Subject Code: R161109/R16 **Set No - 1**

I B. Tech I Semester Regular Examinations Dec. - 2016
MATHEMATICS-II
(Mathematical Methods)
(Com. to CSE, IT, Agri Engg.)

Time: 3 hours **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Four Questions should be answered from **Part-B**
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PART A

1. a) Find real root of the equation $3x = e^x$ by using Bisection method up to 3 approximations.

   b) Show that $e^x\left(u_0 + x\Delta u_0 + \frac{x^2}{2!}\Delta^2 u_0 + \ldots\right) = u_0 + u_1 x + u_2 \frac{x^2}{2!} + \ldots$

   c) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Trapezoidal rule.

   d) Explain about Dirichlet's conditions for a Fourier expansion.

   e) The temperatures at one end of a bar OA of 50 cm length with insulated sides are kept at $0^o C$ at O and $100^o C$ at A until steady state conditions prevail. Find steady state temperature.

   f) If $F(p)$ is the complex Fourier transform of $f(x)$ then prove that

   $$F\{f(ax)\} = \frac{1}{a}F\left(\frac{p}{a}\right), a > 0.$$

   g) Using Newton-Raphson method find square root of a number. (7×2 = 14M)

PART B

2. a) Solve $x^3 = 2x + 5$ for a positive root by regula-falsi method.

   b) Solve the system of equations by Newton Raphson method $3yx^2 - 10x + 7 = 0$ and $y^2 - 5y + 4 = 0$. (7M+7M)

Subject Code: R161109/R16 **Set No - 1**

3. a) Fit a interpolating polynomial in x for the following data

x	1	4	6	8	10
y	1	7	9	12	21

b) Using Lagrange's formula fit a polynomial to the data

x	0	2	5	9
f(x)	1	12	15	33

(7M+7M)

4. a) Evaluate $\int_0^2 \frac{dx}{x^3+x+1}$ by using Simpson's 1/3rd rule with h= 0.25.

b) Evaluate *y(0.8)* using Runge Kutta method given $y' = (x+y)^{1/2}$, y(0.4)= 0.41

(7M+7M)

5. a) Find the Fourier series of *xcosx* for 0<x< 2π.

b) Find half range Fourier sine series of f(x) = π-x in [0,π].

(7M+7M)

6. A tightly stretched flexible string has its ends fixed at x=0 and x= 10. At time t=0, the string is given a shape defined by f(x) = kx(10-x), where k is a constant and then released. Find the displacement of any point x of the string at any time.

(14M)

7. a) Find the Fourier transform of $\frac{1}{\sqrt{|x|}}$.

b) Find the inverse Fourier transform of f(x) of $F_s(p) = \frac{p}{1+p^2}$

(7M+7M)

Subject Code: R161109/R16 **Set No - 2**

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PART A

1. a) Find positive root of the equation $x^3-2x-5=0$ using Regula-Falsi method. Carry out two approximations.

b) Find the missing term in the following table

X	0	1	2	3	4
Y	1	3	9	-	81

c) The table below shows the temperature $f(t)$ as a function of time:

t	1	2	3	4	5	6	7
$f(t)$	81	75	80	83	78	70	60

Using Simpson's $\frac{1}{3}$ rd rule, evaluate $\int_1^7 f(t)dt$.

d) Expand the function $f(x)=x^3$ as a Fourier series in $-\pi \le x \le \pi$.

e) Write One-Dimensional wave equation with initial and Boundary conditions.

f) If $F_s(p)$ and $F_c(p)$ are the Fourier sine and cosine transforms of $f(x)$ respectively, then prove $F_s[f(x)\cos ax]=\frac{1}{2}[F_s(p+a)+F_s(p-a)]$.

g) Evaluate (i) $\Delta^2 e^{2x+3}$ (ii) $\Delta^2 \cos 2x$. (7×2 = 14M)

PART B

2. a) Using Regula-falsi method, find the real root of $2x-\log x=6$ correct to three decimal places.

b) Solve the system of equations by Newton Raphson method $x^2+y^2-1=0$ and $y-x^2=0$. (7M+7M)

Subject Code: R161109/R16 **Set No - 2**

3. a) Fit a interpolating polynomial in x for the following data

x	0	1	2	3	4
y	-3	3	4	27	57

b) Find Interpolating polynomial by Lagrange's method and hence find f(2) for the following data

x	0	1	3	4
f(x)	-12	0	6	12

(7M+7M)

4. a) Evaluate $\int_0^{0.6} e^{-x^2}dx$ by using Simpson's 1/3rd rule with h= 0.1.

b) Find y(74) given that *y(50)= 201, y(60)= 225, y(70)=248 and y(80)=274.* Using Newton's difference formula.

(7M+7M)

5. a) Expand cosπx in (0,1) as Fourier sine series.

b) Obtain the Fourier sin series of f(x) = e^{-x} in the interval 0<x< 2π. (7M+7M)

6. The ends A and B of a rod 20 cm long have the temperature at 30^0 C and 80^0 until steady states prevail. The temperatures of the ends are change at 40^0C and 60^0C respectively. Find the temperature distribution in the rod at time *t*.

(14M)

7. a) Find the Fourier sine and cosine transform of $f(x) = \frac{1}{1+x^2}$.

b) Find the inverse Fourier cosine transform of $F_c(p) = p^n e^{-ap}$.

(7M+7M)

Subject Code: R161109/R16 **Set No - 3**

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PART A

1. a) Using Newton-Raphson method find reciprocal of 18.

b) The function $y = \sin x$ is tabulated below

x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$
$y = \sin x$	0	0.70711	1.0

Using Lagrange's interpolation formula, find the value of $\sin\left(\frac{\pi}{6}\right)$.

c) Solve numerically using Euler's method $y' = y^2 + x, y(0) = 1$. Find $y(0.1)$ and $y(0.2)$.

d) Express $f(x) = x$ as a Half range sine series in $0 < x < 2$.

e) Solve $u_x - 4u_y = 0, u(0, y) = 8e^{-3y}$ by the method of separation of variables.

f) Find finite Fourier cosine transform of $f(x) = x, 0 < x < 4$.

g) Using Euler's method find an approximate value of y corresponding to $x = 0.4$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ at $x = 0$. (7×2 = 14M)

PART B

2. a) Find a real root of the equation $x^3 - 4x - 9 = 0$ using False position method correct to three decimal places.

b) Solve the system of equations by Newton Raphson method $3yx^2 - 10x + 7 = 0$ and $y^2 - 5y + 4 = 0$. (7M+7M)

Subject Code: R161109/R16

Set No - 3

3. a) From the following table of half yearly premium for policies at different ages, estimate the premium for policies at the age of 63.

Age x	45	50	55	60	65
Premium y	114.84	96.16	83.32	74.48	68.48

b) Apply Lagrange's formula to find f(5) given that f(1)=2, f(2)=4, f(4)=16 and f(7)=128.

(7M+7M)

4. a) Evaluate $\int_0^6 \frac{e^x\,dx}{x+1}$ by using Simpson's 1/3rd rule with h= 1.

b) Evaluate *y(0.1)* and *y(0.2)* using Runge Kutta method given $y^1 = xy + y^2$, *y(0)= 1.*

(7M+7M)

5. a) Find the Fourier series of the function f(x) = |sin x| in [-1, 1].

b) Obtain the Fourier cosine series of f(x) = e^{-x} in the interval 0<x< 2π.

(7M+7M)

6. The ends A and B of a rod of length 20 cm have the temperatures at 30°C and 80°C until steady state conditions prevails. The temperature of the ends is changed to 40°C and 60°C respectively. Find the temperature distribution in the rod at time t.

(7M+7M)

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

b) Find the inverse Fourier cosine transform of $F_c(p) = \frac{\sin ap}{p}$.

(7M+7M)

Subject Code: R161109/R16 **Set No - 4**

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*****

PART A

1. a) By the fixed point iteration process, find the root correct to two decimal places of the equation $x = \cos x$ near $x = \frac{\pi}{4}$.

   b) Prove that $\mu^2 = 1 + \frac{\delta^2}{4}$

   c) Write merits and demerits of Runge-Kutta method.

   d) Find Fourier series for the function $f(x) = |x|, -\pi < x < \pi$.

   e) Solve $4u_x + u_y = 0$ and u (0,y) = e^{-5y} by the method of separation of variables.

   f) Find finite Fourier sine transform of $f(x) = x, 0 < x < \pi$.

   g) Write the formula for half range cosine series expansion of f(x) in (0,l). (7×2 = 14M)

PART B

2. a) Using regula-falsi method, find the real root of $2x - \log x = 6$ correct to three decimal places.

   b) Solve the system of equations by Newton Raphson method $3yx^2 - 10x + 7 = 0$ and $y^2 - 5y + 4 = 0$.

(7M+7M)

Subject Code: R161109/R16 **Set No - 4**

3. a) Using Lagrange's Interpolation formula find the value of y(10) from the following table

x	5	6	9	11
y(x)	12	13	14	16

b) Fit a interpolating polynomial in x for the following data

x	0	1	2	3	4
y	3	5	6	9	17

(7M+7M)

4. a) Evaluate $\int_1^7 \frac{e^x\,dx}{x+1}$ by using Simpson's 1/3rd rule with h=1.

b) Using Runge-Kutta fourth order formula, find $y(0.2)$ for the equation $y^1 = \frac{y-x}{y+x}$ $y(0) = 1$ taking h=0.1.

(7M+7M)

5. a) Find the Fourier series of the function f(x) = e^x in [0,2].

b) Obtain the Fourier sine series of f(x) $= x\sin x$ in the interval 0<x< π.

(7M+7M)

6. A tightly stretched flexible string has its ends fixed at x=0 and x= 10. At time t=0, the string is given a shape defined by f(x) = kx(10-x), where k is a constant and then released. Find the displacement of any point x of the string at any time.

(14M)

7. a) Find Fourier cosine transform of $f(x) = \frac{e^{-ax}}{x}$

b) Find the inverse Fourier cosine transform of $F_c(p) = p^n e^{-ap}$.

(7M+7M)