166 (N)

(NEW SYLLABUS)

I

Total No. of Questions : 24
Total No. of Printed Pages : 4

Regd. No. | | | | | | | | | | |

Part-III

MATHEMATICS, Paper - I (A)

(English version)

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

Note : *This question paper consists of* ***three*** *sections* ***A, B*** *and* ***C.***

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SECTION - A **10×2=20**

I. *Very short answer type* questions.

(i) Answer **All** the questions.

(ii) Each question carries **TWO** marks.

1. If $f : R \to R$, $g : R \to R$ are defined by $f(x) = 3x - 1$, $g(x) = x^2 + 1$, then find $(fog)(2)$.

2. Find the domain of the function $f(x) = \frac{1}{\sqrt{1-x^2}}$, where f is real valued function.

3. Define Trace of the Matrix and

find the trace of the matrix $A = \begin{bmatrix} 1 & 3 & -5 \\ 2 & -1 & 5 \\ 2 & 0 & 1 \end{bmatrix}$

4. If $A=\begin{bmatrix}0 & 2 & 1\\ -2 & 0 & -2\\ -1 & x & 0\end{bmatrix}$ is a Skew symmetric matrix, then find x.

5. Find the vector equation of the Plane passing through the points $\bar{i}-2\bar{j}+5\bar{k}$, $-5\bar{j}-\bar{k}$ and $-3\bar{i}+5\bar{j}$.

6. Find the unit vector in the direction of the sum of the vectors $\bar{a}=2\bar{i}+2\bar{j}-5\bar{k}$ and $\bar{b}=2\bar{i}+\bar{j}+3\bar{k}$.

7. Let $\bar{a}=\bar{i}+\bar{j}+\bar{k}$ and $\bar{b}=2\bar{i}+3\bar{j}+\bar{k}$, find projection vector of $\bar{b}$ on $\bar{a}$ and its magnitude.

8. If $\sin\alpha+\operatorname{cosec}\alpha=2$, find the value of $\sin^n\alpha+\operatorname{cosec}^n\alpha$, $n\in Z$.

9. Find a sine function, whose period is $\frac{2}{3}$.

10. If $\cosh x=\sec\theta$, then prove that $\tanh^2\frac{x}{2}=\tan^2\frac{\theta}{2}$.

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SECTION - B

5×4=20

II. *Short answer type* questions.

(i) Answer **ANY FIVE** questions.

(ii) Each question carries **FOUR** marks.

11. Show that $\begin{vmatrix}b+c & c+a & a+b\\ a+b & b+c & c+a\\ a & b & c\end{vmatrix}=a^3+b^3+c^3-3abc$.

12. Find the point of intersection of the line $\bar{r} = 2\bar{a} + \bar{b} + t\left(\bar{b} - \bar{c}\right)$ and the plane $\bar{r} = \bar{a} + x\left(\bar{b} + \bar{c}\right) + y\left(\bar{a} + 2\bar{b} - \bar{c}\right)$, where $\bar{a}, \bar{b}$ and $\bar{c}$ are non-coplanar vectors.

13. Prove that angle in a semi-circle is a right angle by using Vector method.

14. Prove that $\sin^4 \frac{\pi}{8} + \sin^4 \frac{3\pi}{8} + \sin^4 \frac{5\pi}{8} + \sin^4 \frac{7\pi}{8} = \frac{3}{2}$.

15. Solve the equation $2\cos^2\theta + 11\sin\theta = 7$ and write general solution.

16. Prove that $\cos^{-1}\left(\frac{4}{5}\right) + \sin^{-1}\left(\frac{3}{\sqrt{34}}\right) = \tan^{-1}\left(\frac{27}{11}\right)$.

17. In a ΔABC, if $a : b : c = 7 : 8 : 9$, then find $\cos A : \cos B : \cos C$.

SECTION - C $5 \times 7 = 35$

III. *Long answer type questions.*

(i) Answer **ANY FIVE** questions.

(ii) Each question carries **SEVEN** marks.

18. Let $f : A \rightarrow B$, $g : B \rightarrow C$ are bijections, then prove that $gof : A \rightarrow C$ is a bijection.

19. By Mathematical Induction, show that $49^n + 16n - 1$ is divisible by 64 for all positive Integer n.

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20. If $A=\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$ is a non -singular matrix,

then show that A is invertiable and $A^{-1}=\dfrac{\text{Adj}\,A}{\det A}$.

21. Solve the following equations by using Cramer's rule -

$2x-y+3z=9$

$x+y+z=6$

$x-y+z=2$.

22. If $\bar{a}=\bar{i}-2\bar{j}+3\bar{k},\ \bar{b}=2\bar{i}+\bar{j}+\bar{k},\ \bar{c}=\bar{i}+\bar{j}+2\bar{k}$,

then find $\left|(\bar{a}\times\bar{b})\times\bar{c}\right|$ and $\left|\bar{a}\times(\bar{b}\times\bar{c})\right|$.

23. In triangle ABC, prove that

$$\cos\frac{A}{2}+\cos\frac{B}{2}+\cos\frac{C}{2}=4\cos\left(\frac{\pi-A}{4}\right)\cos\left(\frac{\pi-B}{4}\right)\cos\left(\frac{\pi-C}{4}\right)$$

24. In ΔABC, if $r_1=8,\ r_2=12,\ r_3=24$; find a, b and c.

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