

I B. Tech I Semester Regular Examinations Jan./Feb. - 2015  
**MATHEMATICS-II (MATHEMATICAL METHODS)**

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

Time: 3 hours

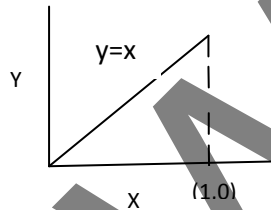
Max. Marks: 70

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.(a) Write iterative scheme to find the *fourth root* of 11.
- (b) Find  $\Delta \log f(x)$ .
- (c) Given  $y' = x + y$ ,  $y(0) = 1$ , find the value of  $y(0.4)$  (take  $h = 0.2$ ) using Euler's method.
- (d) Find the Fourier series of the periodic function with period '1'



- (e) If  $F_p$  is complex Fourier transform of  $f(x)$ , then find the complex Fourier transform of  $f(x)\sin ax$ .

(f) Prove that  $Z(\sinh nt) = \frac{z \sinh t}{z^2 - 2z \cosh t + 1}$ .

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

**PART - B**

- 2.(a) Using Regulae falsi method, find the real root correct to three decimal places of the equation  $xe^x - 2 = 0$ .
- (b) Find  $f(2.5)$  using Newton's forward formulae for the following data:

X	0	1	2	3	4	5
y	0	1	15	75	225	615

[8+8]

- 3.(a) If the interval of differencing is  $\frac{1}{2}$  find  $\Delta^2 \sin(px + q)$
- (b) Find a real root of  $x + \log_{10} x - 2 = 0$  using Newton Raphson method.

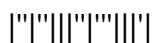
[8+8]

- 4.(a) Solve  $y^1 = x - y^2$ ,  $y(0) = 1$  by using Taylor's series method and compute  $y(0.1)$ .
- (b) Find Half range fourier cosine series of  $f(x) = x$  in the range  $0 < x < 2\pi$  and hence deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ .

[8+8]

- 5.(a) Obtain fourier series for the function  $f(x) = x \sin x$ ,  $0 < x < 2\pi$ .
- (b) Solve  $y^1 = y - x$ ,  $y(0) = 2$  for  $x = 0.2$  by using Runge-Kutta Method of fourth order.

[8+8]



6.(a) Express  $f(x) = \begin{cases} 1 & ; \text{for } 0 \leq x \leq \pi \\ 0 & ; \text{for } x > \pi \end{cases}$  as a Fourier integral and hence evaluate

$$\int_0^\infty \frac{1 - \cos \pi \lambda}{\lambda} \sin(\lambda x) d\lambda$$

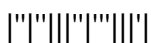
(b) Find inverse Z-transform of  $\frac{z}{(z-1)(z-2)}$ .

[8+8]

7.(a) Solve the difference equation using Z-transform  $y(n+2) - 5y(n+1) + 6y(n) = 5^n$ , given  $y(0) = 0, y(1) = 0$ .

(b) Find inverse fourier transform of  $F(p) = e^{-|p|y}$ .

[8+8]



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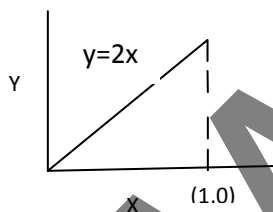
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**PART-A**

- 1.(a) Write iterative scheme to find the  $n^{th}$  root of a real number  $K(>0)$ .
- (b) Find  $\Delta^2 \sin(px + q)$ .
- (c) Find the Fourier series of the periodic function with period '1'



- (d) If  $F_p$  is complex Fourier transform of  $f(x)$ , then find the complex Fourier transform of  $f(x) \cos ax$ .
- (e) Find the Z-transform of  $\sin(n+1)x$ .
- (f) Using Euler's method, find the value of  $y(0.5)$  (take  $h = 0.25$ ) and compare with the exact solution of the equation  $y' = x + y$ ,  $y(0) = 1$ .

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

**PART - B**

- 2.(a) Using Regula-Falsi Method, find the real root of, correct to three decimal places, the equation  $\log x = \cos x$ .
- (b) Find  $y(1.91)$  using Gauss forward difference formula

x	1	2	3	4	5
y	5	14.5	14	13.25	12

[8+8]

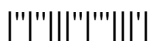
- 3.(a) If  $f(x) = e^{ax}$ , Show that  $\Delta^n f(x) = (e^{ah} - 1)^n e^{ax}$ .
- (b) Find the root of  $e^x - x^3 + \cos 25x = 0$  near  $x = 4.5$  (correct to three decimal places).

[8+8]

- 4.(a) Solve  $y' = y - x^2$ ,  $y(0) = 1$  by Picard's method up to fourth approximation.

- (b) Find a Fourier series to represent the function  $f(x) = e^x$  in  $-\pi < x < \pi$  and hence deduce a series for  $\frac{\pi}{\sinh \pi}$

[8+8]



5.(a) Find Half Range sine series of  $f(x) = x(\pi - x)$  on  $0 < x < \pi$  and deduce that

$$\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} + \dots = \frac{\pi^3}{32}.$$

(b) Using Runge-Kutta method of 4<sup>th</sup> order, compute  $y(1.1)$  for the equation  $y' = 3x + y^2$ ,  $y(1) = 1.2$ .

[8+8]

6.(a) Prove that Fourier transform of  $(x^n f(x)) = (-i)^n \frac{d^n}{dp^n} [F(p)]$ .

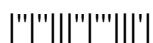
(b) Find  $Z\left(\frac{1}{n(n+1)}\right)$ .

[8+8]

7.(a) Solve the difference equation, using Z-transform  $y(n+2) + 3y(n+1) + 2y(n) = 0$  given  $y(0) = 0$ ,  $y(1) = 1$ .

(b) Find Fourier cosine transform of  $e^{-ax}$ ,  $a > 0$  and hence evaluate  $\int_0^{\infty} \frac{\cos px}{a^2 + p^2} dp$ .

[8+8]



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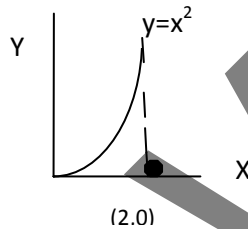
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\*\*\*\*\*

**PART-A**

- 1.(a) Write iterative scheme to find the root of the quadratic equation  $ax^2 + bx + c = 0, a \neq 0$ .
- (b) Prove that  $E^{1/2} = \mu + \frac{1}{2} \delta$
- (c) Find the Fourier series of the periodic function (of period 2) given by



- (d) If  $F_p$  is complex Fourier transform of  $f(x)$ , then find the complex Fourier transform of  $f(x) \sin ax$ .
- (e) Given  $y' = x + y, y(0) = 1$ , find the value of  $y(0.4)$  using Picard's method up to second degree term.
- (f) Find the Z-transform of  $\cos(n+1)x$ .

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

**PART - B**

- 2.(a) Using Regula Falsi method solve the equation  $e^x \sin x = 1$ .
- (b) Using Lagrange's interpolation formula find  $y(10)$  from the data given below:

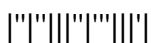
X	5	6	9	11
y	12	13	14	15

[8+8]

- 3.(a) Prove that  $\nabla \Delta = \Delta - \nabla = \delta^2$ .
- (b) Find approximate root of the equation  $x^3 - 8x - 4 = 0$  near 3.
- 4.(a) Given  $y^1 = \frac{y-x}{y+x}, y(0) = 1$  compute  $y(0.2)$  in steps of 0.1 using modified Euler's method.
- (b) If  $f(x) = |x|$  expand  $f(x)$  as fourier series in the interval  $(-2,2)$ .

[8+8]

[8+8]



5.(a) If  $f(x) = \begin{cases} x & ; \text{if } 0 < x < \frac{\pi}{2} \\ \pi - x & ; \text{if } \frac{\pi}{2} < x < \pi \end{cases}$  Find Half range sine series of  $f(x)$ .

(b) Using Runge-Kutta method of fourth order, compute  $y(2.5)$  for the equation  $y^1 = \frac{x+y}{x}$ ,  $y(2) = 2$ .

[8+8]

6.(a) Find Fourier transform of  $f(x) = e^{-|x|}$  and hence deduce that  $\int_0^\infty \frac{\cos xt}{1+t^2} dt = \frac{\pi}{2} e^{-|x|}$ .

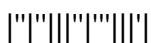
(b) Evaluate  $Z^{-1} \left[ \frac{Z^2}{(Z-3)(Z-4)} \right]$

[8+8]

7.(a) Find finite Fourier cosine transform of  $f(x) = \left(1 - \frac{x}{\pi}\right)^2$  in  $(0, \pi)$ .

(b) Using Z-transform, solve the difference equation  $y_{n+2} - 5y_{n+1} - 6y_n = 2^n$  using  $y_0 = 0, y_1 = 0$ .

[8+8]



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**PART-A**

- 1.(a) Using Newton-Raphson method find the reciprocal of a number.
- (b) Express shift operator E in terms of exponential function.
- (c) Find half range Fourier sine series of  $f(x) = e^x$  in  $(0, 1)$ .
- (d) Using Euler's method, solve for y at  $x = 2$  from  $\frac{dy}{dx} = 3x^2 + 1, y(1) = 2$ .
- (e) If  $F_p$  is complex Fourier transform of  $f(x)$ , then find the complex Fourier transform of  $f(x) \sin ax$ .
- (f) Find the Z  $[n^2 a^n]$ .

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

**PART-B**

- 2.(a) Using Regulae falsi method find approximate root of the equation  $x^3 - x - 4 = 0$ .
- (b) Find  $f(3.5)$  using Newton's forward interpolation formula for the data :

X	0	1	2	3	4	5
y	0	1	12	60	150	225

[8+8]

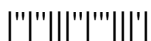
- 3.(a) Prove that  $(1 + \Delta)(1 - \nabla) = 1$ .
  - (b) Using Newton Raphson method compute  $\sqrt[3]{37}$  correct to four decimal places.
- [8+8]
- 4.(a) Using Euler's method solve  $y' = x + y, y(0) = 1$  for  $x = 0.2$  and  $0.4$ , Check with exact solution.

- (b) Expand  $f(x) = \begin{cases} 1 + \frac{2x}{\pi}; & \text{if } -\pi \leq x \leq 0 \\ 1 - \frac{2x}{\pi}; & \text{if } 0 \leq x \leq \pi \end{cases}$  as a fourier series and hence deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ .

[8+8]

- 5.(a) Obtain fourier cosine series for  $f(x) = x \sin x; 0 < x < \pi$ .
- (b) Using Runge-Kutta method of fourth order find  $y(0.4)$  for the differential equation  $y' = x^2 + y^2, y(0) = 0$  use  $h = 0.2$

[8+8]



6.(a) Express  $f(x) = \begin{cases} 1; & 0 \leq x \leq \pi \\ 0; & x > \pi \end{cases}$  as a fourier sine integral and hence evaluate

$$\int_0^{\infty} \frac{1-\cos \pi \lambda}{\lambda} \sin x \lambda d \lambda.$$

(b) Find  $Z\left[2n - 5 \sin \frac{n\pi}{4} + 3a^4\right]$ .

7.(a) Find the solution of the difference equation using Z-transform  $y_{n+2} - 6y_{n+1} + 9y_n = 3^n$  with  $y_0 = 0, y_1 = 1$ . [8+8]

(b) Find fourier transform of  $f(x) = \begin{cases} 1 - x^2; & |x| \leq 1 \\ 0; & |x| > 1 \end{cases}$

[8+8]

