

I B. Tech I Semester Regular Examinations Dec. - 2016
MATHEMATICS-II
(Numerical Methods and Complex Variables)
(Com. to ECE, EIE, E.Com.E.)

Time: 3 hours

Max. Marks: 70

Question Paper Consists of **Part-A** and **Part-B**
 Answering the question in **Part-A** is Compulsory,
Four Questions should be answered from **Part-B**

PART-A

1. a) What is transcendental equation? Given an example.
- b) What is the difference between interpolation and extrapolation?
- c) Find $y(0.1)$ by Taylor's series method for $y' = y - x$, $y(0) = 1$
- d) Show that the function $e^x(\cos y + i \sin y)$ is holomorphic
- e) State the Cauchy's theorem.
- f) Evaluate $\int_0^{1+i} (x^2 - iy) dz$ along the path $y = x$
- g) Find the Pole and residue of $f(z) = \frac{e^z}{(z-1)^2}$

[2+2+2+2+2+2+2]

PART-B

2. a) Find the Real root of the equation $\tan x = x$ using Bisection method.
- b) Find the Real root of the equation $x + \log_{10} x - 2 = 0$ using false position method. [7+7]
3. a) Estimate the minimum weight of bib taps when bore is 20 mm using the following table

Bore(mm)	8	10	15	25	32	40	50
Weight of bib taps in kg	0.25	0.30	0.40	1.25	1.70	2.15	3.65

- b) Determine the value of $f(x)$ at $x = 25$ for the following data [7+7]

x	20	24	28	32
y=f(x)	24	32	35	40

4. a) Evaluate $\int_0^{\frac{\pi}{2}} e^{\sin x} dx$ by (i) Trapezoidal rule (ii) Simpson's 1/3rd Rule [7+7]
- b) Find $y(0.1)$ for the D.E $\frac{dy}{dx} = xy^2$, $y(0) = 1$ using RK method of fourth order



5. a) Find the Analytic function whose real part is $u(x, y) = \frac{\sin 2x}{\cosh 2y + \cos 2x}$
b) Show that the function $f(z) = z\bar{z}$ is differentiable but not analytic at origin. [7+7]
6. a) Using Cauchy's integral formula, evaluate $\int_c \frac{\cosh \pi z}{z(z^2 + 1)} dz$, where c is $|z| = 2$ [7+7]
b) Express $f(z) = \frac{z}{(z-1)(z-3)}$ in a series of positive and negative powers of $(z-1)$
7. a) Evaluate $\int_0^{\infty} \frac{\cos x}{(1+x^2)^2} dx$
b) Evaluate $\int_c \frac{e^z}{(z^2 + \pi^2)^2} dz$

Where C is $|z| = 4$ by using residue theorem [7+7]



Subject Code: R161110/R16

Set No - 2

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PART-A

1. a) What is Algebraic equation? Given an example.
- b) Prove that $\nabla = 1 - E^{-1}$
- c) Explain single step method with simple example?
- d) Determine whether the function $2xy + i(x^2 - y^2)$ is analytic.
- e) Evaluate $\int_0^{1+i} (x^2 - iy) dz$ along the path $y = x^2$
- f) Obtain Taylor's series for $f(z) = e^z$ about $z = 1$
- g) Find the Pole and residue of $f(z) = \frac{z}{(z^2 - 4)}$

[2+2+2+2+2+2+2]

PART-B

2. a) Find the Real root of the equation $x^2 - x - 4 = 0$ using iteration method [7+7]
- b) Find the Real root of the equation $e^{2x} - e^x - 2 = 0$ using Newton Raphson method



3. a) The viscosity of an oil is experimentally measured at different temperatures as shown in the following table

Temp in ⁰ C	110	130	160	190
Viscosity	10.8	8.1	5.5	4.8

Find the Viscosity of the oil at the Temperature of 140 ⁰C

- b) Determine the value of f(x) at x = 10 for the following data [7+7]

x	2	5	9	11
y=f(x)	94.8	87.9	81.3	75.1

4. a) Evaluate $\int_0^1 \log x \cdot \cos x dx$ by (i) Trapezoidal rule (ii) Simpson's 3/8th Rule [7+7]

- b) Find y (0.1) for the D.E $\frac{dy}{dx} = x^2 y - 1, y(0) = 1$ using Taylor's series method

5. a) Define analytic function and Verify the whether $f(z) = \frac{x^3(1+i) - y^3(1-i)}{x^2 + y^2}, (z \neq 0)$ and f(0) = 0 ,is analytic [7+7]

- b) Define Harmonic function and verify whether $u(x, y) = e^{2x}(x \cos 2y - y \sin 2y)$ is harmonic and find its harmonic conjugate.

6. a) Evaluate $\oint \left[\frac{e^z}{z^3} + \frac{z^4}{(z+i)^2} \right] dz$, where c: $|z| = 2$ [7+7]

- b) Expand $f(z) = \frac{z+3}{z(z^2-z-2)}$ in power series where (i) $|z| < 1$ (ii) $1 < |z| < 2$ (iii) $|z| > 2$

7. a) Evaluate $\int_0^{2\pi} \frac{d\theta}{5 - 4 \sin \theta}$ [7+7]

- b) Evaluate $\int_C \frac{z \cos z}{\left(z - \frac{\pi}{2}\right)^3} dz$ where C is the Region bounded by $|z-1|=1$ using Residue theorem



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PART-A

1. a) what is an iterative process , why should we apply iterative technique
- b) Define Newton forward interpolation formula
- c) When do you use numerical integration? Give an example
- d) Find the analytic function whose real part is $\frac{x}{x^2 + y^2}$
- e) Evaluate $\int_0^{1+i} (x^2 + iy) dz$ along the path $y = x$
- f) Obtain Taylor's series for $f(z) = 1/z^2$ about $z = 1$
- g) Find the Singularity of the function $f(z) = e^{1/z}$

[2+2+2+2+2+2+2]

PART-B

2. a) Find the Real root of the equation $2x^3 - 3x - 4 = 0$ using Newton Raphson method
- b) Find the Real root of the equation $4 \sin x = e^x$ using false position method [7+7]
3. a) Determine the value of $f(x)$ at $x = 225$ form the following data [7+7]

x	50	100	150	200	250
y = f(x)	5	5.7	7.7	8.9	10.7

b) Calculate $f(3)$ from the following table

x	0	1	2	4	5	6
Y=f(x)	1	14	15	5	6	19



4. a) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\cos x}{1+x} dx$ by (i) Simpson's 3/8th Rule (ii) Simpson's 1/3rd Rule [7+7]
- b) Find $y(0.1)$ for the D.E $\frac{dy}{dx} = x + y + xy, y(0) = 1$ using Modified Euler's method
5. a) Show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) \log|f'(z)| = 0$, where $f(z)$ is analytic function. [7+7]
- b) If $f(z) = u + iv$ is analytic and $v = \frac{2 \sin x \sin y}{\cos 2x + \cosh 2y}$, find u .
6. a) Evaluate $\int_c \frac{ze^{2z}}{(z-2)^3} dz$ where c is the circle with radius 3 by Cauchy integral formula
- b) Obtain Laurent's expansion for $f(z) = \frac{1}{(z+2)(z+1)}$ in $1 < |z| < 2$ [7+7]
7. a) Evaluate $\int_0^{2\pi} \frac{d\theta}{3-2\sin\theta}$ using residue theorem
- b) Find the Residue of $\frac{1+e^z}{z \cos z + \sin z}$ at $z = 0$ [7+7]



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PART-A

1. a) What are possible ways of finding the roots of nonlinear equation
- b) What are the applications of interpolation?
- c) Write the merits and demerits of Euler's method?
- d) Prove that an analytic function with constant imaginary part is constant.
- e) Evaluate $\int_0^{1+i} (x^2 + iy) dz$ along the path $y = x^2$
- f) Obtain Taylor's series for $f(z) = 1/z$ about $z = 1$
- g) Define Removable singularity and give an example

[2+2+2+2+2+2+2]

PART-B

2. a) Find the Real root of the equation $x^2 - x - 2 = 0$ using iteration method [7+7]
- b) Find the Real root of the equation $e^x - 4x^2 = 0$ using Bisection method
3. a) Determine the value of $f(x)$ at $x = 1.6$ from the following data [7+7]

x	1	1.4	1.8	2.2
y=f(x)	3.49	4.82	5.96	6.5

- b) Using Lagrange's Interpolation, find $f(1.2)$ given that

x	3	7	9	13
y	5	12	13	21



4. a) Evaluate $\int_0^{\frac{\pi}{2}} \sin x \log(\sin x) dx$ by (i) Trapezoidal rule (ii) Simpson's 1/3rd Rule [7+7]

b) Find $y(0.1)$ for the D.E $\frac{dy}{dx} = \frac{x^2}{y^2 + 1}$, $y(0) = 1$ using Picard's method

5. a) Show that for the function $f(z) = \begin{cases} \frac{z^5}{|z|^4}, z \neq 0 \\ 0, z = 0 \end{cases}$ Cauchy- Riemann equation are satisfied

at $z = 0$, but $f(z)$ is not differentiable at 0. [7+7]

b) Show that the function $f(x, y) = x^3y - xy^3 + xy + x + y$ can be the imaginary part of an analytic function of $f(z)$ also find the real part of the complex function

6. a) Evaluate $\int_c \frac{ze^{2z}}{(z - \pi i)^3} dz$ where c is the circle with radius 4 by Cauchy integral formula

b) Obtain Laurent's expansion for $f(z) = \frac{1}{(z+2)^2(z+1)}$ in $|z| > 2$ [7+7]

7. a) Evaluate $\int_0^{\infty} \frac{dx}{(x^4 + 1)}$

b) Find the residue of $f(z) = \frac{z^3}{(z-2)(z-3)(z-1)^4}$ at $z = 1$ [7+7]

