

Subject Code: R13107/R13

Set No - 1

I B. Tech I Semester Regular/Supplementary Examinations Nov./Dec. - 2015
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. (a) Evaluate $\sqrt{24}$ to four decimal places by Newton's iterative method.
- (b) Prove that $\sum_{k=0}^{n-1} \Delta^2 f_k = \Delta f_n - \Delta f_0$.
- (c) Solve by Euler's method, $y' = x - y^2$, $y(0) = 1$, find $y(0.2)$ taking step size $h = 0.1$.
- (d) Find the half range Fourier cosine series for $f(x) = x^2$ in $0 < x < \pi$.
- (e) If $F(p)$ is the complex Fourier transform of $f(x)$, then show that

$$F[f(x) \cos ax] = \frac{1}{2}[F(p+a) + F(p-a)].$$
- (f) State left shifting theorem in Z - transform.

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

PART-B

2. (a) Find the root of $x \sin x + \cos x = 0$ using Newton- Raphson method.
- (b) Using Lagrange's formula, fit a polynomial to the data and find the value of $f(1)$, given that

x	-2	-1	2	7
f(x)	-1	0	4	11

[8+8]

3. (a) Find a real root of $x \tan x + 1 = 0$ using False position method.
- (b) Find $y(66)$ given that $y(50) = 201$, $y(60) = 225$, $y(70) = 248$ and $y(80) = 274$. Using Newton's backward difference formula.

[8+8]

4. (a) Tabulate $y(0.1)$, $y(0.2)$ and $y(0.3)$ using Picard's method given that $y' = y^2 + x$, $y(0) = 1$.
- (b) Find the Fourier series of $x \sin x$ for $0 < x < 2\pi$.

[8+8]

5. (a) Evaluate $y(0.6)$ using Runge Kutta method given $y' = (x + y)^{1/2}$, $y(0.4) = 0.41$.
- (b) Expand $\sin \pi x$ in $(0,1)$ as Fourier cosine series.

[8+8]



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6. (a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & \text{if } |x| \leq 1 \\ 0, & \text{if } |x| > 1 \end{cases}$.

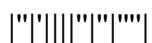
(b) If $\frac{3z^2 - 4z + 7}{(z-1)^3}$ is the z-transform of f(n), find f(0), f(1), f(2).

[8+8]

7. (a) Find the solution of the difference equation $y(n+2) - 2y(n+1) + y(n) = 2^n$,
 $y(0) = 2, y(1) = 1$.

(b) Find the finite Fourier cosine transform of the function $f(x) = \left(1 - \frac{x}{\pi}\right)^2$ in $0 < x < \pi$.

[8+8]



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Set No - 2

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

PART-A

1. (a) Evaluate $\sqrt{42}$ to four decimal places by Newton's iterative method.
- (b) Prove that $1 + \frac{1}{4}\delta^2 = \mu^2$.
- (c) Solve the equation, $y' = x - y^2, y(0) = 1$, find $y(0.2)$ using Taylor's series method.
- (d) Find the half range Fourier sine series for $f(x) = x^2$ in $0 < x < 2$.
- (e) If $F_s(p)$ is the complex Fourier Sine transform of $f(x)$, then show that

$$F_s[f(x)\cos ax] = \frac{1}{2}[F_s(p+a) + F_s(p-a)].$$
- (f) State Final value theorem in Z - transform.

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

PART-B

2. (a) Find a real root of $x^4 - x - 9 = 0$ using false position method.
- (b) Using Lagrange's formula, fit a polynomial to the data and find the value of $f(1)$, given that

x	-1	0	2	3
f(x)	-12	-8	6	11

[8+8]

3. (a) Find a real root of $x \tan x + 1 = 0$ using Newton Raphson method.
- (b) Find $y(54)$ given that $y(50) = 201, y(60) = 225, y(70) = 248$ and $y(80) = 274$. Using Newton's forward difference formula.

[8+8]

4. (a) Tabulate $y(0.1), y(0.2)$ and $y(0.3)$ using Taylor's series method given that $y' = y^2 + x, y(0) = 1$.
- (b) Find the Fourier series of $x \cos x$ for $0 < x < 2\pi$.

[8+8]

5. (a) Evaluate $y(0.8)$ using Runge Kutta method given $y' = (x + y)^{1/2}, y(0.4) = 0.41$.
- (b) Expand $\cos \pi x$ in $(0,1)$ as Fourier sine series.

[8+8]



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Set No - 2

6. (a) Find the Fourier transform of $e^{-\frac{x^2}{2}}$, $-\infty < x < \infty$.

(b) Find inverse Z transform of $\frac{z}{z^3 - 7z^2 + 14z - 8}$.

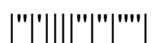
[8+8]

7. (a) Find the solution of the difference equation $y(n+2) - 5y(n+1) + 6y(n) = 5^n$,

$y(0)=0, y(1)=0$.

(b) Find the finite Fourier sine and cosine transform of the function $f(x)=2x$ in $0 < x < 2\pi$.

[8+8]



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Set No - 3

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PART-A

1. (a) Evaluate $\sqrt{26}$ to four decimal places by Newton's iterative method.
- (b) Prove that $1 + \mu^2 \delta^2 = \left(1 + \frac{\delta^2}{2}\right)^2$.
- (c) Solve the equation, $y' = xy + 1, y(0) = 1$, find $y(0.2)$ using Taylor's series method.
- (d) Find the half range Fourier cosine series for $f(x) = x^2$ in $0 < x < 3$.
- (e) If $F_S(p)$ and $F_C(p)$ are the complex Fourier sine and cosine transforms of $f(x)$ respectively, then show that $F_C[f(x)\sin ax] = \frac{1}{2}[F_S(p+a) - F_S(p-a)]$.
- (f) State Right shifting theorem in Z - transform.

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

PART-B

2. (a) Find the root of $x \sin x + \cos x = 0$ using Regula Falsi method.
- (b) Using Lagrange's formula, fit a polynomial to the data and find the value of $f(14)$, given that

x	12	13	15	19
f(x)	11	15	18	31

[8+8]

3. (a) Find a root correct to three decimal places of the equation $x^4 - x - 13 = 0$ using Newton's iterative method.
- (b) The population of a nation in the decimal census was given below. Estimate the population in the year 1925 using appropriate interpolation formula

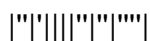
Year x	1891	1901	1911	1921	1931
Population y (thousands)	46	66	81	93	101

[8+8]

4. (a) Solve $y' = 2x - y$ and $y(1) = 3$ by modified Euler's method and compute $y(1.1)$.

(b) Find the Fourier series of $f(x) = \begin{cases} x & 0 \leq x \leq -\pi \\ 2\pi - x & -\pi \leq x \leq \pi \end{cases}$. Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{8}$.

[8+8]



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5. (a) Find the Fourier series of $x \sin x$ for $0 < x < 2\pi$.

(b) Using Runge-Kutta fourth order formula, Find $y(0.2)$ for the equation $y' = \frac{y-x}{y+x}$
 $y(0) = 1$ taking $h=0.1$.

[8+8]

6. (a) Find the Fourier sine and cosine transform of $f(x) = \frac{1}{1+x^2}$.

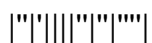
(b) Find inverse Z-transform of $\frac{8z - z^3}{(4-z)^3}$.

[8+8]

7. (a) Find the solution of the difference equation $y(n+2) - 6y(n+1) + 9y(n) = 3^n$.
 $y(0)=0, y(1)=1$.

(b) Find the inverse Fourier cosine transform of $\frac{\sin ap}{p}$.

[8+8]



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Set No - 4

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Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**

PART-A

1. (a) Evaluate $\sqrt{45}$ to four decimal places by Newton's iterative method.
- (b) Prove that $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$.
- (c) Solve the equation, $y' = xy + 1, y(0) = 1$, find $y(0.2)$ using Euler's method taking $h = 0.1$.
- (d) Find the half range Fourier sine series for $f(x) = x^2$ in $0 < x < \pi$.
- (e) If $F_s(p)$ and $F_c(p)$ are the complex Fourier sine and cosine transforms of $f(x)$ respectively, then show that $F_s[f(x)\sin ax] = \frac{1}{2}[F_c(p-a) - F_c(p+a)]$.
- (f) Evaluate $Z(3^{2n+8})$.

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

PART-B

2. (a) Find a real root of $x^2 - \log_x e = 12$ using Regula falsi method.
- (b) Using Lagrange's formula, fit a polynomial to the data and find the value of $f(10)$, given that

x	2	5	9	15
f(x)	11	15	18	31

[8+8]

3. (a) Find a real root of the equation by Newton Raphson method for: $e^x - x^3 + \cos 25x$ correct to three decimal places.
- (b) The population of a nation in the decimal census was given below. Estimate the population in the year 1905 using appropriate interpolation formula

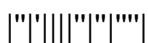
Year x	1891	1901	1911	1921	1931
Population y (thousands)	46	66	81	93	101

[8+8]

4. (a) Solve $y' = x - y^2, y(0) = 1$ using Taylor's series method and compute $y(0.1), y(0.2)$
- (b) Find the Fourier series for the function $f(x) = x^2 - x$ in $(-\pi, \pi)$. Hence deduce that

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

[8+8]



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Set No - 4

5. (a) Find $y(0.1)$, $y(0.2)$ using Runge-Kutta fourth order formula given that

$$y' = x + x^2y, y(0) = 1.$$

(b) Expand $f(x) = (x-1)^2$ as half range sine series in $(0, 1)$.

[8+8]

6. (a) Find the Fourier transform of $f(x) = \frac{1}{\sqrt{|x|}}$.

(b) Find inverse Z-transform of $\frac{8z - z^3}{(4 - z)^3}$.

[8+8]

7. (a) Find the solution of the difference equation $y(n+2) + 5y(n+1) + 4y(n) = 2^n, y(0) = 1, y(1) = -4$.

(b) Find the inverse Fourier cosine transform of $p^n e^{-ap}$.

[8+8]

