Course Code: **23BS3T02**

Bonam Venkata Chalamayya Institute of Technology & Science, (Autonomous)

II B.Tech I Semester Regular Examinations (BR23), November-2024

NUMERICAL METHODS AND COMPLEX VARIABLES

(Electrical and Electronics Engineering)

Time: 3 hours | **Max. Marks: 70**

Question paper consists of Part A & Part B
Answer **All** the questions in Part A & Part B

Part A(10 X 2 = 20M)

1.a	Find the first approximation of $e^x sinx = 1$ by using Bisection method.	[2M]	CO1	L2
b	Prove that $\mu^2 = 1 + \frac{\delta^2}{4}$.	[2M]	CO1	L3
c	Find $\int_0^2 f(x)dx$ from the following data and using Trapezoidal rule. x: 0, 0.5, 1, 1.5, 2 $f(x)$: 0, 0.25, 1, 2.25, 4	[2M]	CO2	L2
d	Write RK method of 2nd order formula.	[2M]	CO2	L1
e	Define analytic function and entire function.	[2M]	CO3	L1
f	State Cauchy's Integral Formula.	[2M]	CO3	L1
g	Find the residue of the function $f(z) = \frac{2z+4}{(z+1)(z^2+1)}$ at $z = i$.	[2M]	CO4	L2
h	Write the Laurent series of the function $f(z)$ having the center at $z = a$.	[2M]	CO4	L1
i	Define Conformal Mapping.	[2M]	CO5	L1
j	Find the image of the circle $\|z\| = 2$, under the transformation $w = z + 3 + 2i$.	[2M]	CO5	L2

Part B (5 X 10 = 50)

2.a.	Find a real root of the equation $xlog_{10}x - 1.2 = 0$ using Regula-falsi method.	5(M)	CO1	L2
b.	Using Lagrange's interpolation formula, find the value of $y(10)$ from the following table: x: 5, 6, 9, 11 y: 12, 13, 14, 16	5(M)	CO1	L2
	OR			

3	a	Evaluate $\sqrt{28}$ to four decimal places using Newton-Raphson method.	5(M)	CO1	L3
	b	Find the Newton's Forward difference interpolating polynomial for the following data and hence find $f(2.5)$ from the polynomial. x: 0, 1, 2, 3 $y = f(x)$: 1, 3, 7, 13	5(M)	CO1	L2
4	a	Evaluate $\int_0^6 \frac{1}{1+x} dx$ by using Simpson's 3/8th rule.	5(M)	CO2	L3
	b	Given that $\frac{dy}{dx} = 1 + xy$and $y(0) = 1$, compute $y(0.1)$ and $y(0.2)$ using Picard's method	5(M)	CO2	L3
		OR			
5	a	Find $y(0.1)$ from the differential equation $y' = x - y^2$, $y(0) = 1$ by using Taylor's series method	5(M)	CO2	L2
	b	Use Runge-Kutta method of fourth order to evaluate $y(0.1)$ and given that $y' = x + y, y(0) = 1$.	5(M)	CO2	L3
6	a	If *f(z)* is a regular function of *z*, then prove that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right] \|f(z)\|^2 = 4\|f'(z)\|^2$	5(M)	CO3	L5
	b	Find the analytic function whose imaginary part is $e^x(x \sin y + y \cos y)$.	5(M)	CO3	L2
		OR			
7	a	Show that the function $u(x, y) = x^3 - 3xy^2$ is harmonic and find its harmonic conjugate.	5(M)	CO3	L2
	b	Evaluate $\int_c \frac{e^{2z}}{(z-1)(z-2)} dz$ where $c$is the circle$\|z\| = 3$.	5(M)	CO3	L3
8	a	Obtain the Taylor's series expansion to represent the function$\frac{z^2-1}{(z+2)(z+3)}$ in the region $\|z\| < 2$.	5(M)	CO4	L3
	b	Evaluate by residue theorem$\int_c \frac{ze^z}{(z^2+9)} dz$,where$c$is the circle$\|z\| = 5$.	5(M)	CO4	L3
		OR			
9	a	Obtain the Laurent's series of the function $\frac{z+3}{z(z^2-z-2)}$in powers of z where$1 < \|z\| < 2$	5(M)	CO4	L3
	b	Show that by method of residues$\int_0^\pi \frac{d\theta}{a+b\cos\theta} = \frac{\pi}{a^2-b^2}, a > b > 0$.	5(M)	CO4	L2
10	a	Show that the function $w = \frac{4}{z}$ transforms the straight line $x = c$ in the z-plane into a circle in the w-plane.	5(M)	CO5	L2
	b	Find the bilinear transformation which maps the points $\infty, i, 0$ in the z-plane into $-1, -i, 1$ in the w-plane.	5(M)	CO5	L2
		OR			
11	a	Show that the transformation $w = z^2$ maps the circle $\|z - 1\| = 1$ into the cardioid $r = 2(1 + \cos\theta)$ where $w = re^{i\theta}$ in w-plane.	5(M)	CO5	L2
	b	Find the fixed points of the following transformations. (i). $w = \frac{2i-6z}{iz-3}$ (ii). $w = \frac{6z-9}{z}$	5(M)	CO5	L2