Subject Code: R13207/R13 **Set No - 1**

I B. Tech II Semester Supplementary Examinations Feb. - 2015

MATHEMATICS-II (MATHEMATICAL METHODS)

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal 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) Solve $x^3 - 2x - 5 = 0$ for a positive root by iteration method.

(ii) Express shift operator E in terms of exponential function.

(iii) Using Euler's method, solve for y at x = 0.2 from $\frac{dy}{dx} = y^2 + x, y(0) = 1$, taking step size h = 0.1.

(iv) Find b_n , Using the Fourier series of the function f(x) is given by

$$f(x) = \begin{cases} \frac{1}{2} + x, \; for -1 \le x \le 0 \\ \frac{1}{2} - x, \; for \;\; 0 \le x \le 1 \end{cases}$$

(v) State Fourier integral theorem and then obtain Fourier integral in complex form.

(vi) Using $Z[2.3^n + 5.n] = \frac{2z}{z-3} + \frac{5z}{(z-1)^2}$, find $Z[2.3^{n+3} + 5(n+3)]$ using shifting theorem.

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

PART–B

2.(a) Using Regula-Falsi Method, find the real root of, $x^3 - x - 4 = 0$.

(b) Construct the difference table for the following data

x	0.2	0.4	0.6	0.8	1.0
y	0.001	0.0045	0.12	0.25	0.45

and evaluate f(0.7).

[8+8]

3.(a) Prove that (i) $E\nabla = \nabla E = \Delta$ (ii) $\delta E^{1/2} = \Delta$.

(b) Find the root of $x \sin x + \cos x = 0$ using Newton-Raphson method.

[8+8]

4.(a) Evaluate y(0.2) and y(0.4) correct to three decimals by Taylor's method if y(x) satisfies $y' = 1 - 2xy, y(0) = 0$.

(b) Find the Fourier series of the function $f(x) = \begin{cases} 0, & 0 < x < 1 \\ x^2, & 1 < x < 2 \end{cases}$.

[8+8]

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5.(a) Find y(0.1) and y(0.2) using Runge-Kutta 4th order formula, given that $y' = x^2 - y$, y(0)=1.

(b) Express f(x) = x as a half range cosine series in $1 < x < 2$ and hence prove that $\frac{8}{\pi^2}\left[1+\frac{1}{3^2}+\frac{1}{5^2}+...\right]=1$.

[8+8]

6.(a) Find the Fourier transform of e^{-x^2}

(b) Find $Z[\cosh at.\sin bt]$

[8+8]

7.(a) Find the finite Fourier transform of $f(x) = x^3$ in $(0, \pi)$.

(b) Solve the difference equation $u_{n+2} - 3u_{n+1} + 2u_n = 0, u_0 = 0, u_1 = 1$ using Z-transform.

[8+8]

Subject Code: R13207/R13 | **Set No - 2**

I B. Tech II Semester Supplementary Examinations Feb. - 2015

MATHEMATICS-II (MATHEMATICAL METHODS)

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal 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) Find a real root of the equation $2x - \log x = 7$ using iteration method.

(ii) Show that $e^x\left(u_0 + x\Delta u_0 + \frac{x^2}{2!}\Delta^2 u_0 + \ldots\right) = u_0 + u_1 x + u_2 x^2 + \ldots$.

(iii) Solve $\frac{dy}{dx} = 1 + xy,\ y(0) = 1$ by using Picard's method up to 2 approximations.

(iv) Find a_n, using the Fourier series of the function f(x) given by

$$f(x) = \begin{cases} -k, & for\ -\pi < x < 0 \\ k, & for\ \ 0 < x < \pi \end{cases}$$

(v) Prove that $F_s\{f'(x)\} = -pF_c(p)$.

(vi) If $f(z) = \frac{2z^2 + 4z + 12}{(z-1)^4}$, find the value of f(2).

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

PART–B

2.(a) Using Regula-Falsi method, find the root of $x^3 - x - 2 = 0$ over (1, 2).

(b) Find $f(2.5)$ using Newton's forward formula for the following table

x	0	1	2	3	4	5
y	0	1	8	21	72	94

[8+8]

3.(a) Find the Lagrange's interpolation formula for the data

X	0	2	5	6
f(x)	2	4	12	14

and hence evaluate f(3.5).

(b) By using Newton-Raphson method, find the root of $x^4 - x - 10 = 0$ correct to three decimal places.

[8+8]

4.(a) Find by Taylor's series method the value of y at x = 0.1 up to 3 decimal places, given that $y' = x^2 y - 1,\ y(0) = 1$.

(b) Obtain the Fourier series of $f(x) = e^x$ in the range $0 < x < 2\pi$.

[8+8]

5.(a) Given $y' = x + \sin y, y(0) = 1$, compute y(0.2) and y(0.4) using Euler's modified method.

(b) Find Fourier cosine series of the function f(x) = sin x in $(0, \pi)$ and hence show that $\sum_{n=1}^{\infty} \frac{1}{4n^2 - 1} = \frac{1}{2}$.

[8+8]

6.(a) Express $f(x) = \begin{cases} 1, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$ as Fourier sine integral and hence evaluate $\int_1^{\infty} \frac{1 - \cos \pi\lambda}{\lambda} \sin x\lambda \; dx$

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

[8+8]

7.(a) Find Fourier sine transform of $e^{-|x|}$ and hence evaluate $\int_0^{\infty} \frac{x \sin mx}{1 + x^2} dx$.

(b) Find $Z^{-1}\left[\frac{8z - z^3}{(4 - z)^3}\right]$.

[8+8]

Subject Code: R13207/R13 **Set No - 3**

I B. Tech II Semester Supplementary Examinations Feb. - 2015

MATHEMATICS-II (MATHEMATICAL METHODS)

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal 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) Find a positive root of the equation by iteration method: 3x = cos x+1.

(ii) Using the method of separation of symbols, show that

$$\Delta^n u_{x-n} = u_x - nu_{x-1} + \frac{n(n-1)}{2}u_{x-2} + ... + (-1)^n u_{x-n}.$$

(iii) Using Euler's method, solve for y(2) from $\frac{dy}{dx} = 3x^2 + 1, y(1) = 2$, taking step size h=0.5.

(iv) Using the Fourier series, Find b_n of the function f(x) given by

$$f(x) = \begin{cases} -x, \ for -\pi < x < 0 \\ x, \ for \ \ 0 < x < \pi \end{cases}.$$

(v) If $F_s(p)$ is the Fourier sine transform of f(x), then show that

$$F_s[f(x)\cos ax] = \frac{1}{2}[F_s(p+a) + F_s(p-a)].$$

(vi) If $f(z) = \frac{5z^2 + 3z + 12}{(z-1)^4}$, find the value of f(2).

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

PART–B

2.(a) Using Regula-Falsi Method, find the root of $xe^x - 2 = 0$.

(b) Use Gauss backward interpolation formula to find f(32) given that
$f(25) = 0.2707, f(30) = 0.3027, f(35) = 0.3386, f(40) = 0.3794$.

[8+8]

3.(a) Find a real root of $xe^x - \cos x = 0$ using Newton-Raphson method.(up to 4 decimals)

(b) Use Lagrange's formula to fit a polynomial to the data

x	0	1	3	4
y	-12	0	6	12

Also find y(2).

[8+8]

4.(a) Solve $y' = y - x^2, y(0) = 1$ using Picard's method up to 4th approx.

(b) Obtain Fourier series of $f(x) = x\sin x, \ 0 < x < \pi$ and Show that

$$\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + ... = \frac{\pi - 2}{4}.$$

[8+8]

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5.(a) Given $y' = -xy^2$, $y(0) = 2$. Compute y(0.2) in steps of 0.1 using modified Euler's method.

(b) Expand $\cos \pi x$ in (0, 1) as Fourier sine series.

[8+8]

6.(a) Solve the difference equation $y_{n+2} + 2y_{n+1} + y_n = n, y_0 = y_1 = 0$ using Z-transform.

(b) Prove that $F\left[\frac{d^n}{dx^n} F(x)\right] = (-ip)^n F(p)$ .where $F[f(x)] = F(p)$.

[8+8]

7.(a) Using Fourier integral Show that $e^{-x}\cos x = \frac{2}{\pi}\int_0^\infty \frac{\lambda^2+2}{\lambda^4+4}\cos \lambda x \, d\lambda$.

(b) Find $Z^{-1}\left[\frac{z^2-3z}{(z+2)(z-5)}\right]$.

[8+8]

Subject Code: R13207/R13 **Set No - 4**

I B. Tech II Semester Supplementary Examinations Feb. - 2015

MATHEMATICS-II (MATHEMATICAL METHODS)

(Common to CE, ME, CSE, PCE, IT, Chem E, Aero E, Auto E, Min E, Pet E, Metal 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) Solve $x = 1 + \tan^{-1} x$ by iteration method.

(ii) If the interval of differencing is unity, prove that $\Delta \tan^{-1}\left(\frac{n-1}{n}\right) = \tan^{-1}\left(\frac{1}{2n^2}\right)$.

(iii) Solve $\frac{dy}{dx} = 2x - y, y(1) = 3$ by using Picard's method up to 2 approximations.

(iv) Find a_n, Using the Fourier series of the function f(x) is given by

$$f(x) = \begin{cases} -\frac{1}{2}(\pi + x), \; for - \pi < x \le 0 \\ \frac{1}{2}(\pi - x), \; for \;\; 0 \le x < \pi \end{cases}$$

(v) State and prove Modulation theorem in Fourier transform.

(vi) Using $Z(n^2) = \frac{z^2 + z}{(z-1)^3}$, find $Z[(n+1)^2]$ using shifting theorem.

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

PART–B

2.(a) Using Regula-Falsi Method, find the root of $xe^x - 2 = 0$.

(b) Prove that $(1 + \Delta)(1 - \nabla) = 1$.

[8+8]

3.(a) Find the root $x^3 - x - 4 = 0$ up to 3 decimal places using Newton-Raphson method.

(b) Given that $y(3) = 6, y(5) = 24, y(7) = 58, y(9) = 108, y(11) = 174$, find x when y = 100 using Lagrange's formula.

[8+8]

4.(a) Using Taylor's series method, solve $y' = xy + y^2, y(0) = 1$, x = 0.1 and 0.2

(b) Find Half range Fourier cosine series of f(x) = cos ax (a is not an integer) in $0 < x < \pi$.

[8+8]

5.(a) Find the half-range cosine series for $\mathrm{f(x) = x(2 - x)}$, in $0 \le \mathrm{x} \le 2$ and hence find sum of the series $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots$

(b) Given $y' = x - y, y(1) = 0.4$, find y(1.2) using Runge-Kutta method.

[8+8]

|''|''|||''|'''|||'|

6.(a) Find the inverse Fourier transform f(x) of $F_s(p) = \frac{p}{1+p^2}$.

(b) Solve the difference equation $y_{n+2} - 6y_{n+1} + 8y_n = 2^n$, using Z-transform.

[8+8]

7.(a) Using Fourier integral, Show that $\int_0^\infty \frac{\cos \lambda x}{\lambda^2 + a^2} dx = \frac{\pi}{2a} e^{-ax}, a > 0, x \geq 0$.

(b) If $\frac{3z^2 - 4z + 7}{(z-1)^3}$ is Z[f(n)], then find f(0), f(1), and f(2).

[8+8]