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Code No: 154BG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, November/December - 2020

LAPLACE TRANSFORMS, NUMERICAL METHODS AND COMPLEX VARIABLES

(Common to EEE, ECE, EIE)

Time: 2 hours **Max. Marks: 75**

Answer any Five Questions

All Questions Carry Equal Marks

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1.a) Solve the differential equation using Laplace transforms
$\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = e^{-t}; x(0) = 0, x'(0) = 1.$

b) Prove that $L^{-1}\{F(s)\} = f(t)$ and $f(0) = 0$ then $L^{-1}\{sF(s)\} = \frac{df}{dt}$ [10+5]

2.a) Find up to the four places of decimals the smallest root of the equation $e^{-x} = \sin x$ using Newton-Raphson method.

b) Fit a polynomial of second degree to the data points (2,3.07), (4,12.85), (6,31.47), (8,57.38) and (10,91.29).

c) Find the root of the equation $x \log_{10} x = 1.2$ using False position method. [5+5+5]

3. Evaluate the integral $\int_0^1 \frac{dx}{3+2x}$ using trapezoidal rule. [15]

4. Use Runge-Kutta method of order four to find y when $x = 0.6$ given that
$\frac{dy}{dx} = 1 + y^2, y(0) = 0.$ [15]

5. Given $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$. Compute $y(0.1)$ in steps of 0.02 using Euler's modified method. [15]

6.a) Prove that the function $f(z) = \sqrt{xy}$ is not analytic at the origin even though the C-R equations are satisfied there at.

b) If $f(z) = u + iv$ is an analytic function in a region R, prove that the curves $u(x, y) = c_1$, $v(x, y) = c_2$ form two orthogonal families. [8+7]

7.a) Evaluate $\oint_C \frac{e^z}{(z+1)^2} dz$, where C is the circle $|z - 3| = 3$.

b) Find the residue of $e^z \operatorname{cosec}^2 z$. [8+7]

8. Verify Cauchy's theorem for the integral of z^3 taken over the boundary of the rectangle with vertices -1, 1, 1+ i, -1+ i. [15]

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