SET - 1

## I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov-2018 <br> 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

## PART -A

1. a) Using Newton Raphson method find an approximate root, which lies near $x=2$ of the equation $x^{3}-3 x-5=0$ up to two approximations.
b) In Fourier series expansion of $f(x)=x^{3},-\pi \leq x \leq \pi$ find the Fourier coefficient $b_{n}$.
c) Evaluate $\Delta\left(e^{x} \log 2 x\right)$.
d) Evaluate $\int_{0}^{6} \frac{1}{1+x} d x$ by using Simpson's $1 / 3^{\text {rd }}$ rule, given that

| 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 $f(x)=x^{2},-\pi \leq x \leq \pi$ find the Fourier coefficient $a_{n}$.
f) Solve $u_{x}-4 u_{y}=0$, by using method of separation of variables.
g) If $F(p)$ is the complex Fourier transform of $f(x)$ then prove that $F\{f(a x)\}=\frac{1}{a} F\left(\frac{p}{a}\right), a>0$.

## PART -B

2. a) Solve $x^{3}=2 x+5$ for a positive root by iteration method.
b) Perform two iterations of the Newton-Raphson method to solve the system of equations $x^{2}+3 y^{2}=4$ and $x^{2}+3 x+y=5$.
3. a) Prove that $\Delta \tan ^{-1}\left(\frac{n-1}{n}\right)=\tan ^{-1}\left(\frac{1}{2 n^{2}}\right)$.
b) Find the first and second derivatives of the function tabulated below at the point $\mathrm{x}=0.6$.

| 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 $\int_{0}^{1} x \sqrt{1+x^{4}} d x$ using Simpson's $3 / 8$ rule.
b) Given $y^{\prime}=x+\sin y, \mathrm{y}(0)=1$. Compute $\mathrm{y}(0.2)$ with $\mathrm{h}=0.2$ using fourth order Runge-Kutta method.
5. a) Find the Fourier series of $f(x)=\left\{\begin{array}{l}\frac{-1}{2}(\pi-x) \text {, for }-\pi<\mathrm{x}<0 \\ \frac{1}{2}(\pi-x) \text {, for } 0<\mathrm{x}<\pi\end{array}\right.$
b) Obtain half range sine series for $e^{x}$ in $0<x<1$.
6. a) Find the Fourier transform of $f(x)=\left\{\begin{array}{ll}1-x^{2}, \text { if }|\mathrm{x}|<1 \\ 0 & , \text { if }|\mathrm{x}|>1\end{array}\right.$. Hence Show that (7M)

$$
\begin{equation*}
\int_{0}^{\infty} \frac{\sin x-x \cos x}{x^{3}} d x=\frac{\pi}{4} \tag{7M}
\end{equation*}
$$

b) Find the finite Fourier sine transform of $f(x)=\sin a x$ in $(0, \pi)$.
7. Find the temperature in a bar of length 20 cms whose ends are kept at zero and ( 14 M ) lateral surface insulated, if the initial temperature is $\sin \frac{\pi x}{2}+3 \sin \frac{5 \pi x}{2}$.

SET - 2

## 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
$\sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim \sim ~$
PART -A

1. a) Using Newton Raphson method find an approximate root, which lies near $x=1.2$
(2M) of the equation $x^{4}-x-9=0$ upto two approximations.
b) Evaluate $\Delta^{3} e^{x}$ with $h=1$.
c) Evaluate $\int_{0}^{4} e^{x} d x$ by using Trapezoidal rule given that

| X | 1 | 2 | 3 | 4 |
| :--- | :--- | :--- | :--- | :--- |
| Y | 2.72 | 7.39 | 20.09 | 54.6 |

d) In Fourier series expansion of $f(x)=x^{3},-\pi \leq x \leq \pi$ find the Fourier coefficient $a_{n}$.
e) Solve $3 u_{x}+2 u_{y}=0$ by using method of separation of variables.
f) If $F(p)$ is the complex Fourier transform of $f(x)$ then prove that $F\{f(x-a)\}=e^{i p a} F(p)$.
g) State Dirichlet's conditions.

## PART -B

2. a) Solve $x=1+\tan ^{-1} x$ by iteration method.
b) Perform two iterations of the Newton-Raphson method to solve the system of

$$
\begin{equation*}
\text { equations } x^{2}+y^{2}+x y=7 \text { and } x^{3}+y^{3}=9 . \tag{7M}
\end{equation*}
$$

3. a) Show that $\Delta f_{i}^{2}=\left(f_{i}+f_{i+1}\right) \Delta f_{i}$
b) For the table below: find $f^{\prime}(1.76)$ and $f^{\prime}(1.72)$

| 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 $\int_{0}^{2} x e^{-x^{2}} d x$ using Simpson's rule taking $\mathrm{h}=0.25$.
b) Using fourth order Runge-Kutta method, solve for y at $\mathrm{x}=2$ from $\frac{d y}{d x}=3 x^{2}+1$,

$$
\begin{equation*}
y(1)=2 . \tag{7M}
\end{equation*}
$$

5. a) Find the Fourier series of $f(x)=\left(\frac{\pi-x}{2}\right)^{2}$ in the interval $0<x<2 \pi$.
b) Obtain the Fourier cosine series for $\mathrm{f}(\mathrm{x})=\mathrm{x} \sin \mathrm{x}, 0<x<\pi$.
6. a) Find Fourier transform of $f(x)=e^{-x^{2} / 2},-\infty<x<\infty$.
b) Find the finite Fourier cosine transform of $f(x)=x^{3}$ in $(0, \pi)$.
7. A tightly stretched string of length 20 cms ., fastened at both ends is displaced from (14M) its position of equilibrium, by imparting to each of its points an initial velocity given by:
$\mathrm{V}(\mathrm{x})=\left\{\begin{array}{c}x, 0 \leq x \leq 10 \\ 20-x, 10 \leq x \leq 20\end{array}\right.$ x being the distance from one end. Determine the displacement at any subsequent time.

SET - 3

## I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov-2018 MATHEMATICS-II (MM)

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

## 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.
b) Evaluate $\Delta\left(\frac{2^{x}}{x!}\right)$ with $h=1$.
c) Evaluate $\int_{0}^{6} \frac{1}{1+x^{2}} d x$ by using Simpson's $1 / 3^{\text {rd }}$ rule given that

| 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 $a_{n}$.
e) Find fourier cosine transform of $f(x)=\left\{\begin{array}{l}\cos x, o<x<a \\ 0, x \geq a\end{array}\right.$
f) Solve $4 u_{x}+u_{y}=3 u$ by using method of separation of variables.
g) Define Fourier Integral theorem.

## PART -B

2. a) Find a real root for $e^{x} \sin x=1$ using Regula Falsi method.
b) Find an approximate root of the equation $x e^{x}-\cos x=0$ using Newton-Raphson method.
3. a) Show that $\Delta\left(\frac{f_{i}}{g_{i}}\right)=\left(g_{i} \Delta f_{i}-f_{i} \Delta g_{i}\right) / g_{i} g_{i+1}$
b) Compute $f^{\prime}(4)$ from the following table:

| x | 1 | 2 | 4 | 8 | 10 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathrm{f}(\mathrm{x})$ | 0 | 1 | 5 | 21 | 27 |

4. a) Evaluate $\int_{0}^{2} e^{-x^{2}} d x$ using Simpson's rule taking $\mathrm{h}=0.25$.
b) Using fourth order Runge-Kutta method, find $\mathrm{y}(0.2)$, given $y^{\prime}=x+y, \mathrm{y}(0)=1$.
5. a) Find the Fourier series expansion for $\mathrm{f}(\mathrm{x})$, if $f(x)=\left\{\begin{array}{l}2, \text { if }-2 \leq x \leq 0 \\ x, \text { if } 0<x<2\end{array}\right.$
b) Obtain half range cosine series for $e^{x}$ in $0<x<1$.
6. a) If $\mathrm{F}(\mathrm{p})$ is the complex Fourier transform of $\mathrm{f}(\mathrm{x})$, then the complex Fourier transform of $\mathrm{f}(\mathrm{x}) \cos$ ax is $\frac{1}{2}[F(p+a)+F(p-a)]$.
b) Find the finite Fourier sine transform of $f(x)=x^{3}$ in $(0, \pi)$.
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 $\mathrm{y}(\mathrm{x}, \mathrm{t})$.

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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.
b) Evaluate $\Delta^{3}\left(a^{x}\right)$.
c) Evaluate $\int_{1}^{2} e^{\frac{-1}{2} x} d x$ using Trapezoidal rule given that

| 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 $b_{n}$.
e) Solve $u_{x}=2 u_{t}+u$ by using method of separation of variables.
f) Find the finite fourier sine transform of $\mathrm{f}(\mathrm{x})=\mathrm{x}$ where $0<\mathrm{x}<4$.
g) Define first shifting property of Fourier transforms.

## PART -B

2. a) Find the root of the equation $x \log _{10}(x)=1.2$ using False position method.
b) Find an approximate root of the equation $(x-1) \sin x-x=1$ using Newton-Raphson method.
3. a) Show that $\sum_{k=0}^{n-1} \Delta^{2} f_{k}=\Delta f_{n}-\Delta f_{0}$.
b) Find the first and second derivatives of the function tabulated below at the point $\mathrm{x}=1.5$.

| 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 $\int_{0}^{1} \sqrt{1+x^{4}} d x$ using Simpson's $3 / 8$ rule.
b) Using fourth order Runge-Kutta method find $\mathrm{y}(0.2)$, given $y^{\prime}=y+e^{x} . \mathrm{Y}(0)=0$.
5. a) Find the Fourier series of $f(x)=\left\{\begin{array}{l}0, \text { for }-\pi<\mathrm{x}<0 \\ \mathrm{x}^{2}, \text { for } 0<\mathrm{x}<\pi\end{array}\right.$.
b) Obtain the Fourier sine series for $\mathrm{f}(\mathrm{x})=\mathrm{x} \sin \mathrm{x}, 0<x<\pi$.
6. a) Using Fourier integral, Show that $e^{-x} \cos x=\frac{2}{\pi} \int_{0}^{\infty} \frac{\lambda^{2}+2}{\lambda^{4}+4} \cos \lambda x d \lambda$.
b) Find the finite Fourier cosine transform of $f(x)=\sin a x$ in $(0, \pi)$.
7. Solve $\frac{\partial^{2} u}{\partial x^{2}}+\frac{\partial^{2} u}{\partial y^{2}}=0$ subject to the conditions $u(0, y)=0, u(1, y)=0, u(x, 0)=0$ and $\mathrm{u}(\mathrm{x}, \mathrm{a})=\sin \frac{n \pi x}{l}$, where $0 \leq x \leq l, 0 \leq y \leq a$ and n is a positive integer.

2 of 2

