

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**

PART -A

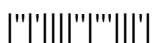
1. a) Using Newton Raphson method find an approximate root, which lies near $x = 2$ (2M)
of the equation $x^3 - 3x - 5 = 0$ up to two approximations.
- b) In Fourier series expansion of $f(x) = x^3, -\pi \leq x \leq \pi$ find the Fourier coefficient (2M)
 b_n .
- c) Evaluate $\Delta(e^x \log 2x)$. (2M)
- 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 $f(x) = x^2, -\pi \leq x \leq \pi$ find the Fourier coefficient (2M)
 a_n .
- 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 (2M)
 $F\{f(ax)\} = \frac{1}{a} F\left(\frac{p}{a}\right), a > 0$.

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 (7M)
equations $x^2 + 3y^2 = 4$ and $x^2 + 3x + y = 5$.
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 (7M)
 $x = 0.6$.

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 $\int_0^1 x\sqrt{1+x^4} dx$ 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 (7M)
Runge-Kutta method.



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 $f(x) = \begin{cases} 1 - x^2, & \text{if } |x| < 1 \\ 0, & \text{if } |x| > 1 \end{cases}$. 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

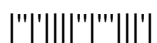
1. a) Using Newton Raphson method find an approximate root, which lies near $x = 1.2$ (2M)
 of the equation $x^4 - x - 9 = 0$ upto two approximations.
- b) Evaluate $\Delta^3 e^x$ with $h = 1$. (2M)
- c) Evaluate $\int_0^4 e^x dx$ by using Trapezoidal rule given that (2M)
- | | | | | |
|---|------|------|-------|------|
| X | 1 | 2 | 3 | 4 |
| Y | 2.72 | 7.39 | 20.09 | 54.6 |
- d) In Fourier series expansion of $f(x) = x^3, -\pi \leq x \leq \pi$ find the Fourier coefficient (2M)
 a_n .
- 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 (2M)
 $F\{f(x-a)\} = e^{ipa} F(p)$.
- 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 (7M)
 equations $x^2 + y^2 + xy = 7$ and $x^3 + y^3 = 9$.
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 $\int_0^2 x e^{-x^2} dx$ using Simpson's rule taking $h = 0.25$. (7M)
- b) Using fourth order Runge-Kutta method, solve for y at $x = 2$ from $\frac{dy}{dx} = 3x^2 + 1$, (7M)
 $y(1) = 2$.



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



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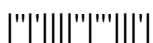
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PART -A

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 $1/3^{\text{rd}}$ 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 $f(x) = \begin{cases} 2, & \text{if } -2 \leq x \leq 0 \\ x, & \text{if } 0 < x < 2 \end{cases}$ (7M)
- b) Obtain half range cosine series for e^x in $0 < x < 1$. (7M)



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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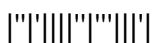
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PART -A

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 $\Delta^3(a^x)$. (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)



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 $u(0, y) = 0$, $u(l, y) = 0$, $u(x, 0) = 0$ (14M)
and $u(x, a) = \sin \frac{n\pi x}{l}$, where $0 \leq x \leq l$, $0 \leq y \leq a$ and n is a positive integer.

