BITS, Pilani-Dubai
Dubai International Academic City, Dubai

COMPREHENSIVE EXAMINATION –III YEAR –II SEMESTER 2007-2008

Date: 29/05/08
Duration: 3hours
Instructors: Dr Priti Bajpai, Dr A.Somasundaram

Course: Numerical Analysis AAOC C341
Total Marks: 40

NOTE : ANSWER PART – A AND PART – B SEPARATELY

PART – A

Q1

(a) Using the simplified number system with 3 digit arithmetic determine the result with rounding for the following.

(i) $(-.1^{**}+.222)\times\frac{0.00111}{999}$ (in left to right order) [1]

(b) Find a root of $f(x)=x\cos\left(\frac{x}{x-2}\right)$ in the interval $(1,\ 5)$ by Bisection method. Do four iterations with five digit arithmetic. [2]

Q2

(a) Given $f(x)=x^3-\sin x+1$. Find the root of the above equation between -2 and -1 by Newton's method. Do three iterations using 5 digit arithmetic taking $x_n=$ [2]

(b) Do one iteration of Muller's method using 5 digit arithmetic in the interval (0, 1 for the function $x^3-\frac{1}{2}=0$. [2]

Q3

(a) Find the determinant of the following matrix by using the Gauss elimination method with 5 digit arithmetic. [2]

$$\begin{pmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{pmatrix}$$

(b) Find the inverse of the above matrix by Gauss elimination method with 5 digit arithmetic. [3]

Q4

(a) Using Newton's divided difference formula, find $f(8)$ from the following data

x:	4	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	2028

[3]

(b) Fit a natural cubic spline curve and evaluate the spline value at $x = 75$ for the following data with 5 digit arithmetic. [3]

x:	0.0	1.0	1.5	2.25
$f(x)$:	2.000	4.4366	6.7134	13.9130

PART – B

Q5

(a) Express $f(x) = 4 - 7x + 2x^2 + 5x^3$ in terms of Chebyshev polynomial [2]

(b) Find the largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 6 & 2 & 0 \\ 2 & 4 & 1 \\ 0 & 1 & -1 \end{pmatrix}$ Do four iterations using 5 digit arithmetic. [2]

Q6

(a) Find the Fourier series approximation of $f(x) = 2x + 3x^2$ in $(-\pi, \pi)$ [3]

(b) Find $\frac{dy}{dx}$ at $x = 51$ from the following data using 5 digit arithmetic. [3]

x	50	60	70	80	90
y	19.96	36.65	58.81	77.21	94.61

Q7

(a) Evaluate $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by dividing the interval into eight equal parts using Simpson's 1/3 rule with 4 digit arithmetic. [2]

(b) Compute $y(0.1)$ by Runge-Kutta method of order 4 for the differential equation $\frac{dy}{dx} = xy + y^2,\ y(0) = 1$ with four digit arithmetic. [3]

Q8

(a) Find $y(0.8)$ by Milne's predictor corrector method for the equation $y' = y - x^2, y(0) = 1,\ y(0.2) = 1.2187$ and $y(0.4) = 1.4684$. Obtain the value of $y(0.6)$ by Taylor's series method of order 3with 5 digit arithmetic. [4]

(b) Solve the following boundary value problem by finite difference method. $y'' - xy' + 3y = 11x, y(1) = 1.5, y(2) = 15$ with $h = 0.25$ using 5 digit arithmetic. [3]

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III Year – Second Semester 2007-2008

Test: II (OB) Course: Numerical Analysis – AAOC UC341
Duration: 50 min
Date: 27.04.08
Weightage: 20
Total Marks: 20

Answer ALL Questions

1 Develop a Lagrange's quadratic interpolation formula for $e^{0.5x}$ using the values at $x_0 = 0, x_1 = 2, x_2 = 4$ and use it to estimate the value of $e^{0.5x}$ at $x = 1$ using 7 digit arithmetic.

2 Fit a natural cubic spline curve and evaluate the spline value at $x = 7$ for the following data using 6 digit arithmetic.

x:	2	3	6.5	8	12
$f(x)$	14	20	17	16	23

3 Find x_1, A_0, A_1 so that the following integration rule is exact for a polynomial of degree as high as possible.

$$\int_0^1 x\, f(x)\, dx = A_0\, f\left(\frac{1}{3}\right) + A_1\, f(x_1)$$

4 Find the Fourier series approximation of $f(x) = e^{-ax}$ in $(-\pi, \pi)$ **[4]**

5 Solve the following system of equations by Gauss Seidal iteration method using 5 digit arithmetic with rounding. Do two iterations. **[3]**

$$4x + y + z = 9$$
$$3x + 4y + 15z = 40$$
$$x - 3y + z = 13$$

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III Year – Second Semester 2007-2008

Test: (CB) Course: Numerical Analysis – AAOC UC341
Date: 16.03.08 **Duration: 50 min**
Total Marks: 25 **Weightage: 25**

Answer ALL Questions

1. (a) If $x = 3.141592$ and $\bar{x} = 3.14$ find the relative error. **[1]**

   (b) Evaluate $f(x) = 1.107x^3 + 0.319x^2 - 0.017x + 1.107$ for $x = 0.123$ in nested form using four digit arithmetic. **[2]**

2. Find a root of the equation $f(x) = x^3 + x - 1 = 0$ in the interval [0, 1] at the end of third iteration by Bisection method using 5 digit arithmetic. **[2]**

3. Find a root of the equation $f(x) = x^3 - 2x^2 + x - 2 = 0$ with the values $x_0 = 1.5, x_1 = 3, x_2 = 0$ at the end of second iteration by Muller's method using 5 digit arithmetic. **[5]**

4. Solve the non-linear equation $f(x) = x^2 - 2x - 3 = 0$ by fixed point iteration method starting with $x_0 = 4$. Do five iterations using 6 digit arithmetic with two different $g(x)$. **[3]**

5. Establish an iteration formula to find the reciprocal of a positive number N by Newton's method. **[2]**

6. Solve the following system of equations by Gauss elimination method with scaling and partial pivoting:

$$0.003x + 4y + 5z = 9.003$$
$$-3x + 3.85y - 6.75z = -5.9$$
$$4x - 5.25y - 3.5z = -4.75$$

[5]

7. Solve the following system of equations by Crout's method

$$2x - 6y + 8z = 24$$
$$5x + 4y - 3z = 2$$
$$3x + y + 2z = 16$$

[5]