MATHEMETICS ,PAPER – IA

(English version)

MODEL QUESTION PAPER

(For the Academic year 2021-22 only)

Time : 3 Hours **Max. Marks: 75**

Note : This question paper consist of three section A, B and C.

SECTION – A

I. Very short answer type questions.

i. Answer ANY TEN question.

ii. **Each question carriers 2 marks.** $10\times 2 = 20$

1. If A = $\left\{0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\right\}$ and F : A→ B is a surjection defined by f(x) = cos x, then find B,
2. Find the domain of the real valued function f(x) = $\frac{\sqrt{3+x}+\sqrt{3-x}}{x}$
3. If A = $\begin{bmatrix} 2 & 3 & -1 \\ 7 & 8 & 5 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & 0 & 1 \\ 2 & -4 & -1 \end{bmatrix}$
4. Construct 3× 2 matrix whose elements are defined by $a_{ij} = \frac{1}{2}|i - 3j|$
5. If $\begin{bmatrix} 2 & -4 \\ -5 & 3 \end{bmatrix}$ then find A+A' and AA'
6. If A = $\begin{bmatrix} 2 & -4 \\ -1 & k \end{bmatrix}$ and $A^2 = 0$, then find the value of k.
7. I f$\bar{a} = \bar{2i} + 5\bar{j} + \bar{k} and \bar{b} = 4\bar{i} + m\bar{j} + n\bar{k}$ are collinear, then find m and n.
8. Find the vector equation of the line passing through the point $2\bar{i} + 3\bar{j} + \bar{k}$ and prarelle to the vector $4\bar{i} - 2\bar{i} + 3\bar{k}$.
9. Find the vector equation of the line joining the points $2i + j + k.$ and $- 4i + 3j - k.$
10. If $\bar{a} = \bar{i} + 2\bar{j} - 3\bar{k}$ and $\bar{b} = 3\bar{i} - \bar{j} + 2\bar{k}$ then show that $\bar{a} + \bar{b}$ and $\bar{a} - \bar{b}$ are perpendicular to each other,
11. If$|P| = 2, |q| = 3 \text{ and } (p, q) = \frac{\lambda}{6}$, then find $|p \times q|^2$
12. Evaluate , $\sin^2 82^{\frac{1}{2}} - \sin^2 22^{\frac{1}{2}}$
13. Find the period of the function defined by f (x) = tan $(x + 4x + 9x + \ldots + n^2x)$
14. If $\sin\sinh x = \frac{3}{4}$, find cosh (2x) and (2x).
15. If $\cosh x = \sec\theta$ then provide that $\tanh^2 \frac{x}{2} = \tan^2 \frac{\theta}{2}$.

SECTION - B

II. Short answer type questions, $5\times 4 = 20$

i. Answer any FIVE questions.

ii. Each question carries four marks.

16. If $\theta - \phi = \frac{\pi}{2}$ then show the $\begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}\begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

17. Show that A = $\begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$ is non – singular and find A^{-1}

18. If A = $\begin{bmatrix} 0 & 1 & 3 \\ 3 & 3 & 4 \\ 4 & 5 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} -1 & 2 & 3 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$, find B – A and 4A – 5B

19. Let ABCDEF be regular hexagone with centre O, show that $\overline{AB}+\overline{AC}+\overline{AD}+\overline{AE}+\overline{AF}+ = \overline{3AD}+\overline{6AO}$.

20. If a,b,c are non – coplanar vector prove that -a +4b-3c , 3a+2b = 5c ,-3a + 2b + c are coplanar

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

22. Find the unit vector perpendicular both $\bar{i} + \bar{j} + \bar{k}$ and $\overline{2i} + \bar{j} + \overline{3k}$

23. Prove that $\sin^4\left(\frac{\pi}{8}\right) + \sin^4\left(\frac{3\pi}{8}\right) + \sin\left(\frac{5\pi}{8}\right) + \sin^4\left(\frac{7\pi}{8}\right) = {}^3/_2$

24. Find the range of 7 cos x – 24 sin x + 5

25. Prove that $\frac{\cosh x}{1-\tanh\ x} + \frac{\sinh x}{1-\coth\ x}$ = sin h x + coth x for $x \neq 0$,

26. Prove that cot $\frac{A}{2}$ + cot $\frac{B}{2}$ + cot $\frac{C}{2}$ = $\frac{s^2}{\Delta}$

27. If $\sin\theta = \frac{a}{b+c}$ then show that $\cos\theta$ $\frac{2\sqrt{bc}}{b+c}$ cos $\frac{A}{2}$

SECTION – C

III. Long Answer type question $5\times 7 = 35$

i. Anwer any FIVE questions.

ii. Each question carries seven marks.

28. If f = $\{(1,2),(2,-3),(3,-1)\}$ then find (i) $2f$ (ii) $2+f$ (iii) f^2 (iv) $\sqrt{f}$

29. If A = $\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ then find A^3

30. Solve the following system of equation by Cramer's rule

$x+y+z=1, 2x+2y+3z=6, x+4y+9z=3$

31. Solve the following system of equation by Matrix Inversion method

$2x-y+3z=9, x+y+z=6, x-y+z=2$

32. Find the vector equation of the plane passing through 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

33. If $\bar{a}=7\bar{i}-2\bar{j}+3\bar{k}, \bar{b}=2\bar{i}+8\bar{k}$ and $\bar{c}=\bar{i}+\bar{j}+\bar{k}$ then compute $\bar{a}\times\bar{b}, \bar{a}\times\bar{c}$ and $\bar{a}\times(\bar{b}\times\bar{c})$. Verify where the cross product is distributive over vector addition,

34. If [b c d] + [c a d] + [a b d] = [a b c]. Then show that the points with position vector a, b, c, and d are coplanar.

35. If A, B, C are angles in a triangles, then prove that

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

36. Show that cosA + cosB + cosC = $1+\frac{r}{R}$

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