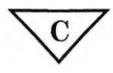
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Total No. of Questions - 24

Total No. of Printed Pages - 4

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Part - III

MATHEMATICS, Paper - I (A)

(Algebra, Vector Algebra and Trigonometry)

(English Version)

Time: 3 Hours

Max. Marks: 75

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

SECTION A

 $10 \times 2 = 20$

- Very short answer type questions.
 - i) Answer all questions.
 - ii) Each question carries two marks:
- 1. If $A = \{-2, -1, 0, 1, 2\}$ and $f: A \to B$ is a surjection defined by $f(x) = x^2 + x + 1$, then find B.
- 2. Find the domain of the real valued function

$$f(x) = Log_e(x^2 - 4x + 3).$$

- 3. Solve the following system of homogeneous equations x y + z = 0, x + 2y z = 0, 2x + y + 3z = 0.
- 4. Define Triangular Matrix.
- 5. Let $\overline{a} = \overline{i} + 2\overline{j} + 3\overline{k}$ and $\overline{b} = 3\overline{i} + \overline{j}$. Find the unit vector in the direction of $\overline{a} + \overline{b}$.

- 6. Find the vector equation of the line joining the points $2\overline{i} + \overline{j} + 3\overline{k}$ and $-4\overline{i} + 3\overline{j} \overline{k}$.
- 7. If the vectors $\lambda \, \overline{i} 3\overline{j} + 5\overline{k}$ and $2\lambda \, \overline{i} \lambda \, \overline{j} \overline{k}$ are perpendicular to each other, find λ .
- 8. If $A + B = \frac{\pi}{4}$, then prove that (1 + TanA)(1 + TanB) = 2
- 9. Eliminate ' θ ' from $x = a \cos^3 \theta$, $y = b \sin^3 \theta$.
- 10. If Sinh x = 3, then show that $x = Log_e(3 + \sqrt{10})$.

SECTION B

 $5 \times 4 = 20$

- Short answer type questions.
 - Attempt any five questions.
 - ii) Each question carries four marks.
- 11. If $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ and $E = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$ then show that $(aI + bE)^3 = a^3I + 3a^2bE \text{ where } I \text{ is identity matrix of order } 2.$
- 12. Show that the line joining the pair of points $6\overline{a} 4\overline{b} + 4\overline{c}$, $-4\overline{c}$ and the line joining the pair of points $-\overline{a} 2\overline{b} 3\overline{c}$, $\overline{a} + 2\overline{b} 5\overline{c}$ intersect at the point $-4\overline{c}$ when \overline{a} , \overline{b} , \overline{c} are non-coplanar vectors.

Find λ in order that the four points

$$A(3,2,1), B(4,\lambda,5), C(4,2,-2)$$
 and $D(6, 5,-1)$ be coplanar.

14. If none of the denominators is zero, prove that

$$\left(\frac{Cos\,A + Cos\,B}{Sin\,A - Sin\,B}\right)^n + \left(\frac{Sin\,A + Sin\,B}{Cos\,A - Cos\,B}\right)^n = \begin{cases} 2 & Cot^n\left(\frac{A - B}{2}\right), \text{ if } n \text{ is even} \\ 0 & \text{, if } n \text{ is odd} \end{cases}$$

- 15. If θ_1 , θ_2 are solutions of the equation $a \cos 2\theta + b \sin 2\theta = e$, $Tan\theta_1 \neq Tan\theta_2$ and $a+c\neq 0$, then find the values of
 - i) $Tan\theta_1 + Tan\theta_2$ ii) $Tan\theta_1 \cdot Tan\theta_2$
- 16. Prove that $Sin^{-1}\frac{4}{5} + Sin^{-1}\frac{7}{25} = Sin^{-1}\frac{117}{125}$
- 17. If $a = (b-c) \operatorname{Sec}\theta$, then prove that $\operatorname{Tan}\theta = \frac{2\sqrt{bc}}{b-c} \operatorname{Sin} \frac{A}{2}$.

SECTION C

 $5 \times 7 = 35$

- III. Long answer type questions.
 - Attempt any five questions. i)
 - Each question carries seven marks.
- 18. If $f: A \to B$, $g: B \to C$ are bijections, then prove that $(gof)^{-1} = f^{-1}og^{-1}$
- 19. Using Mathematical induction, for all $n \in N$, show that

$$a+(a+d)+(a+2d)+\dots n$$
 upto n terms $=\frac{n}{2}[2a+(n-1)d]$

20. Show that
$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

- 21. Solve the following system of equations by using Matrix inversion method. 2x y + 3z = 9, x + y + z = 6, x y + z = 2
- 22. If $\overline{a} = \overline{i} 2\overline{j} + 3\overline{k}$, $\overline{b} = 2\overline{i} + \overline{j} + \overline{k}$, $\overline{c} = \overline{i} + \overline{j} + 2\overline{k}$ then find $|(a \times b) \times c|$ and $|a \times (b \times c)|$.
- 23. If A+B+C=2S, then prove that $Sin\left(S-A\right)+Sin\left(S-B\right)+SinC=4 \ Cos\left(\frac{S-A}{2}\right)Cos\left(\frac{S-B}{2}\right)Sin\frac{C}{2}$
- 24. If $r_1=2$, $r_2=3$, $r_3=6$ and r=1 then prove that $\alpha=3$, b=4 and c=5.