

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**

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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 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]



- 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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**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  $f(x) = \begin{cases} 0, & |x| < a \\ 1, & |x| > a \end{cases}$
- [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]



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

[8+8]

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  $\frac{s}{1+s^2}$
- 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]

[8+8]



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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**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  $(2e^{-5x} + 5e^{-2x})$ .

(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]



- 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]

