{-1} = A^3$.

(ii) Find the adjoint and the inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$.

20. Solve the system of equations

$2x - y + 3z = 8$, $-x + 2y + z = 4$, $3x + y - 4z = 0$ by Crammer's method.

21. Find the vector equation of the plane passing through the points $4\bar{i} - 3\bar{j} - \bar{k}$, $3\bar{i} + 7\bar{j} - 10\bar{k}$ and $2\bar{i} + 5\bar{j} - 7\bar{k}$ and show that the point $\bar{i} + 2\bar{j} - 3\bar{k}$ lies in the plane.

22. Find the vector area and the area of the parallelogram having $\bar{a} = \bar{i} + 2\bar{j} - \bar{k}$ and $\bar{b} = 2\bar{i} - \bar{j} + 2\bar{k}$ as adjacent sides.

23. If A, B, C are angles in a triangle, then prove that

$\cos A + \cos B - \cos C = -1 + 4 \cos \frac{A}{2} \cos \frac{B}{2} \sin \frac{C}{2}$.

24. If $a = 13$, $b = 14$, $c = 15$ show that $R = \frac{65}{8}$, $r = 4$, $r_1 = \frac{21}{2}$, $r_2 = 12$ and $r_3 = 14$.

****