



LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – MATHEMATICS

FIRST SEMESTER – APRIL 2025

UMT1MC01 – ALGEBRA



Date: 23-04-2025

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A - K1& K2 (CO1)

Q.No	Levels	Answer ALL the Questions (10 x 2 = 20)
1	K1	Transform the equation $2x^4 - 5x^2 + 3x - 4 = 0$ into one in which the leading coefficient be one.
2		Find the quotient and remainder when $3x^3 + 8x^2 + 8x + 12 = 0$ is divided by $x - 4$.
3		Find the sum of the cubes of the roots of the equation $x^5 - x^2 - x - 1 = 0$.
4		State Sturm's theorem of unequal roots.
5		Find the sum and product of the eigen values of $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$.
6	K2	Find the eigen values of the $A = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$.
7		Compute $\phi(18)$.
8		State De Gua's rule.
9		If $-1 < x < 1$, then $\log(1 + x) = \dots\dots\dots$
10		Write the expansion of e^x and e^{-x} .

SECTION B- K3& K4 (CO2)

		Answer ALL the Questions (4 x 10 = 40)
11	K3	Find the equation whose roots are the roots of $x^5 + 4x^3 - x^2 + 11 = 0$, each diminished by 3. [OR]
12		If α, β, γ are the roots of the equation $x^3 + ax^2 + bx + c = 0$ form the equation whose roots are $\alpha\beta, \beta\gamma, \gamma\alpha$.
13		Find the eigen values and eigen vectors of $A = \begin{pmatrix} 7 & 0 & -2 \\ 0 & 5 & -2 \\ -2 & -2 & 6 \end{pmatrix}$. [OR]
14		Form the equation whose roots are $-\frac{3}{2}, 3, \frac{1}{7}$.
15	K4	State and Prove Lagrange's theorem. [OR]
16		Find the inverse of the matrix $A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 0 & 3 \\ 4 & -3 & 8 \end{pmatrix}$.
17		If p is a prime, then prove $(p - 1)! \equiv -1 \pmod{p}$. [OR]
18		Show that if $x > 0$, $\log x = \frac{x-1}{x+1} + \frac{1}{2} \frac{x^2-1}{(x+1)^2} + \frac{1}{3} \frac{x^3-1}{(x+1)^3} + \dots$

SECTION C – K5 & K6 (CO3)

Answer ALL the Questions (2 x 20 = 40)		
19	K5	a) Form the cubic equation two of whose roots are $3, 1 + \sqrt{2}$. b) Increase the roots of the equation $x^4 + 12x^3 + 56x^2 + 20x + 9 = 0$ by 3 and hence solve the equation.
20		[OR] a) If $\alpha, \beta, \gamma, \delta$ be the roots of the equation $x^4 - 7x^3 + 8x^2 - 5x + 10 = 0$ find the value of $(\alpha^2 + 2)(\beta^2 + 2)(\gamma^2 + 2)(\delta^2 + 2)$. b) Solve the equation $x^4 + 20x^3 + 143x^2 + 430x + 462 = 0$ by removing its second term.
21	K6	Diagonalize the matrix $\begin{pmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$.
22		[OR] a) State and prove Fermat's theorem. b) Sum the series $1 + \frac{1+3}{2!} + \frac{1+3+3^2}{3!} + \frac{1+3+3^2+3^3}{4!} + \dots$

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