

**R18**

Code No: 154BG

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) Explain 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  $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t, y = \frac{dy}{dt} = 0$  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.

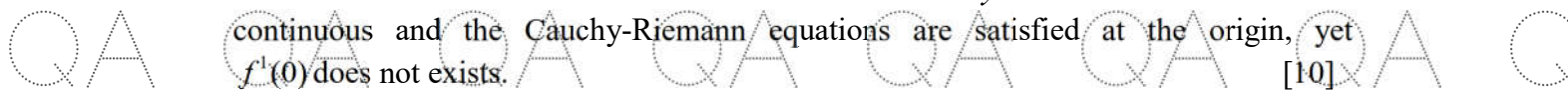
b) Evaluate  $f(10)$  given that  $f(x) = 168,192,336$  at  $x = 1,7,15$  respectively by using Lagrange's interpolation formula. [5+5]

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



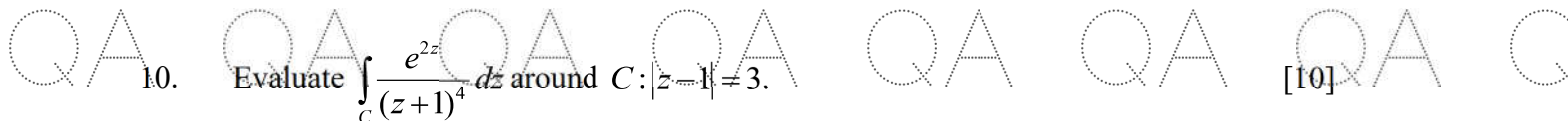
7. Find  $y(0.1), y(0.2)$  using Euler's modified formula given that  $\frac{dy}{dx} = x^2 - y, y(0) = 1$ . [10]

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  $f'(0)$  does not exist. [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]

