Code: 21500 **B.Sc. Semester – 5 CBCS (NEW)**

MAT-CC-505: Advanced Numerical Methods and Laplace Transformation

Time: 2 ½ Hours **Total Marks: 70**

Note: Notations used are standard notations.

Q.1 (a) If α, β and γ are the roots of the equation $x^3 + px^2 + qx + r = 0$. Find the value of $\sum \alpha^2, \sum \alpha^2 \beta\gamma, \sum(\alpha - \beta), \sum \frac{1}{\alpha}$. [7]

(b) Solve: $6x^3 - 11x^2 - 3x + 2 = 0$ given that the roots are in harmonic progression. [7]

OR

Q.1 (a) Solve: $x^3 - 9x^2 + 26x - 24 = 0$ given that the roots are in arithmetic progression. [7]

(b) Discuss: Equation with real co-efficient and imaginary roots. [7]

Q.2 (a) Discuss: Ramanujan's method. [7]

(b) Use Muller's method to find root of the equation $x^3 - x - 1 = 0$ [7]

OR

Q.2 (a) Discuss: Horner's method. [7]

(b) Find the real root of the equation $xe^x = 1$ using secant method. [7]

Q.3 (a) Discuss: method of factorization. [7]

(b) Solve the equation by Gauss Jordan method $10x + y + z = 12, 2x + 10y + z = 13, x + y + 5z = 7$ [7]

OR

Q.3 (a) Discuss: Jacobi method of iteration. [7]

(b) Find the inverse of matrix $A = \begin{bmatrix} 2 & 2 & 5 \\ 0 & -1 & 2 \\ 1 & 3 & 1 \end{bmatrix}$ using Crout's method. [7]

Q.4 (a) State and prove Linearity of Laplace transformation. [7]

(b) Find $L\{t(\sqrt{t}e^{2t})\}$. [7]

OR

Q.4 (a) Find the Laplace transformation of $f(t)$ defined as $f(x) = \begin{cases} t\ ; 0 < t < 4 \\ 5\ ; \quad t > 4 \end{cases}$ [7]

(b) Find $L\{e^{-2t}(2\cos 5t - 3\sin 5t)\}$. [7]

Q.5 (a) If $L\{f(t)\} = \bar{f}(s)$ then prove that $L\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n}(\bar{f}(s))$, where $n = 1,2,3, \ldots\ldots$ [7]

(b) Find $L^{-1}\left(\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right)$. [7]

OR

Q.5 (a) Find inverse Laplace transformation using convolution: [7]

$$L^{-1}\left(\frac{s}{(s^2+4)^2}\right)$$

(b) If $L\{f(t)\} = \bar{f}(s)$ then prove that $L\left\{\int_0^t f(u)du\right\} = \frac{1}{s}\bar{f}(s)$. [7]
