BITS, Pilani-Dubai
Dubai International Academic City, Dubai

COMPREHENSIVE EXAMINATION –III YEAR –II SEMESTER 2009-2010

Date: 19/05/10 Course: Numerical Analysis AAOC C341

Duration: 3hours Total Marks: 120 Weight age: 40%

NOTE : ANSWER PART – A, PART – B AND PART – C SEPARATELY

PART – A

1. (a) For $x = 3.4327$ find the values of absolute and relative errors if:
   i) x is truncated to three decimal places.
   ii) x is rounded off to three decimal places. **[4]**

   (b) Find a root of the equation $(2x+1)^2 = 4\cos \pi x$ at the end of 4^{th} iteration in the interval $\left[\frac{1}{4}, \frac{1}{3}\right]$ using Bisection method with 5 digit arithmetic and rounding. **[6]**

2. (a) Find a root of the equation $f(x) = 4x^3 - 3x^2 + 2x - 1$ by Muller's method starting with $0.5, 0.6, 0.7$. Do one iteration using 5 digit arithmetic with rounding. **[10]**

   (b) For $f(x) = x^3 - 3x + 1$ defined in the interval $[0,1]$ write all possible iterative functions $g(x)$ and check the conditions of convergence of fixed point iteration theorem. Compute smallest positive root starting with $x_0 = 1$ using 5 digit arithmetic with rounding at the end of fourth iteration. **[10]**

3. (a) Find the determinant and inverse of the following matrix using Gauss Jordan method.

$$\begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 3 \\ 5 & 5 & 1 \end{pmatrix}$$ **[10]**

   (b) Use Gauss-Siedel Method to obtain the solution of the system of equations, starting with initial vector [0 0 0].

$$0.1x + 7y - 0.3z = -19.3$$
$$3x - 0.1y - 0.2z = 7.85$$
$$0.3x - 0.2y + 10z = 71.4$$

   Do two iterations with 5 digit arithmetic with rounding. **[10]**

PART – C

1. (a) Estimate the area of the curve $3y = x^3$ in the interval $[0,1]$ using Simpson's $\frac{1}{3}$ rule taking 4 subintervals. Use 5 digit arithmetic with rounding. [4]

   (b) Using 4th order Runge-Kutta method solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, with $y(0) = 1$ at $x = 0.2$. Use 5 digit arithmetic with rounding. [6]

2. Solve $\frac{dy}{dx} = xy + x^2 - 1$ with $y(1) = 0.649$, $y(1.1) = 0.731$, $y(1.2) = 0.854$ and $y(1.3) = 1.028$ using Adam-Moulton predictor–corrector method at $x = 1.4$ using 5 digit arithmetic with rounding. [10]

3. (a) Solve the following system of equations by Taylor's series of order 3 at $t = 0.1$ using 5 digit arithmetic with rounding.

   $$\frac{dx}{dt} = xy + t, \; x(0) = 1$$

   $$\frac{dy}{dt} = ty + x, \; y(0) = -1$$

   [5]

   (b) Solve the boundary value problem $y'' = xy' + x^2$ with $y(1) = 1$, $y(3) = -1$ using the set of equations by dividing into 4 subintervals. [5]

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Third year – Second semester 2009 – 2010

AAOC C341 – Numerical Analysis
Test - 2 (Open Book)

Date: 08.04.2010
Time: 50 Minutes

Max. Marks: 60
Weightage: 20%

Answer ALL the Questions

1. If $f(x)=\frac{1}{x}$ whose arguments are a, b, c, d in this order prove that $f[a, b, c, d]=-\frac{1}{abcd}$ **[6]**

2. The population of a certain town is shown in the following table:

Year	: 1951	1961	1971	1981	1991
Population	: 40.62	60.30	79.95	103.56	132.65

Interpolate at $x=1955$ and find the rate of growth in 1955. **[12]**

3. Find the value of $\log 2^{\frac{1}{3}}$ from $\int_0^1 \frac{x^2}{1+x^3}dx$ using Trapezoidal rule with $h=0.1$ **[12]**

4. Fit a natural cubic spline curve and evaluate the spline value at $x=5$ for the following data using 6 digit arithmetic. **[15]**

x:	2	3.5	6	7.5	10.5
$f(x)$:	12	24	13	15	23.5

5. Expand $\cos x$ in half-range sine series and $\sin x$ in half cosine series over the interval $(0, \pi)$. **[15]**

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AAOC C341 – Numerical Analysis
Test - 1 (Closed Book)

Date: 21.02.2010 **Max. Marks: 75**
Time: 50 Minutes **Weightage: 25%**

Answer ALL the Questions

1. Evaluate the cubic polynomial $f(x) = 1.107\,x^3 + 0.319\,x^2 - 0.017\,x + 0.171$ at x = 0.123 using five digit arithmetic with rounding in nested form. Also find the relative error. **(10)**

2. The quadratic $f(x) = (x-0.3)(x-0.5)$ obviously has zeros at 0.3 and 0.5.
   a) Why is the interval [0.1, 0.6] not a satisfactory starting interval for bisection method?
   b) If you start with [0, 0.49] which root is reached.
   c) Also find the root in the interval [0, 0.49] at the end of fifth iteration by Bisection method using 5 digit arithmetic with rounding. **(13)**

3. Find a root of the equation $e^x - 2 - x = 0$ with the starting values -2.4 and -1.6 at the end of fourth iteration by Regula – Falsi method using 5 significant digits with rounding. **(13)**

4. Using Newton's method, find the cube root of 31 correcting to 5 digit arithmetic with rounding starting with $x_0 = 3$. **(13)**

5. Find a root of the nonlinear equation $f(x) = \tan(x) + 3x^2 - 1$ with the values 0.5, 0.8, 1.0. at the end of first iteration by Muller's method using 5 digit arithmetic. **(13)**

6. Find a suitable interval [a, b] and any four different iteration functions $g(x)$ for $f(x) = e^{x-1} - x^3 + 2x = 0$ by fixed point method. **(13)**

Good Luck

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III YEAR II SEMESTER 2009-10
QUIZ – 2 (Closed Book)

A

Course Title: Numerical Analysis — Course No: AAOC C341
Date: 26.04.2010 — Max marks: 21 — Weight age: 7%

Name of the Student: _____

ID No: _____

1. Using Simpson's $\frac{3}{8}$ rule find the velocity after 18 seconds if a rocket has acceleration as given below:

x:	0	2	4	6	8	10	12	14	16	18
y:	40	60	70	75	80	83	85	87	88	88

Use five digit arithmetic with rounding. **[5]**

2. Evaluate $\int_{-1}^{1} \frac{x \sin x}{1+x^2} dx$ using 3 point Gaussian quadrature with five digit arithmetic. **[5]**

3. Find y at $x = 2.1$ for $\frac{dy}{dx} = x^2 + y^2$, $y(2) = 3$ using second order Taylor's series with 5 digit arithmetic. **[5]**

4. Solve $y' = \sin x + y,\ y(0) = 2$ by the modified Euler's method to get $y(0.1)$ using 5 digit arithmetic with rounding. [6]

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Numerical Analysis (AAOC C341)

A

Quiz - 1

Time: 25 Minutes | Max Marks: 24 | Weightage: 8%

Name: | ID: | 15.3.2010

Answer ALL the Questions

1. (a) Do one iteration of Newton's method correct to 5 digits to obtain the double root of the cubic polynomial $f(x) = x^3 - 3x + 2$ which is close to 1.2. (4)

(b) State the Newton's iteration formula to find the solution of the system of non-linear equations? (2)

2. Solve the system of linear equations using Gauss elimination method using 5 digit arithmetic (without scaling and partial pivoting) and hence find the determinant of the coefficient matrix: (6)

$$6x + 3y + z = 12$$
$$x + 5y + 2z = 3$$
$$2x + 4y + 7z = 21$$

3. Write a brief note on (a) Scaling (b) Ill-conditioned system (c) find 1- norm, ∞- norm and Frobenius norm for the following matrix $A = \begin{pmatrix} 3 & 5 & 2 \\ 2 & -4 & -2 \\ 10 & 5 & 1 \end{pmatrix}$ (6)

4. Find the minimum number of iterations required in Jacobi method to solve the system of linear equations correcting to 5 arithmetic digits with rounding. Assume the initial vector as (1, −1, 1). (6)

$$4x - 10y + 5z = 32$$

$$5x - 4y + 10z = 39$$

$$10x + 5y - 4z = 17$$