NARASIMHA REDDY ENGINEERING COLLEGE
(Autonomous)
Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad
Accredited by NAAC with A Grade, Accredited by NBA

Course Title	:	Numerical Methods and Complex Variables
Course Code	:	23MA301
Year & Sem	:	II – I
Regulation	:	NR23 (NRCM – NR23 Autonomous Syllabus)

Previous Question Paper

1. Using Laplace transforms, solve $\dfrac{d^2 y}{dt^2} - 4\dfrac{dy}{dt} - 12y = e^{3t}$, given that $y(0) = 1$ and $y'(0) = -2$. [15]

2.a) Find a real root of the equation $x\log_{10} x = 1.2$ by Bisection method.

   b) Prove that $E\nabla = \Delta = \nabla E$ and $\nabla\Delta = \Delta - \nabla = \delta^2$. [8+7]

3. Using Lagrange's interpolation formula, find y(6) from the following table. [15]

x	3	5	7	9	11
y	6	24	58	108	74

4. Taking n = 6, evaluate the approximate value of $\int_4^{5.2} \log x\,dx$ by using a) Trapezoidal rule b) Simpson's $1/3^{rd}$ and c) Simpson's $3/8^{th}$ rules. [5+5+5]

5. Using Runge – Kutta method of fourth order, solve $\dfrac{dy}{dx} = \dfrac{y^2 - 2x}{y^2 + x}$, $y(0) = 1$. Compute y(0.1) and y(0.2). [15]

6.a) Find the value of 'p', if the function $f(z) = \dfrac{1}{2}\log(x^2 + y^2) + i\tan^{-1}\left(\dfrac{px}{y}\right)$ is analytic.

   b) Show that $u = e^{-x}(x\sin y - y\cos y)$ is harmonic. [8+7]

7.a) Using Cauchy's integral formula, evaluate $\oint \dfrac{e^z}{(z+2)(z+1)^2}\,dz$ where C is the circle $|z| = 3$.

   b) Determine the poles and residues of the function $f(z) = \dfrac{z+1}{z^2(z-2)}$. [7+8]

R18

Time: 2 hours   Max. Marks: 75

Answer any Five Questions
All Questions Carry Equal Marks
- - -

1.a) Find the Laplace transform of the function $f(t) = \begin{cases} t & 0 < t < a \\ -t + 2a & a < t < 2a \end{cases}$

b) Using Laplace transform, solve $(D^2 + 1)x = t\cos 2t$, given $x = 0, \frac{dx}{dt} = 0$ at $t = 0$.

[5+10]

2.a) By using method of false position, find the root of the equation $\cos x - xe^x = 0$.

b) Given $\sin 45^0 = 0.7071, \sin 50^0 = 0.7660, \sin 55^0 = 0.8192$ and $\sin 60^0 = 0.8660$. Find $\sin 52^0$ using Newton's interpolation formula.   [7+8]

3.a) Using Lagrange formula express the function $\frac{x^2 + 6x - 1}{(x^2 - 1)(x-4)(x-6)}$ as a sum of partial fractions.

b) Show $\Delta^2 x^{(m)} = m(m-1)x^{(m-2)}, m$ is a positive integer and $h = 1$ [10+5]

4. Using modified Euler's method, find an approximate value of y when $x = 1.3$ in steps of 0.1, given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}, y(1) = 1$.   [15]

5.a) Find the successive approximate solution of the differential equation $y' = y, y(0) = 1$ by Picard's method and compare it with exact solution.

b) Evaluate $\int_0^{\pi/2} e^{\sin x} dx$ taking $h = \pi/6$.   [7+8]

6.a) Find an analytic function whose imaginary part is $e^x(x \sin y + y \cos y)$.

b) Show that xy^2 cannot be real part of an analytic function.

c) Determine all the values of $(1 - i)^{1+i}$.   [5+5+5]

7.a) Evaluate $\oint_c \frac{dz}{z^2 + 6iz}$ where c is the circle $|z| = 1$.

b) Evaluate $\int_c (y - x - 3x^2 i)dz$, where c consists of the line segments from $z = 0$ to $z = i$ and the other from $z = i$ to $z = 1+i$.   [7+8]

8.a) State Cauchy integral formula.

b) If $0 < |z-1| < 2$ then express $f(z) = \frac{z}{(z-1)(z-3)}$ in a series of positive and negative powers of $(z-1)$.   [7+8]

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, August/September - 2021
LAPLACE TRANSFORMS, NUMERICAL METHODS AND COMPLEX VARIABLES
(Electrical and Electronics Engineering)

Time: 3 Hours   Max. Marks: 75

Answer any five questions
All questions carry equal marks
- - -

1.a) Find $L\left[te^{2t}\sin 3t\right]$

  b) Find Inverse Laplace transform of $\dfrac{3s+7}{(s^2-2s-3)}$.   [7+8]

2.a) Use convolution theorem to find $L^{-1}\left[\dfrac{s}{(s^2+4)^2}\right]$

  b) Find $L^{-1}\left[\dfrac{S+3}{S^2-10S+29}\right]$.   [8+7]

3.a) Find a real root of $xe^x=3$ using Regula falsi method.

  b) Using Newton's forward interpolation formula find the value of $f(1.6)$ if   [7+8]

x	1	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

4.a) Find a real root of the equation $x^3-3x+1=0$ using iterative method.

  b) Find y(43) if y(20) = 0.939, y(25) = 0.906, y(32) = 0.848 and y(49) = 0.56 using Lagrange's formula.   [7+8]

5.   Given $\dfrac{dy}{dx}=x+\sin y$ and y(0)=1 compute y(0.2) and y(0.4) with h=0.2 using Euler's modified method.   [15]

6.a) Find the analytic function whose real part is $e^{-x}(x\sin y-y\cos y)$

  b) If f(z) is an analytic function then show that $\left(\dfrac{\partial^2}{\partial x^2}+\dfrac{\partial^2}{\partial y^2}\right)|f(z)|^2=4|f'(z)|^2$.   [7+8]

7.a) Expand $\dfrac{z}{(z+2)(z+1)}$ about z=2.

  b) The function defined by f(z) = $\dfrac{x^3(1+i)-y^3(1-i)}{(x^2+y^2)}$ at $z\neq 0$, and f(0) = 0 is continuous and satisfies C.R equations at the origin, but $f'(0)$ does not exist.   [7+8]

8.a) Expand $\dfrac{2z^3+1}{(z+z^2)}$ about z = =1 as a Taylor's series about z = 0 as a Laurent series.

  b) Evaluate using Residue theorem $\displaystyle\int_c\dfrac{ze^{2z}dz}{(z-1)^3}$ where C is $|z|=2$.   [8+7]

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