Code No: 154BG **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, February - 2024
LAPLACE TRANSFORMS, NUMERICAL METHODS AND COMPLEX VARIABLES
(Common to EEE, ECE, EIE)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Find the Laplace transform of $f(t) = t\sin 2t$. [2]
b) State and prove the linearity property of Laplace transforms. [3]
c) Expalin the Regula-falsi method. [2]
d) Define forward and backward differences. [3]
e) Explain Trapezoidal rule to evaluate $\int_a^b f(x)\,dx$. [2]
f) Write R-K fourth order formula. [3]
g) Define the differentiability of a complex function. [2]
h) Explain Milne-Thomson method. [3]
i) State Cauchy residue theorem. [2]
j) Evaluate $\int_0^{1+i} z^2 dz$ along $y=x^2$. [3]

PART – B

(50 Marks)

2.a) Find the Laplace transform of $f(t) = 2e^{-3t}\sin t + 3e^t \sin 4t + 7\sqrt{t}$.
b) Explain the Laplace transform of a periodic function. [6+4]

OR

3. Solve by Laplace transform technique $\dfrac{d^2y}{dt^2} + 2\dfrac{dy}{dt} - 3y = \sin t,\ y = \dfrac{dy}{dt} = 0\ when\ t = 0.$ [10]

4.a) Find a real root of $x^3 - 5x + 3 = 0$ using bisection method.
b) Estimate the population in 1925 from the following table. [5+5]

Year x:	1891	1901	1911	1921	1931
Population y:	46	66	81	93	101

OR

5.a) Find a real root $x\tan x + 1 = 0$ using Newton-Raphson method.

b) Evaluate $f(10)$ given that $f(x) = 168, 192, 336$ at $x = 1, 7, 15$ respectively by using Lagrange's interpolation formula. [5+5]

6. Use (a) Trapezoidal rule (b) Simpson's 1/3rd rule and (c) Simpson's 3/8th rule to estimate $\int_0^2 e^{x^2} dx$. [10]

OR

7. Find $y(0.1), y(0.2)$ using Euler's modified formula given that $\frac{dy}{dx} = x^2 - y, y(0) = 1$. [10]

8. Prove that the function f(z) defined by $f(z) = \frac{x^3(1+i) - y^3(1-i)}{x^2 + y^2}, z \neq 0 \; and \; f(0) = 0$ is continuous and the Cauchy-Riemann equations are satisfied at the origin, yet $f^1(0)$ does not exists. [10]

OR

9. Determine p such that function $f(z) = \frac{1}{2}\log(x^2 + y^2) + i\tan^{-1}\left(\frac{px}{y}\right)$ be an analytic function. [10]

10. Evaluate $\int_C \frac{e^{2z}}{(z+1)^4} dz$ around $C: |z-1| = 3$. [10]

OR

11. Expand $f(z) = \frac{1}{z^2 - 4z + 3}$ in the region $1 < |z| < 3$. [10]

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