Enrolment No/Seat No.: _____

R.N.G.PATEL INSTITUTE OF TECHNOLOGY-RNGPIT

(An Autonomous College U/s UGC Act 1956)

B.Tech. SEMESTER-II, SEMESTER END EXAMINATION – WINTER 2025

SUBJECT CODE: 1SH202 **DATE: 06-01-2026**

SUBJECT NAME: NUMERICAL METHODS AND COMPLEX VARIABLES

TIME: 11:00 AM to 02:00 PM **TOTAL MARKS: 70**

Instructions

1. It is **compulsory** for students to write **Enrolment No. /Seat No.** on the question paper.
2. Write answers of **Section A** and **Section B** in **separate answer books**.
3. Attempt all questions from both **Section A** and **Section B**.
4. Each section carries **35 marks**, with a total of **70 marks** for the examination.
5. The figures to the right of each question indicate full marks, make suitable assumptions with justification.
6. BL - Bloom's Taxonomy Levels (R-Remember, U-Understanding, A –Application, N –Analyze, E – Evaluate, C -Create), CO - Course Outcomes.

SECTION A

		Marks	BL	CO
Q.1	**Multiple-Choice Questions**	**[05]**		
	(a) Secant Method is also called as _____.	**1**	**R**	**1**
	(i) 5-point method **(ii)** 2-point method **(iii)**3-point method **(iv)** 4-point method			
	(b) The Bisection method is also known as _____	**1**	**R**	**1**
	(i) Binary Chopping **(ii)** Quaternary Chopping **(iii)** Tri region Chopping **(iv)** Diameter method			
	(c) Rate of convergence of the Newton-Raphson method is generally _____.	**1**	**R**	**5**
	(i) Linear **(ii)** Quadratic **(iii)** Super-linear **(iv)** Cubic			
	(d) $\cosh z =$ _____ .	**1**	**R**	**5**
	(i) $\frac{e^z - e^{-z}}{2}$ **(ii)** $\frac{e^z - e^{-z}}{2i}$ **(iii)** $\frac{e^z + e^{-z}}{2}$ **(iv)** $\frac{e^{iz} + e^{-iz}}{2i}$			

(e) The necessary conditions for a function $f(z)=u+iv$ to be an analytic function at all the points in a region R are_____. **1** **R** **5**

(i) $\frac{\partial u}{\partial x}=\frac{\partial v}{\partial y}, \quad \frac{\partial u}{\partial y}=-\frac{\partial v}{\partial x}$ **(ii)** $\frac{\partial u}{\partial x}=\frac{\partial v}{\partial y}, \quad \frac{\partial u}{\partial y}=\frac{\partial v}{\partial x}$

(iii) $\frac{\partial u}{\partial x}=-\frac{\partial v}{\partial y}, \quad \frac{\partial u}{\partial y}=-\frac{\partial v}{\partial x}$ **(iv)** $\frac{\partial u}{\partial x}=-\frac{\partial v}{\partial y}, \quad \frac{\partial u}{\partial y}=\frac{\partial v}{\partial x}$

Q.2 Attempt Any Two [10]

(a) Perform the four iterations of the bisection method to obtain a root of the equation $x^3-4x-9=0$. **5** **A** **1**

(b) Find the root of the equation $x^4-x^3+10x+7=0$, correct up to three decimal places between -2 and -1 by Newton-Raphson method. **5** **A** **1**

(c) Find the approximate root of $xe^x-1=0$, correct up to three decimal places between 0 and 1 by Secant method. **5** **A** **1**

Q.3 Attempt Any Two [10]

(a) Fit a straight line $y=a+bx$ to the following data: **5** **A** **3**

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

(b) Fit a parabola $y=a+bx+cx^2$ to the following data: **5** **A** **3**

x	1	2	3	4	5
y	5	12	26	60	97

(c) Fit a curve of the form $y=ae^{bx}$ to the following data by the method of least square: **5** **A** **3**

x	1	3	5	7	9
y	115	105	95	85	80

Q.4 Attempt Any Two [10]

(a) Solve the equation $z^2+(2i-3)z+5-i=0$. **5** **A** **5**

(b) Find all the values of $(1-i)^{\frac{2}{3}}$. **5** **A** **5**

(c) Determine whether the function $2xy+i(x^2-y^2)$ is analytic or not. **5** **A** **5**

SECTION B

		Marks	BL	CO
Q.5	**Multiple-Choice Questions**	**[05]**		
(a)	Newton's interpolation formula can be used _____.	**1**	**R**	**2**
	(i) only for equally spaced intervals **(ii)** only for unequally spaced intervals			
	(iii) for both equally and unequally spaced intervals **(iv)** for unequally intervals			
(b)	What is forward difference operator?	**1**	**R**	**2**
	(i) $\Delta y_x = y_x - y_{x-1}$ **(ii)** $\Delta y_x = y_{x+1} - y_x$			
	(iii) $\Delta y_x = y_{x+1} + y_x$ **(iv)** $\Delta y_x = y_x + y_{x-1}$			
(c)	Which relation between the operators is correct?	**1**	**R**	**2**
	(i) $\Delta = E - 1$ **(ii)** $\Delta = E + 1$			
	(iii) $\nabla = E - 1$ **(iv)** $\nabla = E + 1$			
(d)	Which method is commonly used to approximate solutions to ordinary differential equations by expanding the solution as a Taylor series?	**1**	**R**	**4**
	(i) Euler's Method **(ii)**Modified Euler's Method			
	(iii) Taylor's Series Method **(iv)**Runge-Kutta Method			
(e)	Which numerical method is commonly used for approximating solutions to initial value problems (IVPs) for ordinary differential equations (ODEs)?	**1**	**R**	**4**
	(i) Euler's Method **(ii)**Runge-Kutta Method			
	(iii) Taylor's Series Method **(iv)**Modified Euler's Method			
Q.6	**Attempt Any Two**	**[10]**		
(a)	Use Newton's forward difference method to find the approximate value of *f(2.3)* from the following data:	**5**	**A**	**2**

x	2	4	6	8
$f(x)$	4.2	8.2	12.2	16.4

(b)	Using Lagrange's interpolation formula, find the value of $f(2)$.	**5**	**A**	**2**

x	-1	0	1	3
y	2	1	0	-1

(c) Compute $f(8)$ from the following values using Newton's divided difference formula: **5 A 2**

x	4	5	7	10	11	13
$f(x)$	48	100	244	900	1210	2028

Q.7 Attempt Any Two **[10]**

(a) Compute the integral $\int_{-1}^{1} e^x dx$ with n=4 using trapezoidal rule. **5 A 4**

(b) Evaluate $\int_0^6 \frac{dx}{1+x}$ with h = 1 by using Simpson's 1/3 rule. **5 A 4**

(c) The velocity of a train which starts from rest is given by the following table, the time being reckoned in minutes from the start and speed in *km/h*. **5 A 4**

Time	3	6	9	12	15	18
Velocity	22	29	31	20	4	0

Estimate approximately the distance covered in 18 minutes by Simpson's 3/8 rule.

Q.8 Attempt Any Two **[10]**

(a) Use Taylor's series method to solve $\frac{dy}{dx} = x^2 y - 1, y(0) = 1$. Also find y (0.03). **5 A 4**

(b) Using Euler's method, find *y (0.2)* given $\frac{dy}{dx} = y - \frac{2x}{y}, y(0) = 1$ with h=0.1. **5 A 4**

(c) Using the fourth order Runge-Kutta method find *y* at *x=0.1* for differential equation $\frac{dy}{dx} = 3e^x + 2y, y(0) = 0$ by taking h=0.1. **5 A 4**

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