Subject Code: R13107/R13 **Set No - 1**

I B. Tech I Semester Supplementary Examinations Aug. - 2015

MATHEMATICS-II (MATHEMATICAL METHODS)

(Common to ECE, EEE, EIE, Bio-Tech, ECom.E, 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) What is the difference between Bisetion method and Regula-Falsi method.

(b) Prove the result, $1+\mu^2\delta^2 = (1+\frac{\delta^2}{2})^2$

(c) Find the Picard's first approximation of $\frac{dy}{dx} = 1+y^2, y(0)=0$

(d) If $f(x)=\frac{x}{2}$ express and f(x) as a Fourier series in the interval (-π,π)

(e) Find the inverse Finte cosine transform f(x) if $F_c(n) = \frac{\cos(\frac{2n\pi}{3})}{(2n+1)^2}$, where 0<x<4

(f) Show that $Z[\sinh n\theta] = \frac{z\sinh\theta}{z^2 - 2z\cosh\theta + 1}$

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

PART-B

2.(a) Find a root correct to 3decimal places for the equation $x^3 - 4x + 9 = 0$ using bisection method.

(b) Find a real root of the equation $xe^x - \cos x = 0$ using Netwon Raphson method.

[8+8]

3.(a) Certain values of x and $\log_{10}^{x}$ are (300,2.4771),(304,2.4829),(305,2.4843),(307,2.4871). Find $\log_{10}^{301}$

(b) Using Lagrange's formula find y(5), given that

x	0	1	3	8
y	1	3	13	128

[8+8]

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4.(a) Use Runge-Kutta fourth order method to find the value of y when x=1 given that y=1 When x=0 , $\frac{dy}{dx}=\frac{y-x}{y+x}$;

(b) Use Taylor's series method to approximate y when x=0.1, x=0.2 for $\frac{dy}{dx}=x+y^2$ where y(0) =0

[8+8]

5.(a) Obtain the Fourier series expansion of f(x) given that $f(x)=(\pi-x)^2$ in $0<x<2\pi$ and Deduce the value of $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+-------- =\frac{\pi^2}{6}$.

(b) Find the Fourier cosine transform of f(x) defined by $f(x)=\frac{1}{1+x^2}$ hence find Fourier sine transform of $f(x)=\frac{x}{1+x^2}$

[8+8]

6.(a) Using Fourier integral ,show that $e^{-ax}=\frac{2a}{\pi}\int_0^\infty \frac{\cos\lambda x}{\lambda^2+a^2}d\lambda$, (a>0,x≥0)

(b) Obtain a half –range cosine series for $f(x)=\begin{cases} kx;\ for 0\le x\le l/2 \\ k(x-1);\ for l/2\le x\le l\end{cases}$

And deduce the sum of the series $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.................=\frac{\pi^2}{8}$

[8+8]

7.(a) Solve $y_{n+2}+6y_{n+1}+9y_n=2^n$ with $y_0=y_1=0$ Using Z-transform.

(b) If $F(z)=\frac{5z^2+3z+12}{(z-1)^4}$; then find the values of y_2, y_3

[8+8]

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Subject Code: R13107/R13 **Set No - 2**

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

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PART-A

1.(a) Find the reciprocal of 18 using Newten-Raphsen method.

(b) Prove that if f(x) is a polynomial of degree 'n' and the values of x are equally spaced then $\Delta^n f(x)$ is a constant.

(c) Solve By Euler's method, the equation $\frac{dy}{dx} = x + y, y(0) = 0$ Choose h=0.2 compute y(0.4).

(d) Define the Fourier series for even and odd functions.

(e) Find the Fourier transform f(x) defined by $f(x) = \begin{cases} e^{iqx}, \alpha < x < \beta \\ 0, x < \alpha, x > \beta \end{cases}$

(f) Using Convolution theorem show that $Z^{-1}\left[\frac{1}{n!} * \frac{1}{n!}\right] = \frac{2^n}{n!}$

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

PART-B

2.(a) Find real root of the equation $x^3 + x + 1 = 0$ correct to 3decimal places by iteration method.

(b) Find real root of the equation $x \log_{10} x = 1.2$ correct to 4decimal places by regula –Falsi method.

[8+8]

3.(a) Using Lagrange's formula, fit the polynomial to the data

x	-1	0	2	3
y	-8	3	1	12

and hence find y(1).

(b) Applying Netwon's forward interpolation formula compute the value of $\sqrt{5.5}$ given that $\sqrt{5} = 2.236, \sqrt{6} = 2.449, \sqrt{7} = 2.646, \sqrt{8} = 2.828$ correct upto three places of decimal.

[8+8]

Subject Code: R13107/R13 **Set No - 2**

4.(a) Given $\frac{dy}{dx} - \sqrt{xy} = 2$ and y(1)=1 .Find the value of y(1.5) in steps of 0.25 using Euler's modified method.

(b) Given $\frac{dy}{dx} = 1 + xy$, y=1at x=0 compute y(0.1) correct to 4 decimal places using Taylor series method.

[8+8]

5.(a) Find a Fourier series to represent the function $f(x) = e^x$, for $-\pi < x < \pi$ and hence derive a series for $\frac{\pi}{\sinh \pi}$

(b) Obtain the half-range sine and cosine series for the function $f(x) = \frac{\pi x}{8}(\pi - x)$ in the range $0 \le x \le \pi$.

[8+8]

6.(a) Show that the Fourier transform of $f(x) = \begin{cases} a - |x|, \; for\,|x| < a \\ 0, \; for\,|x| > a \end{cases}$ is $\sqrt{\frac{2}{\pi}}\left(\frac{1-\cos as}{s^2}\right)$

Hence deduce that $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 = \frac{\pi}{2}$

(b) Find the finite Fourier sine transform of f(x)= defined by $f(x) = \left(1 - \frac{x}{\pi}\right)^2$ where 0<x<π

[8+8]

7.(a) Find the inverse Z-transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$

(b) Find the Z-transform of the following functions

(i) $2n - 5\sin\frac{n\pi}{4} + 3a^4$ (ii) $\cos\left(\frac{n\pi}{2} + \theta\right)$

[8+8]

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Subject Code: R13107/R13

Set No - 3

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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) What is the convergence of Newton –Raphson method.

(b) Find the second difference of the polynomial $x^4 - 12x^3 + 42x^2 - 30x + 9$ with interval of difference h=2

(c) Using Runge-Kutta method of second order, compute y(2.5) from $\frac{dy}{dx} = \frac{x+y}{x}$,y(2)=2, Taking h=0.25.

(d) What is condition for expansion a Fourier series?

(e) Prove that $F(x^n f(x)) = (-i)^n \frac{d^n}{dp^n}[F(p)]$

(f) Find $Z\left[\frac{1}{(n+1)(n+2)}\right]$

[4+4+4+2+4+4]

PART-B

2.(a) Evaluate $\sqrt{12} and \frac{1}{\sqrt{12}}$ by the fixed point iteration method.

(b) Find the real root for $xe^x = 2$ by using Regula –Falsi method.

[8+8]

3.(a) Using Lagrange's interpolation formula ,express $\frac{3x^2 + x + 1}{(x-1)(x-2)(x-3)}$ as sum of partial fractions.

(b) Using Netwen's forward interpolation formula, evaluate y(1.2).

x	1.1	1.3	1.5	1.7	1.9
y	0.21	0.69	1.25	1.89	2.61

[8+8]

4.(a) Use Runge-Kutta method to solve $10\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ for the interval $0 < x \le 4$ with h=0.4

(b) Apply Taylor series method to find y(1.1),y(1.2) correct to 3 decimal places, given $\frac{dy}{dx} = xy^{1/3}$,y(0)=1.

[8+8]

Subject Code: R13107/R13 **Set No - 3**

5.(a) If $f(x)=\begin{cases} x;0<x<\pi/2 \\ \pi-x;\pi/2<x<\pi \end{cases}$

Show that $f(x)=\frac{\pi}{4}-\frac{2}{\pi}\left[\frac{1}{1^2}\cos 2x+\frac{1}{3^2}\cos 6x+\frac{1}{5^2}\cos 10x+-------\right]$

(b) Obtain a half range cosine series for $f(x)=\begin{cases} Kx, 0\le x\le \frac{L}{2} \\ K(L-x), \frac{L}{2}\le x\le L \end{cases}$ Deduce the sum of the series $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+$................

[8+8]

6.(a) Show that the Fourier transform of $e^{\frac{-x^2}{2}}$ is $\sqrt{2\pi}.e^{-p^2/2}$ by finding the Fourier transform of $e^{-a^2x^2},(a>0)$

(b) Find the finte Fourier cosine transform of $(i)\,f(x)=\frac{x^2}{2\pi}-\frac{\pi}{6}$, $0\le x\le\pi$

$(ii)\,f(x)=x, 0<x<4$

[8+8]

7.(a) Using Z-transform solve $y_{n+2}+2y_{n+1}+y_n=n$; Given that $y_0=y_1=0$

(b) Find $(i)Z\left[a^n \sin nt\right]$ (ii) $Z\left[a^n \cosh nt\right]$

[8+8]

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Subject Code: R13107/R13 **Set No - 4**

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MATHEMATICS-II (MATHEMATICAL METHODS)

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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) What is the convergence of Newton - Raphson method.

(b) Evaluate $\Delta^n e^{ax+b}$

(c) Using Euler's method, Solve for y at x=2 from $\frac{dy}{dx} = 3x^2 + 1, y(1) = 2,$ and h=0.5

(d) Find half range Fourier series for $f(x) = ax + b, 0 < x < 1$

(e) State and prove that modulation property.

(f) Evaluate the inverse Z- transform of $\log(1+\frac{a}{z}); |z| > |a|$

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

PART-B

2.(a) Find the root of the equation $x \sin x - 1 = 0$ lies in between x=1 and x=1.5 using bisection method.

(b) Using Netwon Raphson method
(i) Find square root of a number (ii) Find Reciprocal of a number.

[8+8]

3.(a) Find the cubic polynomial which takes the following values
y(0) =1, y(1)=0, y(2)=1, y(3)=10

(b) (i) if y_x is the value of at for which the fifth differences are constant and $y_1 + y_7 = -784, y_2 + y_6 = 686, y_3 + y_5 = 1088,$ *find* y_4

(ii) if $f(x) = x^3 + 5x - 7$, from a table of forward differences taking x = -1,0,1,2,3,4,5. Show that the third differences are constant.

[8+8]

4.(a) Given $\frac{dy}{dx} = x^2 + y, y(0) = 1$ determine y(0.02), y(0.04) using Euler's modified method.

(b) Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2+1}$ with initial condition y=0 at x=0, use Picard's method's to obtain y at x=0.25, x = 0.5, x =1.

[8+8]

Subject Code: R13107/R13 **Set No - 4**

5.(a) Obtain Fourier series for the function f(x) given by $f(x)=\begin{cases}1+\dfrac{2x}{\pi}, -\pi \le x \le 0\\ 1-\dfrac{2x}{\pi}, 0 \le x \le \pi\end{cases}$

and deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+............=\frac{\pi^2}{8}$

(b) Develop f(x) as Forier series in (-2,2), if $f(x)=\begin{cases}0, -2 < x < -1\\ k, -1 < x < 1\\ 0, 1 < x < 2\end{cases}$

[8+8]

6.(a) Find the Fourier sine transform of f(x), defined by $f(x)=x^{m-1}$

(b) Find the inverse Fourier cosine transform f(x) of $F_C(p)=\begin{cases}\dfrac{1}{2a}(a-\dfrac{p}{2}), p < 2a\\ 0, p \ge 2a\end{cases}$

[8+8]

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

(b) Find (i) $Z\left[n^2a^n\right]$ (ii) $Z\left[2.5^n+3.n\right]$ and deduce $Z\left[2.5^{n+3}+3(n+3)\right]$

[8+8]

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