

I B. Tech I Semester Regular/Supplementary Examinations, Nov/Dec - 2017

MATHEMATICS-II (NM&CV)

(Com. to ECE, EIE, E Com E)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (Part-A and Part-B)

2. Answer ALL the question in Part-A

3. Answer any FOUR Questions from Part-B

PART -A

1. a) Define algebraic equation with suitable example. (2M)
- b) Define shift operator. (2M)
- c) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Trapezoidal Rule. (2M)
- d) Show that $f(z) = xy + iy$ is everywhere continuous. (2M)
- e) Define Harmonic function with an example. (2M)
- f) Identify the singularity of $f(z) = \frac{\sin z}{z}$ at $z = 0$. (2M)
- g) Evaluate $\int_0^{3+i} z^2 dz$ along the line $y = \frac{x}{3}$. (2M)

PART -B

2. a) Solve $2x - \log_{10} x = 7$ by iteration method. (7M)
- b) Solve $x^3 - x + 11 = 0$ by bisection method. (7M)
3. a) Find $y(2.4)$ using Newton's Backward difference formula from the table. (7M)

X	1	1.4	1.8	2.2
Y	3.49	4.82	5.91	6.5

- b) Find the $y(4)$ from the following data. (7M)

x	0	1	2	5
y	2	3	12	147

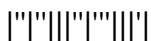
4. a) Find the solution of $\frac{dy}{dx} = x - y$, $y(0)=1$ at $x=0.1, 0.2$ using Taylor's series method. (7M)
- b) Find the solution of $\frac{dy}{dx} = x^2 - y$, $y(0)=1$ at $x=0.1, 0.2$ using Modified series method. (7M)

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SET - 1

5. a) Prove that $f(z) = |z|^2$ is differentiable only at origin. (7M)
- b) Check $U(x, y) = e^{-x} (x \sin y - y \cos y)$ is harmonic or not. If harmonic find its conjugate. (7M)
6. a) If $f(a) = \int_c \frac{4z^2+z+5}{z-a} dz$ where c is the ellipse $x = 2\cos\theta$, $y = 3\sin\theta$ find the values of (a) $f(3.5)$ (b) $f(i)$. (7M)
- b) Expand $\frac{\sin z}{z-\pi}$ at $z = \pi$ as a Taylor's series. (7M)
7. a) Evaluate $\int_0^{\infty} \frac{x \sin mx}{(16+x^4)} dx$ (7M)
- b) Evaluate $\oint_c \frac{2e^z}{z(z-3)} dz$ Where $c : |z| = 2$ by Residue theorem (7M)



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PART -A

1. a) Define Transcendental equation with suitable example. (2M)
- b) Define average operator. (2M)
- c) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal Rule. (2M)
- d) Show that the function $f(z)=z$ is continuous. (2M)
- e) Prove that $f(z) = z^2$ is analytic. (2M)
- f) Identify the singularity of $f(z) = e^{1/z}$ at $z = 0$. (2M)
- g) Evaluate $\int_{(0,0)}^{(1,1)} [3x^2 + 5y + i(x^2 - y^2)]dz$ along $y^2=x$. (2M)

PART -B

2. a) Solve $2x - \log_{10}x = 7$ by Newton Raphson method. (7M)
- b) Solve $x^3 - x + 11 = 0$ by False position method. (7M)
3. a) Find $y(1.5)$ using Gauss Backward difference formula from the table. (7M)

X	1	1.4	1.8	2.2
Y	3.49	4.82	5.91	6.5

- b) Find the $y(3)$ from the following data. (7M)

x	0	1	2	6
y	2	3	12	147

4. a) Find the solution of $\frac{dy}{dx} = x - y$, $y(0)=1$ at $x=0.1, 0.2$ using Picard's method. (7M)
- b) Find the solution of $\frac{dy}{dx} = x^2 - y$, $y(0)=1$ at $x=0.1, 0.2$ using RK method of fourth order. (7M)

5. a) If $f(z) = u(r, \theta) + iv(r, \theta)$ is differentiable at $z = re^{i\theta} \neq 0$ then prove that (7M)

$$\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}, \quad \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$$

- b) Show that $u(x, y) = e^{-2xy} \sin(x^2 - y^2)$ is harmonic, find its conjugate. (7M)

6. a) Evaluate $\int_c \frac{z^2 - z + 1}{z - 1} dz$ where c is (i) $|z| = 1$ (ii) $|z| = \frac{1}{2}$ using Cauchy's integral formula. (7M)

- b) Expand $f(z) = \frac{1}{z^2 - 3z + 2}$ in the region (7M)
(i) $0 < |z + 1| < 1$ (ii) $1 < |z| < 2$

7. a) Evaluate $\oint_C \frac{dz}{\sinh z}$, where C is the Circle $|z| = 4$. using residue theorem. (7M)

- b) Show by the method of Contour integration that (7M)

$$\int_0^{\infty} \frac{\cos mx}{(a^2 + x^2)^2} dx = \frac{\pi}{4a^3} (1 + ma) e^{imx} \quad (a > 0)$$

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PART -A

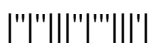
1. a) Define quadratic convergence. (2M)
- b) Prove that $\Delta \nabla = \nabla \Delta$ (2M)
- c) Write the merits of Euler's method. (2M)
- d) Find $\lim_{z \rightarrow 0} \frac{x^2 y}{x^4 + y^2}$ (2M)
- e) Show that $f(z) = \bar{z}$ is now here analytic. (2M)
- f) Evaluate $\int_0^{1+i} (x^2 - iy) dx$ along the paths $y = x$. (2M)
- g) Find the Residue of $f(z) = \frac{\sin z}{z \cos z}$ at $z = 0$. (2M)

PART -B

2. a) Solve $xe^x = 2$ by Bisection method. (7M)
- b) Solve $x^3 - 5x + 1 = 0$ by Newton Raphson method. (7M)
3. a) Find $f(1.75)$ if $f(1.7) = 5.474$, $f(1.8) = 6.050$, $f(1.9) = 6.686$, $f(2) = 7.389$ (7M)
- b) Evaluate $y(7)$ from the following table. (7M)

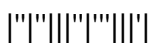
X	1	3	5	6	8
Y	2	1.5	2.4	4	5.6

4. a) Find the solution of $\frac{dy}{dx} = x - y$, $y(0)=1$ at $x=0.1, 0.2$ using RK method of fourth order (7M)
- b) Evaluate $\int_0^1 \frac{dx}{1+x^4}$ using (i) Simpson's 1/3rd Rule (i) Simpson's 3/8th Rule (7M)



5. a) Show that $f(z) = \begin{cases} \frac{(x^3 + y^3) + i(x^3 + y^3)}{x^2 + y^2}, & z \neq 0 \\ 0, & z = 0 \end{cases}$ is not analytic at $z = 0$ although the C-R equations are satisfied at the origin. (7M)
- b) Determine analytic function whose real part $u = e^{x^2 - y^2} \cos 2xy$ (7M)
6. a) Using Cauchy's Integral formula evaluate $\int_c \frac{z^4}{(z+1)(z-i)^2} dz$ where c is the ellipse $9x^2 + 4y^2 = 36$ (7M)
- b) Find the Laurent's series of $f(z) = \frac{1}{z^2 - 4z + 3}$ for
(i) $1 < |z| < 3$ (ii) $|z| > 3$ (7M)
7. a) Evaluate $\oint_C e^{\frac{-1}{z}} \sin \frac{1}{z} dz$ where $C: |z| = 1$ using Cauchy's residue theorem. (7M)
- b) Evaluate by Contour integration $\int_0^{\infty} \frac{dx}{1+x^2}$ (7M)

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1. a) Define order of convergence. (2M)
- b) Find $\Delta^2(x^2)$ if $h = 1$. (2M)
- c) Write the working procedure to solve the ODE by second order RK method. (2M)
- d) Find $\lim_{z \rightarrow 1} \frac{x^2 - y^2}{x^2 + y^2}$ (2M)
- e) Evaluate $\int_0^{1+i} (x^2 + iy) dz$ along the paths $y = x$. (2M)
- f) If C is a simple closed curve then Evaluate $\int_C (\sin 3z + z^4 + e^z) dz$. (2M)
- g) Find the Residue of. $f(z) = \frac{e^{z^2}}{z^3}$ at $z = 0$. (2M)

PART -B

2. a) Solve $xe^x = 2$ by False position method. (7M)
- b) Solve $x^3 - 5x + 1 = 0$ by Iteration method. (7M)
3. a) Fit a $y(0.5)$ from the following data. (7M)

x	-1	0	1	2
y	10	5	8	10

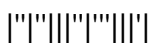
(7M)

- b) Find the $y(4)$ for the following data.

x	0	2	3	6
y	707	819	866	966

4. a) Find the solution of $\frac{dy}{dx} = x - y$, $y(0)=1$ at $x=0.1, 0.2$ using modified Euler's method. (7M)

- b) Evaluate $\int_0^1 \frac{dx}{1+x^3}$ using (i) Simpson's 1/3rd Rule (i) Simpson's 3/8th Rule. (7M)



5. a) Find analytic function whose Real part $u(x, y) = x^3 - 3xy^2 + 3x^2 - 3y^2 + 2x + 1$ (7M)

b) If $f(z)$ is an analytic function show that (7M)

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |\operatorname{Re} f(z)|^2 = 2 |f'(z)|^2$$

6. a) Obtain the Taylor's series expansion $f(z) = \frac{2z^3+1}{z^2+z}$ about $z = i$. (7M)

b) Evaluate $\oint_c \frac{\cos \pi z}{z^2-1} dz$ along the rectangle with vertices $2 \pm i, -2 \pm i$. (7M)

7. a) Evaluate $\oint_c \frac{\operatorname{Coth} z}{z-1} dz$ Where $c : |z| = 2$ using Cauchy's residue theorem. (7M)

b) Show that by the method of Residues $\int_0^\pi \frac{d\theta}{a+b \cos \theta} = \frac{\pi}{\sqrt{a^2-b^2}}$ ($a > b > 0$) (7M)

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