

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)

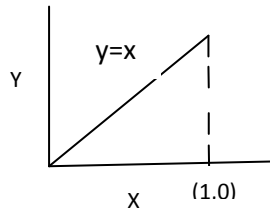
Time: 3 hours

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**

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.

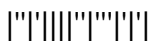
[8+8]

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

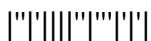
(b) Find inverse Z-transform of $\frac{z}{(z-1)(z-2)}$.

[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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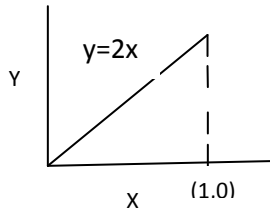
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PART-A

- 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 4th 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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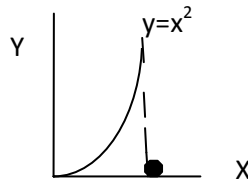
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 Answering the question in **Part-A** is Compulsory,
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PART-A

- 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



(2.0)

- (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

- 3.(a) Prove that $\nabla \Delta = \Delta - \nabla = \delta^2$. [8+8]
- (b) Find approximate root of the equation $x^3 - 8x - 4 = 0$ near 3. [8+8]
- 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]



- 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 $y' = \frac{x+y}{x}$, $y(2) = 2$. [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.

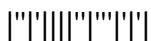
- (b) Expand $f(x) = \begin{cases} 1 + \frac{2x}{\pi}; & \text{if } -\pi \leq x \leq 0 \\ 1 - \frac{2x}{\pi}; & \text{if } 0 \leq x \leq \pi \end{cases}$ as a fourier series and hence deduce that

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}.$$

[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 $Z \left[2n - 5 \sin \frac{n\pi}{4} + 3a^4 \right]$. [8+8]
- 7.(a) Find the solution of the difference equation using Z-transform $y_{n+2} - 6y_{n+1} + 9y_n = 3^n$ with $y_0 = 0, y_1 = 1$.
- (b) Find fourier transform of $f(x) = \begin{cases} 1 - x^2; & |x| \leq 1 \\ 0; & |x| > 1 \end{cases}$ [8+8]

