PANDIAN SARASWATHI YADAV ENGINEERING COLLEGE

MA6459- NUMERICAL METHODS

PART-B QUESTIONS

UNIT – I

SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

1. Find the positive root of $x^4 - x = 10$ correct to three decimal places using Newton – Raphson method. **[A.U MAY 1996, A.U A/M 2010]**
2. Using Newton iterative method find the root between 0 & 1 of $x^3 = 6x - 4$ correct to two places. **[A.U MAY 2000, A.U M/J 2008]**
3. Find the real positive root of $3x - \cos x - 1 = 0$ by newton method coprrect to 6 decimal places. **[A.U 2015, A.U M/J 2007, N/D 2009]**
4. Find a root of $x\log_{10}x - 1.2 = 0$ by N – R method correct to 3 decimal places. **[A.U N/D 2015, M/J 2007, M/J 2010, N/D 2010]**
5. Obtain newton iterative formula for finding root N . where N is a positive real number. Hence evaluate root of 142. **[A.U MAY 1999]**
6. Solve the following system of equations by Gauss – Jordon method.
   $10x+y+z = 12$, $2x+10y+z =13$, $x+y+5z =7$ **[A.U A/M 2008, M/J 2010, N/D 2014]**
7. Solve the following system of equations by Gauss – Jacobi method.
   $27x+6y-z = 85$, $x+y+54z =110$, $6x+15y+2z =72$ **[A.U A/M 2009, M/J 2006, M/J 2010]**
8. Solve the following system of equations by Gauss – Jacobi Gauss – Seidel method.
   $20x+y-2z = 17$, $3x+20y-z = -18$, $2x-3y+20z =25$ **[A.U M/J 2009, N/D 2009]**
9. Using Gauss – Jordon method, find the inverse of $A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$
   [A.U N/D 2004, APL 2000, OCT 1996]
10. Find the dominant eigen value and the corresponding eigen vetor of $A = \begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. Find also the least latent root and hence the third eigen value also.
    [A.U M/J 2010, M/J 2007, A/M 2008, A/M 2010]

11. Find the numerically largest eigen value of A = $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ and the corresponding eigen vector **[A.U M/J 2006, A/M 2008]**

12. Apply Jacobi process to evalute the eigen values and eigen vectors of the matrix $\begin{pmatrix} 1 & 1 & 2 \\ 1 & 9 & -3 \\ 2 & -3 & 25 \end{pmatrix}$ **[A.U A/M 2015]**

UNIT – II

INTERPOLATION AND APPROXIMATION

1. Find the polynomial f(x) by using Lagrange's formula and hence find f(3) for

x	0	1	2	5
f(x)	2	3	12	147

[A.U A/M 2008]

2. Using Lagrange's interpolation, calculate the profit in the year 2000 from the following data: **[A.U A/M 2011]**

Year:	1997	1999	2001	2002
Profit in lakhs of Rs.	43	65	159	248

[A.U A/M 2014]

3. Find the missing term in the following table using Lagrange’s interpolation.

x	0	1	2	3	4
y	1	3	9	-	81

[A.U A/M 2011]

4. Find the lagrangian interpolating polynomial for the following data:

x	1	2	3	5

f(x)	0	7	26	124

[A.U 2010, M/J 2010]

5. Using Newton's divided difference formula, find u(3) given u(1) = -26, u(2) = 12, u(4) = 256, u(6) = 844. **[A.U A/M 2004]**

6. Foind f(x) as a polynomial in x for the following data by Newton's divided difference formula

x	-4	-1	0	2	5
f(x)	1245	33	5	9	1335

[A.U N/D 2013]

7. Find the missing term in the following table using divided difference .

x	1	2	4	5	6
y	14	15	5	-	9

[A.U A/M 2012]

8. Obtain the cubic spline approximation for the function y = f(x) from the following data, given that $y_0'' = y_3'' = 0$.

x	-1	0	1	2
f(x)	-1	1	3	35

[A.U M/J 2010, N/D 2010,2011]

9. Using Newton's forward interpolation formula,find the polynomial f(x) satisfying the follwing dta. Hece evaluate y at x =5.

x	4	6	8	10
y	1	3	8	10

[A.U A/M 2014]

10. Use Newton's backward difference formula to consruct an interpolating polynomial of degree 3 for the data: f(-0.75) = -0.07181250, f(-0.5) = -0.024750, f(-0.25) = -0.33493750, f(0) = 1.10100. Hence find f(-1/3**)** **[A.U A/M 2013]**

11. From the following data, find ϴ at x = 43 and x =84

x	40	50	60	70	80	90
ϴ	184	204	226	250	276	304

[A.U N/D 2010,2011]

12. From the data given below, find the number of students whose weight is between 60 to 70.

Weight in lbs:	0-40	40-60	60-80	80-100	100-120
No. of students	250	120	100	70	50

[A.U N/D 2003, A/M 2010,2011,2012]

13. The following data are taken from the table:

Temp. ^{0}C :	140	150	160	170	180
Pressure kgf/cm^2	3.685	4.854	6.302	8.076	10.225

[A.U M/J 2009, N/D 2010]

UNIT-III

NUMERICAL DIFFERENTIATION AND INTEGRATION

1. Given data **(A.U M/J 2015)**

X	1.0	1.1	1.2	1.3	1.4	1.5	1.6
F(x)	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}$ at x=1.1

2.Find $\frac{dy}{dx}$ *and* $\frac{d^2y}{dx^2}$ at x= 1.5 from the following data **(A.U M/J 2015)**

X:	1.5	2	2.5	3	3.5	4
Y:	3.375	7	13.625	24	38.875	59

3.Find y' at x = 51 from the following data **(A.U M/J 2015,2014,2013)**

X:	50	60	70	80	90
Y:	19.96	36.65	58.81	77.21	94.61

4.Find y' at x=51 from the following data **(A.U M/J 2015,2014,2013,2012)**

X:	50	60	70	80	90
Y:	19.96	36.65	58.81	77.21	94.61

5.The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds .Find the initial acceleration using the entire data. **(A.U M/J 2013)**

Time(sec)	0	5	10	15	20
Velocity(m/sec)	0	3	14	69	228

6.Using Romberg's rule evaluate $I = \int_0^1 \frac{dx}{1+x}$ correct to three decimal places by taking h = 0.5, 0.25 and 0.125. **(A.U M/J 2014, 2015)**

9.Evaluate $\int_0^{\Pi/2} \sin x dx$ using (i)Simpson's $1/3^{rd}$ rule and (ii) Simpson's $3/8^{th}$ rule,by dividing the range into six equal subintervals. **(A.U M/J 2014, 2013)**

10.Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $3/8$ rule, dividing the range into 6 equal parts(h=0.2). **(A.U M/J 2014, 2012)**

11.Evaluate $\int_0^2 \int_0^1 4xydxdy$ by using Simpon's rule and taking $h = \frac{1}{4}$ and $k = \frac{1}{2}$ **(M/J 2012)**

12.Evaluate $\int_2^{2.4} \int_4^{4.4} xydxdy$ using Simpson's rule(h = k = 0.1). **(M/J 2013)**

UNIT-IV

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

1.Solve $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$, Use Taylor series method at x = 0.2, and 0.4.(**A.U 2015)**

2.Using Runge –Kutta method of fourth order ,solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with y(0)=1 at x=0.2

(A.U 2015,2014,2011)

3.Given $\frac{dy}{dx} = xy + y^2$,y(0)=1, y(0.1)=1.1169and y(0.2)=1.2774 find (i) y(0.3) by R.K method of fourth order and (ii)y(0.4) by Milne's method. **(A.U 2015,2014,2013,2011)**

4. Solve the equation $\frac{dy}{dx} = 1 - y, given y(0) = 0$ using modified Euler method and tabulate the solution at x = 0.1,0.2 and 0.3 .hence find y(0.4) by Milne's method.

(A.U 2015,2014,2013,2011)

5.Apply Milne's method, to find a solution of the differential equation $\frac{dy}{dx}=x-y^2$ at x = 0.8, given the values. Use Taylor series method to find y(0.1),y(0.2) and y(0.3). **(A.U,2013,2011)**

6. Using R.K method ,solve y''=y+xy', y(0)=1,y'(0)=0 to find y(0.2) and y'(0.2). **(A.U 2015,2014,2013,2010)**

7. Consider the initial value problem $\frac{dy}{dx}=y-x^2+1, y(0)=0.5$ **(A.U 2015,2014,2013,2011)**

(i) Using the modified Euler's Method ,find y(0.2)

(ii)Using 4th order R-K method find y(0.4) and y(0.

(iii) Using Adam's Bashforth Method.to find y(0.8)

UNIT- V

BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

1. Obtain the Crank-Nicholson finite difference method by taking $\lambda=\frac{kc^2}{h^2}=1$.Hence find u(x,t) in the root for two times steps for the heat equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$,given u(x,0)=sin(πx),u(0,t)=u(1,t)=0.Take h = 0.2. **(A.U 2015,2013)**

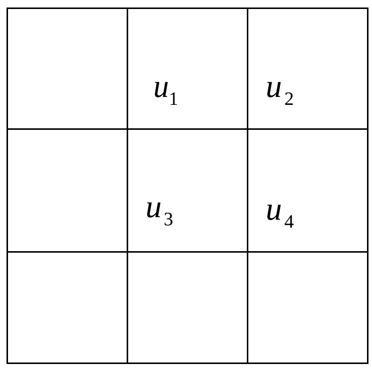
2.Solve $\nabla^2 u=8x^2\ y^2$ in the square region $-2\le x,y\le 2$ with u=0 on the boundaries after dividing the region into 16 sub intervals of length one unit. **(A.U 2015,2013)**

3.Evaluate :u(x,t) at the pivotal points of the equation $\frac{\partial u}{\partial t}=16\frac{\partial^2 u}{\partial x^2}$, $\frac{\partial u}{\partial t}(x,0)$ =0,,u(0,t)=0,u(5,t)=0,and u(x,0)=x^2(5-x)taking Δx=1 and upto t = 1.25. **(A.U 2012)**

4. Solve $u_t=u_{xx}$ in $0<x<5$, $t>0$ given that $U(x.0)= x^2(25-x^2)$, $U(0,t)=0=U(5,t)$ .compute u upto $t=2$ with $\Delta x = 1$ by using Bender Smith formula. **(A.U 2013)**

5. UseCrank Nicholson scheme to solve $\frac{\partial u}{\partial t} = 16\frac{\partial^2 u}{\partial x^2}$,$0<x<1$ and $t>0$ given $u(x,0)=0$,$u(0,t)=0$, and $u(1,t)=100t$.Compute $u(x,t)$ for one time step taking $\Delta x=1/4$. **(A.U 2015,2014,2011)**

6. Deduce the standard five point formula for $\nabla^2 u = 0$ hence solve it over the square region given by the boundary conditions as in figure below **(A.U 2012,2011,2010)**



7. .Solve $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$,$0<x<1$,$t>0$ given $u(x,0)=0$, $\frac{\partial u}{\partial t}(x,0) = 0$,$u(0,t)=0$ and $u(1,t)=100 \sin\pi t$. Compute $u(x,t)$ for the four time steps with $h=0.25$. **(A.U 2013,2011)**

8. Solve the boundary value problem $y''' = xy$ subject to the condition $y(0)+y'(0)=1$, $y(1)=1$ taking $h=1/3$ by finite difference method. **(A.U 2014,2010)**

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