

Subject Code: R13107/R13
Set No - 1

I B. Tech I Semester Regular Examinations Feb./Mar. - 2014
MATHEMATICS-II (MATHEMATICAL METHODS)

(Common to ECE, EEE, EIE, Bio-Tech, EComE, Agri.E)

Time: 3 hours
Max. Marks: 70

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

PART-A

- 1.(i) Write the sufficient condition for the convergence of Newton-Raphson method?
- (ii) Show that $\mu\delta = \frac{1}{2}(\Delta + \nabla)$?
- (iii) Write the merits and demerits of Euler Modified method?
- (iv) Write the Dirichlet's conditions of $f(x)$?
- (v) State Initial and Final value theorems of Z-transforms?
- (vi) Write the statement of Fourier integral theorem?

[3+4+4+3+4+4]

PART- B

- 2.(a) Using Runge-Kutta method of fourth order solve $y' = xy$, $y(1) = 2$ at $x = 1.2$ with $h = 0.2$.
- (b) Find the Fourier transform of $f(x) = x^{n-1}$ [8+8]
3. For the following data estimate $f(1.720)$ using forward, $f(2.68)$ using backward and $f(2.36)$ using central difference formula.

x	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
f(x)	0.0495	0.0605	0.0739	0.0903	0.1102	0.1346	0.1644	0.2009

[16]

- 4.(a) Solve the differential equation $\frac{dy}{dx} = x + y$ subject to $y(0) = 1$ by Picard's method and hence find $y(0.2)$.
- (b) Using Regula Falsi method find a real root of $f(x) = 2x^7 + x^5 + 1 = 0$ correct upto two decimal places.

[8+8]

- 5.(a) Find the Fourier series for $f(x) = 2lx - x^2$ in $(0, 2l)$, hence show that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$$

- (b) Find the inverse Z transform of $\frac{3z^2+z}{(5z-1)(5z-2)}$

[8+8]

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- 6.(a) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$
- (b) Find a real root of $f(x) = x + \log x - 2$ using Newton-Raphson method.

[8+8]

- 7.(a) Find Z-transform of (i) $an^2 + bn + c$ (ii) $\sin(3n + 5)$
- (b) Find the half range Fourier sine series for $f(x) = x$ in $(0, \pi)$?

[8+8]

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Subject Code: R13107/R13
Set No - 2

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PART-A

- 1.(i) State Intermediate Value theorem?
- (ii) Show that $\Delta(e^{ax} \log bx)$?
- (iii) Write the second order Runge-Kutta formula?
- (iv) Give any one application of Fourier Series with example?
- (v) State the convolution theorem of inverse Z-transforms?
- (vi) Write the formulas Fourier cosine and sine transform?

[4+3+4+3+4+4]

PART- B

- 2.(a) Using modified Euler's method to find the value of y at x = 0.2 with h = 0.1 where $y' = 1 - y$, $y(0) = 0$
 - (b) Find the Fourier transform of $f(x) = \begin{cases} 0, & |x| \leq a \\ 1, & |x| > a \end{cases}$
- [8+8]
- 3.(a) Prove the relation $\sum_{k=0}^{n-1} \Delta^2 f_k \equiv \Delta f_n - \Delta f_0$
 - (b) Use Lagrange's interpolation formula to calculate f(3) from the following table.

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

[4+12]

- 4.(a) Solve the differential equation $\frac{dy}{dx} = x^2 y$ subject to $y(0) = 1$ by Taylor series method and hence find $y(0.1)$, $y(0.2)$.
 - (b) Using bisection method find a root of $f(x) = x - \cos x = 0$.
- [8+8]
- 5.(a) Obtain the Fourier series for $f(x) = |x|$ in $[-\pi, \pi]$, hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$
 - (b) Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$ with $u_0 = 0$; $u_1 = 1$ using Z transforms

[8+8]

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6.(a) Using Fourier integral, prove that $e^{-ax} = \frac{2a}{\pi} \int_0^{\infty} \frac{\cos ax}{a^2 + \alpha^2} d\alpha$, $a > 0, x > 0$

(b) Find a real root of $f(x) = x \log_{10} x = 1.2$ using Newton-Raphson method.

[8+8]

7.(a) Find the Z transform of (i) $\cos(n+1)\theta$ (ii) $\sin h \frac{n\pi}{2}$

(b) Obtain the Fourier series for spectrum of a periodic function with example?

[8+8]

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PART-A

- 1.(i) Write the sufficient condition for the convergence of Newton-Raphson method?
- (ii) Show that $\mu\delta = \frac{1}{2}(\Delta + \nabla)$?
- (iii) Write the advantages & disadvantages of Taylor series method?
- (iv) Write the Fourier series when the given function $f(x)$ is an even?
- (v) Write the properties of multiplication by n and division by n of Z-transforms?
- (vi) Write the complex form of Fourier integral theorem?

[3+3+4+4+4+4]

PART- B

- 2.(a) Using iteration method find a real root of $f(x) = x^2 - 3x + 1$ correct upto three decimal places starting with $x=1$.
- (b) Solve $u_{n+2} - 2u_{n+1} + u_n = 3n + 5$ using Z-Transforms?

[8+8]

- 3.(a) Evaluate $\Delta(e^{ax} \log bx)$
- (b) By using Lagrange's interpolation formula, fit a polynomial data

x	0	1	3	4
f(x)	-12	0	6	12

[4+12]

- 4.(a) Using modified Euler method solve numerically the equation $\frac{dy}{dx} = 2 + \sqrt{xy}$ with $y(1) = 1$ to find $y(1.2)$

- (b) Find $f(x)$ if its Fourier sine transform is $\frac{s}{1+s^2}$

[8+8]

- 5.(a) Obtain the Fourier series for $f(x) = (\pi - x)^2$ in $0 < x < 2\pi$, hence deduce that

$$\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$$

- (b) Using convolution theorem, evaluate $Z^{-1}\left[\frac{z^2}{z^2-4z+3}\right]$

[8+8]

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- 6.(a) Using Parseval's identities, prove that $\int_0^{\infty} \frac{dt}{(a^2 + t^2)(b^2 + t^2)} = \frac{\pi}{2ab(a+b)}$
- (b) Using Runge-Kutta method of third order, find the values of $y(x)$ for $x = 0.1, 0.2$ where $y' = x - 2y$, $y(0) = 1$.

[8+8]

- 7.(a) Find the half range sine series for $f(x) = x(\pi - x)$ in $(0, \pi)$
- (b) Find a real root of $f(x) = x^3 - 19$ correct upto three decimal places using Newton-Raphson method

[8+8]

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Set No - 4

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 Three Questions should be answered from **Part-B**

PART-A

- 1.(i) Show that $\mu\delta = \frac{1}{2}(\Delta + \nabla)$?
- (ii) Write the merits and demerits of Iteration method?
- (iii) Write the merits and demerits of Euler Modified method?
- (iv) Write the Dirichlet's conditions of $f(x)$?
- (v) State convolution theorem of Z-transforms?
- (vi) Write the statement of Fourier integral theorem?

[3+4+4+3+4+4]

PART- B

- 2.(a) Find the Fourier sine and cosine transforms of $(2.e^{-5x} + 5.e^{-2x})$.

- (b) Given $f(x) = \begin{cases} 1-x, & -\pi \leq x \leq 0 \\ 1+x, & 0 \leq x \leq \pi \end{cases}$

Is the function even or odd? Find the Fourier series for $f(x)$.

[8+8]

- 3.(a) Prove the relation between E and D ?
- (b) For the following data estimate $K(0.25)$ using backward difference formula.

m	0.20	0.22	0.24	0.26	0.28	0.30
K(m)	1.659624	1.669850	1.680373	1.691208	1.702374	1.713889

[4+12]

- 4.(a) Solve the differential equation $\frac{dy}{dx} = 1 + xy$ subject to $y(0) = 1$ by Taylor series method and hence find $y(0.2)$.
- (b) Solve the difference equation $y_{n+2} + 3y_{n+1} + 2y_n = 0$, $y_0 = 1$, $y_1 = 2$ by z - transform.

[8+8]

- 5.(a) Find the Fourier series of $f(x) = x + x^2$, $-\pi < x < \pi$ and hence deduce the series

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots = \frac{\pi^2}{12}$$

- (b) Apply Runge - Kutta Method to find $y(0.1)$ and $y(0.2)$ where $\frac{dy}{dx} = x^2 - y$ and $y(0) = 1$.

[8+8]

Subject Code: R13107/R13**Set No - 4**6.(a) Find the Fourier transform of $e^{-|x|}$ (b) Using Regula Falsi method find a real root of $f(x) = 2x^7 + x^5 + 1 = 0$ correct upto two decimal places.

[8+8]

7.(a) Find $z\left(\frac{1}{n!}\right)$ and hence evaluate $z\left(\frac{1}{(n+1)!}\right)$ and $z\left(\frac{1}{(n+2)!}\right)$ (b) Find a real root of $f(x) = x + \log x - 2$ using Newton-Raphson method.

[8+8]

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