

Code No: R161202

R16
SET - 1
I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
MATHEMATICS-II (MM)

(Com to CE,EEE,ME,AE,AME,Bio-Tech,Chem E,Metal E,Min E,PCE,PE)

Time: 3 hours

Max. Marks: 70

 Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)

 2. Answer **ALL** the question in **Part-A**

 3. Answer any **FOUR** Questions from **Part-B**
PART -A

1. a) Write the iteration formula to find $\sqrt{N}$ using Newton Raphson method. (2M)
- b) Prove that $\mu\delta = \frac{1}{2}[\Delta + \nabla]$ (2M)
- c) Write the formula for RK method of second order. (2M)
- d) Write Simpson's $1/3^{\text{rd}}$ Rule. (2M)
- e) Find the value of a_0 for $f(x) = \begin{cases} 1 & 0 < x < \frac{\pi}{2} \\ -1 & \frac{\pi}{2} < x < \pi \end{cases}$ (2M)
- f) State Linear property in Fourier Transform. (2M)
- g) Write the equation for the PDE $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$ by variable separable method. (2M)

PART -B

2. a) Find the root of the equation $x^3 - 6x - 4 = 0$ using iteration method. (7M)
- b) Find the root of the equation $2x - \log_{10} x = 7$ using False position method. (7M)
3. a) Find the parabola passing through the points (0,1), (1,3) and (3,55) using Lagrange's interpolation formula. (7M)
- b) Area A of circle and diameter d is given for the following values (7M)

d	80	85	90	95	100
A	5026	5674	6362	7088	7854

Calculate the area of circle of diameter 105.

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 4. a) Evaluate $y(0.1)$ using RK method of fourth order for $\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$ (7M)

 b) Evaluate $y(0.1)$, $y(0.2)$ using Picard's method for $\frac{dy}{dx} = x + y$, $y(0) = 1$ (7M)

 5. a) Find the Fourier series of $f(x) = \begin{cases} 1 + \frac{2x}{\pi} & \text{if } -\pi \leq x < 0 \\ 1 - \frac{2x}{\pi} & \text{if } 0 \leq x < \pi \end{cases}$ (7M)

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

 b) Find the Half range sine series of $f(x) = x^2$ in $[0, 2]$ (7M)

 6. a) Using Fourier integral, Show that $\int_0^\infty \frac{\cos \lambda x + \lambda \sin \lambda x}{1 + \lambda^2} d\lambda = \begin{cases} 0 & \text{if } x < 0 \\ \pi e^{-x} & \text{if } x > 0 \end{cases}$ (7M)

 b) Find the Fourier cosine transform of $\frac{1}{1+x^2}$ and hence deduce Fourier sine transform $\frac{x}{1+x^2}$ (7M)

 7. a) Solve the PDE $\frac{\partial u}{\partial x} = 4 \frac{\partial u}{\partial y}$ where $u(0, x) = 8e^{-3y}$ (7M)

 b) A tightly stretched string with fixed end points at $x = 0$ and $x = 1$ is initially in a position given by (7M)

$$f(x) = \begin{cases} x & 0 < x < \frac{1}{2} \\ 1-x & \frac{1}{2} < x < 1 \end{cases}$$

 If it is released from this position with velocity zero find the displacement $u(x, t)$ at any point of x of the string at any time $t > 0$.

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SET - 2

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 3. Answer any **FOUR** Questions from **Part-B**
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PART -A

1. a) Find two iterations of $x = \cos x$ using bisection method. (2M)
- b) Prove that $\Delta \log f(x) = \log \left[1 + \frac{\Delta f(x)}{f(x)} \right]$ (2M)
- c) Write Trapezoidal Rule. (2M)
- d) Write the Dirichlet conditions for Fourier series. (2M)
- e) Find the value of a_n for $f(x) = \begin{cases} 1 & 0 < x < \frac{1}{2} \\ -1 & \frac{1}{2} < x < 1 \end{cases}$ (2M)
- f) State modulation property in Fourier transforms. (2M)
- g) Write two dimensional steady state equation. (2M)

PART -B

2. a) Find the root of the equation $x e^x = 2$ using Newton Raphson method. (7M)
 - b) Find the root of the equation $3x = 1 + \cos x$ using False position method. (7M)
 3. a) Find the Lagrange's polynomial for the following data, hence find $y(15)$. (7M)
- | | | | | |
|---|----|----|----|----|
| x | -5 | 6 | 9 | 11 |
| y | 12 | 13 | 14 | 16 |
- b) Find $y(23)$ for the following data using Gauss Forward interpolation formula. (7M)
- | | | | | | |
|---|------|-------|-------|-------|-------|
| x | 10 | 20 | 30 | 40 | 50 |
| y | 9.21 | 17.54 | 31.82 | 55.32 | 92.51 |
4. a) Evaluate $y(0.1)$ using RK method of fourth order for $\frac{dy}{dx} = y + x e^x$, $y(0) = 1$ (7M)
 - b) Evaluate $y(0.1)$ using Taylor's method for $\frac{dy}{dx} = x + y^2$, $y(0) = 1$ (7M)

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R16**SET - 2**

5. a) Find the Fourier series of $f(x) = \sin x$ in $-\pi < x < \pi$ (7M)

b) Find the half range sine series of $f(x) = \begin{cases} x & 0 < x < \frac{l}{2} \\ l-x & \frac{l}{2} < x < l \end{cases}$ (7M)

6. a) Using Fourier cosine integral, show that $\frac{\pi}{2} e^{-x} = \int_0^{\infty} \frac{\cos \lambda x}{\lambda^2 + 1} d\lambda$ (7M)

- b) Find the Fourier sine transform of the function $f(x) = x$ in $(0, \infty)$ (7M)

7. a) Solve $4 \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} = 3z$ and $z(0, y) = e^{-5y}$ (7M)

- b) Find the temperature $u(x, t)$ in a homogenous bar of heat conducting method of length ' l ' whose ends are kept at 0°C and whose initial temperature is $\frac{ax}{l^2}(l-x)$ (7M)

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**PART -A**

1. a) Find two iterations of  $x e^x = 2$  using False position method. (2M)
- b) Show that  $\nabla = 1 - E^{-1}$  (2M)
- c) Evaluate  $y(0.1)$  by Euler's method for  $\frac{dy}{dx} = \frac{x+y}{y-x}$ ,  $y(0) = 1$ . (2M)
- d) Write Simpson's  $3/8^{\text{th}}$  Rule. (2M)
- e) Find the value of  $b_n$  for  $f(x) = \begin{cases} 1 & 0 < x < \frac{\pi}{2} \\ -1 & \frac{\pi}{2} < x < \pi \end{cases}$  (2M)
- f) Write shifting theorem in Fourier transforms. (2M)
- g) Write one dimensional heat equation. (2M)

**PART -B**

2. a) Find the root of the equation  $x^4 - 10 = x$  using Bisection method. (7M)
- b) Find the root of the equation  $x \tan x + 1 = 0$  using Newton Raphson method. (7M)

3. a) Find the Lagrange's polynomial for the following data. (7M)

|   |     |     |     |     |
|---|-----|-----|-----|-----|
| x | 0   | 2   | 3   | 6   |
| y | 648 | 704 | 729 | 792 |

- b) Fit a  $y(0.5)$  the following data using Newton Forward interpolation formula. (7M)

|   |    |   |   |    |
|---|----|---|---|----|
| x | -1 | 0 | 1 | 2  |
| y | 10 | 5 | 8 | 10 |

4. a) Evaluate  $\int_0^2 \frac{1}{1+x} dx$  by taking  $h = 0.1$  by (7M)
  - (i) Trapezoidal rule.
  - (ii) Simpson's  $1/3^{\text{rd}}$  rule

- b) Evaluate  $y(0.1)$  using Modified Euler's method for  $\frac{dy}{dx} = x^2 + y^2$ ,  $y(0) = 1$  (7M)

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**R16**
**SET - 3**

5. a) Find the Half range cosine of  $f(x) = \begin{cases} kx & 0 < x < \frac{\pi}{2} \\ k(\pi - x) & \frac{\pi}{2} < x < \pi \end{cases}$  (7M)

b) Find the Fourier series of  $f(x) = \frac{\pi - x}{2}$  in  $0 < x < 2$  (7M)

6. a) Express the  $f(x)$  defined by  $f(x) = \begin{cases} 1 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$  as a Fourier integral (7M)

Hence Evaluate  $\int_0^{\infty} \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda$

b) Find Fourier transform of  $f(x) = e^{-x^2}$ ,  $-\infty < x < \infty$  hence evaluate (7M)

(i)  $F\left(e^{-\frac{x^2}{3}}\right)$  (ii)  $F\left(e^{-4(x-3)^2}\right)$

7. a) Solve  $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$  given that  $u(0, y) = 3e^{-y} - e^{-5y}$  (7M)

b) A rectangular plate with insulated surface is 8 cm wide. If the temperature along one short edge  $y = 8$  cm. is given by  $100\sin\frac{\pi x}{8}$ ,  $0 < x < 8$  while the two long edges  $x = 0$  and  $x = 8$  and other edge are kept  $0^\circ\text{C}$ . Find the steady state temperature at any point on the plane (7M)

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 2. Answer **ALL** the question in **Part-A**

 3. Answer any **FOUR** Questions from **Part-B**
**PART -A**

1. a) Find two iterations of  $x = \sin x$  using iteration method. (2M)
- b) Find  $\Delta \left( \tan^{-1} \left( \frac{n-1}{n} \right) \right)$  by taking  $h=1$  (2M)
- c) Evaluate  $y(0.1)$  by Euler's method for  $\frac{dy}{dx} = x + y$ ,  $y(0) = 1$ . (2M)
- d) Write half range sine series for  $f(x) = 1$  in  $[0,2]$  (2M)
- e) Find the value of  $a_n$  for  $f(x) = \begin{cases} 1 & 0 < x < \frac{1}{2} \\ -1 & \frac{1}{2} < x < 1 \end{cases}$  (2M)
- f) Write Finite Fourier cosine transform for  $f(x)$  (2M)
- g) Write one dimensional wave equation. (2M)

**PART -B**

2. a) Find the root of the equation  $x^3 - 8x - 4 = 0$  using Newton raphson method. (7M)
- b) Find the root of the equation  $4\sin x = e^x$  using False position method. (7M)
3. a) Find  $y(10)$  for the data  $y(3)=2.7, y(4)=6.4, y(5)=12.5, y(6)=21.6, y(7)=34.3, y(8)=51.2, y(9) = 72.9$  (7M)
- b) Evaluate  $y(2)$  from the following table. (7M)

|   |   |     |     |   |     |
|---|---|-----|-----|---|-----|
| X | 1 | 3   | 5   | 6 | 8   |
| Y | 2 | 1.5 | 2.4 | 4 | 5.6 |

4. a) Evaluate  $\int_0^1 \sqrt{1+x^4} dx$  by taking  $h = 0.125$  by (7M)
  - (i) Simpson's  $1/3^{\text{rd}}$  rule (ii) Simpson's  $3/8^{\text{th}}$  rule
- b) Evaluate  $y(0.1)$  using Taylor's for  $\frac{dy}{dx} = x^2 - y^2$ ,  $y(0) = 1$  (7M)

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**SET - 4**

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

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

b) Find the Half range cosine series of  $f(x) = e^x$  in  $[0, 1]$  (7M)

6. a) Using Fourier integral, Show that  $\int_0^\infty \frac{\sin \pi \lambda}{1 - \lambda^2} \sin \lambda x d\lambda = \begin{cases} \frac{1}{2} \pi \sin x & \text{if } 0 < x < \pi \\ 0 & \text{if } x > \pi \end{cases}$  (7M)

b) Find the Fourier cosine transform of  $x^{n-1}$  (7M)

7. a) Solve  $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u$ , where  $u(x, 0) = 6e^{-3x}$  by the method of separation of variables. (7M)

b) A bar of 50cm long with insulated sides kept at  $0^\circ \text{C}$  and that the other end is kept at  $100^\circ \text{C}$  until steady state conditions prevail. The two ends are suddenly insulated so that the temperature is zero at each end thereafter. Find the temperature distribution. (7M)