Code No: R161109 **R16** SET - 1

I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018
MATHEMATICS-II (MM)
(Com to CSE, IT, Agri E)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is Compulsory
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Using Newton Raphson method find an approximate root, which lies near $x = 2$ of the equation $x^3 - 3x - 5 = 0$ up to two approximations. (2M)

b) In Fourier series expansion of $f(x) = x^3, -\pi \le x \le \pi$ find the Fourier coefficient b_n. (2M)

c) Evaluate $\Delta\left(e^x \log 2x\right)$. (2M)

d) Evaluate $\int_0^6 \frac{1}{1+x}dx$ by using Simpson's 1/3rd rule, given that (2M)

X	0	1	2	3	4	5	6
Y	1	0.5	0.33	0.25	0.2	0.167	0.143

e) In Fourier series expansion of $f(x) = x^2, -\pi \le x \le \pi$ find the Fourier coefficient a_n. (2M)

f) Solve $u_x - 4u_y = 0$, by using method of separation of variables. (2M)

g) If $F(p)$ is the complex Fourier transform of $f(x)$ then prove that $F\{f(ax)\} = \frac{1}{a}F\left(\frac{p}{a}\right), a > 0.$ (2M)

PART -B

2. a) Solve $x^3 = 2x + 5$ for a positive root by iteration method. (7M)

b) Perform two iterations of the Newton-Raphson method to solve the system of equations $x^2 + 3y^2 = 4$ and $x^2 + 3x + y = 5$. (7M)

3. a) Prove that $\Delta \tan^{-1}\left(\frac{n-1}{n}\right) = \tan^{-1}\left(\frac{1}{2n^2}\right)$. (7M)

b) Find the first and second derivatives of the function tabulated below at the point x = 0.6. (7M)

X	0.4	0.5	0.6	0.7	0.8
Y	1.5836	1.7974	2.0442	2.3275	2.26511

4. a) Evaluate $\int_0^1 x\sqrt{1+x^4}\,dx$ using Simpson's 3/8 rule. (7M)

b) Given $y' = x + \sin y$, y(0) = 1. Compute y(0.2) with h = 0.2 using fourth order Runge-Kutta method. (7M)
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5. a) Find the Fourier series of $f(x)=\begin{cases}\frac{-1}{2}(\pi-x), \text{for } -\pi<x<0\\ \frac{1}{2}(\pi-x), \text{for } 0<x<\pi\end{cases}$ (7M)

b) Obtain half range sine series for e^x in $0<x<1$. (7M)

6. a) Find the Fourier transform of $f(x)=\begin{cases}1-x^2, \text{if } |x|<1\\ 0 \quad , \text{if} |x|>1\end{cases}$. Hence Show that (7M)

$\int_0^\infty \frac{\sin x - x\cos x}{x^3}dx=\frac{\pi}{4}$.

b) Find the finite Fourier sine transform of $f(x)=\sin ax$ in $(0,\pi)$. (7M)

7. Find the temperature in a bar of length 20cms whose ends are kept at zero and lateral surface insulated, if the initial temperature is $\sin\frac{\pi x}{2}+3\sin\frac{5\pi x}{2}$. (14M)

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PART –A

1. a) Using Newton Raphson method find an approximate root, which lies near $x=1.2$ of the equation $x^4 - x - 9 = 0$ upto two approximations. (2M)

b) Evaluate $\Delta^3 e^x$ with $h=1$. (2M)

c) Evaluate $\int_0^4 e^x dx$ by using Trapezoidal rule given that (2M)

X	1	2	3	4
Y	2.72	7.39	20.09	54.6

d) In Fourier series expansion of $f(x) = x^3, -\pi \le x \le \pi$ find the Fourier coefficient a_n. (2M)

e) Solve $3u_x + 2u_y = 0$ by using method of separation of variables. (2M)

f) If $F(p)$ is the complex Fourier transform of $f(x)$ then prove that $F\{f(x-a)\} = e^{ipa} F(p)$. (2M)

g) State Dirichlet's conditions. (2M)

PART -B

2. a) Solve $x = 1 + \tan^{-1} x$ by iteration method. (7M)

b) Perform two iterations of the Newton-Raphson method to solve the system of equations $x^2 + y^2 + xy = 7$ and $x^3 + y^3 = 9$. (7M)

3. a) Show that $\Delta f_i^2 = (f_i + f_{i+1})\Delta f_i$ (7M)

b) For the table below: find $f'(1.76)$ and $f'(1.72)$ (7M)

x	1.72	1.73	1.74	1.75	1.76
y	0.17907	0.17728	0.17552	0.17377	0.17204

4. a) Evaluate $\int_0^2 xe^{-x^2} dx$ using Simpson's rule taking h = 0.25. (7M)

b) Using fourth order Runge-Kutta method, solve for y at x = 2 from $\frac{dy}{dx} = 3x^2 + 1$, y(1) = 2. (7M)

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5. a) Find the Fourier series of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval $0 < x < 2\pi$. (7M)

   b) Obtain the Fourier cosine series for f(x) = x sin x, $0 < x < \pi$. (7M)

6. a) Find Fourier transform of $f(x) = e^{-x^2/2}, -\infty < x < \infty$. (7M)

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

7. A tightly stretched string of length 20 cms., fastened at both ends is displaced from its position of equilibrium, by imparting to each of its points an initial velocity given by: (14M)

   $V(x) = \begin{cases} x, & 0 \le x \le 10 \\ 20 - x, & 10 \le x \le 20 \end{cases}$ x being the distance from one end. Determine the displacement at any subsequent time.

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PART –A

1. a) Using Newton Raphson method find an approximate root, which lies near $x=1$ of the equation $x^3 - x - 2 = 0$ up to two approximations. (2M)

b) Evaluate $\Delta\left(\frac{2^x}{x!}\right)$ with $h=1$. (2M)

c) Evaluate $\int_0^6 \frac{1}{1+x^2}dx$ by using Simpson's 1/3rd rule given that (2M)

X	0	1	2	3	4	5	6
y	1	0.5	0.2	0.1	0.058	0.038	0.027

d) In Fourier series expansion of $f(x)=|\sin x|, -\pi < x < \pi$ find the Fourier coefficient a_n. (2M)

e) Find fourier cosine transform of $f(x)=\begin{cases} \cos x, 0 < x < a \\ 0, x \geq a \end{cases}$ (2M)

f) Solve $4u_x + u_y = 3u$ by using method of separation of variables. (2M)

g) Define Fourier Integral theorem. (2M)

PART -B

2. a) Find a real root for $e^x \sin x = 1$ using Regula Falsi method. (7M)

b) Find an approximate root of the equation $xe^x - \cos x = 0$ using Newton-Raphson method. (7M)

3. a) Show that $\Delta\left(\frac{f_i}{g_i}\right) = (g_i \Delta f_i - f_i \Delta g_i)/g_i g_{i+1}$ (7M)

b) Compute $f'(4)$ from the following table: (7M)

x	1	2	4	8	10
f(x)	0	1	5	21	27

4. a) Evaluate $\int_0^2 e^{-x^2} dx$ using Simpson's rule taking h = 0.25. (7M)

b) Using fourth order Runge-Kutta method, find y(0.2) , given $y' = x + y$, y(0) = 1. (7M)

5. a) Find the Fourier series expansion for f(x), if $f(x)=\begin{cases} 2, if\ -2 \leq x \leq 0 \\ x, if\ 0 < x < 2 \end{cases}$ (7M)

b) Obtain half range cosine series for e^x in $0 < x < 1$. (7M)
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6. a) If F(p) is the complex Fourier transform of f(x), then the complex Fourier transform of f(x) cos ax is $\frac{1}{2}[F(p+a)+F(p-a)]$. (7M)

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

7. A tightly stretched string with fixed end points x = 0 and x = L is initially in a position given by $y = y_0 \sin^3 \frac{\pi x}{l}$. If it is released from rest from this position; find the displacement y(x, t). (14M)

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2. Answering the question in **Part-A** is Compulsory
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Using Newton Raphson method find an approximate root, which lies near $x = 2$ of the equation $x^4 - x - 10 = 0$ upto two approximations. (2M)

b) Evaluate $\Delta^3\left(a^x\right)$. (2M)

c) Evaluate $\int_1^2 e^{\frac{-1}{2}x}dx$ using Trapezoidal rule given that (2M)

X	1	1.25	1.5	1.75	2
y	0.6065	0.5352	0.4724	0.4169	0.3679

d) In half range Fourier sine series expansion of $f(x) = \cos x, 0 < x < \pi$ find the Fourier coefficient b_n. (2M)

e) Solve $u_x = 2u_t + u$ by using method of separation of variables. (2M)

f) Find the finite fourier sine transform of f(x)=x where $0 < x < 4$. (2M)

g) Define first shifting property of Fourier transforms. (2M)

PART -B

2. a) Find the root of the equation $x\log_{10}(x) = 1.2$ using False position method. (7M)

b) Find an approximate root of the equation *(x-1)sin x –x=1* using Newton-Raphson method. (7M)

3. a) Show that $\sum_{k=0}^{n-1}\Delta^2 f_k = \Delta f_n - \Delta f_0$. (7M)

b) Find the first and second derivatives of the function tabulated below at the point x = 1.5. (7M)

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.0	13.625	24.0	38.875	59.0

4. a) Evaluate $\int_0^1 \sqrt{1+x^4}\,dx$ using Simpson's 3/8 rule. (7M)

b) Using fourth order Runge-Kutta method find y(0.2) , given $y' = y + e^x$. Y(0) = 0. (7M)
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5. a) Find the Fourier series of $f(x)=\begin{cases} 0, \text{for } -\pi < x < 0 \\ x^2, \text{for } 0 < x < \pi \end{cases}$. (7M)

b) Obtain the Fourier sine series for f(x) = x sin x, $0 < x < \pi$. (7M)

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

b) Find the finite Fourier cosine transform of $f(x) = \sin ax$ in $(0, \pi)$. (7M)

7. Solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ subject to the conditions u(0, y) = 0, u(l, y) = 0, u(x, 0) = 0 and u(x, a) = $\sin\frac{n\pi x}{l}$, where $0 \le x \le l, 0 \le y \le a$ and n is a positive integer. (14M)