Total No. of Questions : 5] [Total No. of Printed Pages : 4

Roll No. .....

MCA–204

M. C. A. (Second Semester) EXAMINATION, June, 2008

COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS

(MCA–204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt all questions. All questions carry equal marks.

Unit–I

1. (a) Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to 3 decimal places.

   (b) Find the root of the equation $x e^x = \cos x$ using the Regula-Falsi method correct to four decimal places.

Or

   (a) Find a root of the equation $x \log_{10} x = 1{\cdot}2$ correct to 3 decimal places which lies between 2 and 3 (using bisection method).

   (b) Evaluate $\sqrt{30}$ by iteration method correct to four decimal places.

Unit–II

2. (a) Use Newton's forward interpolation formula for the problem ahead :

Estimate the number of students, who obtained marks between 40 and 45 from the table :

Marks	No. of Students
30–40	31
40–50	42
50–60	51
60–70	35
70–80	31

(b) Employ Stirling's formula to compute y_{35} given :

$$y_{31} = 512,\ y_{30} = 439,\ y_{40} = 346,\ y_{50} = 243$$

where y_x represents the number of persons of age x year in a life table.

Or

(a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using :

(i) Simpson's $\frac{1}{3}$ rule

(ii) Simpson's $\frac{3}{8}$ rule

Compare the results with its above value.

(b) Compute the integral $\int_{-1}^{1} e^x\,dx$ using composite trapezoidal rule for (i) $n = 2$ and (ii) $n = 4$.

Unit–III

3. (a) Define partial and complete pivoting. Explain step by step, Gauss elimination method for solving the simultaneous equations :

$$a_1x + b_1y + c_1z = d_1$$

$$a_2x + b_2y + c_2z = d_2$$

$$a_3x + b_3y + c_3z = d_3$$

(b) Use Gauss-Seidel iteration method for solving the equations :

$$10x_1 - 2x_2 - x_3 - x_4 = 3$$

$$-2x_1 + 10x_2 - x_3 - x_4 = 15$$

$$-x_1 - x_2 + 10x_3 - 2x_4 = 27$$

and $$-x_1 - x_2 - 2x_3 + 10x_4 = -9$$

Or

(a) Using Taylor series method, compute $y(0{\cdot}2)$ to three places of decimals from $\frac{dy}{dx} = 1 - 2xy$ given that $y(0) = 0$.

(b) Find the Runge-Kutta method an approximate value of y for $x = 0{\cdot}8$ given that $y = 0{\cdot}41$ when $x = 0$ and $\frac{dy}{dx} = \sqrt{x + y}$.

Unit–IV

4. (a) Derive mean and variance of Binomial distribution.

(b) Fit a normal distribution to the following data :

Variable	Frequency
60–62	5
63–65	18
66–68	42
69–71	27
72–74	8

Or

(a) Define Rectangular distribution. Calculate the mean and variance of rectangular distribution whose frequency function is :

$$F(x) = \begin{cases} \frac{1}{2h}, & \text{if } 10 - h < x < 10 + h \\ 0, & \text{otherwise} \end{cases}$$

P. T. O.

(b) Prove that the mean deviation from the mean of the normal distribution is about $\frac{4}{5}$ times its standard deviation.

Unit – V

5. (a) Define the following terms :
   (i) Sample
   (ii) Large and Small sample
   (iii) Parameter and Statistic
   (iv) Null Hypothesis

   (b) What is meant by testing of Hypothesis ? Explain the terms type I and type II error.

Or

(a) What are the main features and properties of F curve ?

(b) Show how you would use Student's t-test and Fisher z-test to decide whether the two sets of observations :

17, 27, 18, 25, 27, 29, 27, 23, 17

and 16, 18, 20, 16, 20, 17, 15, 21

indicate samples drawn from the same universe.

Total No. of Questions : 10] [Total No. of Printed Pages : 5

MCA–204

M. C. A. (Second Semester)
EXAMINATION, Nov.-Dec., 2007
COMPUTER ORIENTED NUMERICAL ANALYSIS
(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : All questions are compulsory. In internal choice, *one* question from each Unit.

Unit–I

1. (a) Describe the errors due to shortage, limitations and safeguards against them.

   (b) Find a real root of the equation $x \log_{10} x = 1 \cdot 2$ by Regula-Falsi method, correct to three decimal places.

2. (a) Calculate the value of $(x^2 - y^2)/(x + y)$ with $x = 0 \cdot 4845$ and $y = 0 \cdot 4800$ using normalized floating point arithmetic. Compare the result with the value of $(x - y)$.

   (b) Show that Newton's method has a quadratic convergence.

Unit – II

3. (a) Derive Newton's forward interpolation formula and use it to estimate the value of $f(1{\cdot}25)$ from the following table :

x	$f(x)$
1·0	4·00
1·5	18·25
2·0	44·00
2·5	84·25

(b) Evaluate :

$$\int_0^1 \sqrt{(\sin x + \cos x)}\, dx$$

Using Simpson's $\frac{1}{3}$ rule, correct to three decimal places using seven ordinates.

4. (a) Find F (9) from the following table :

x	$f(x)$
5	150
7	392
11	1452
13	2366
17	5202

(b) Write short notes on the following :

(i) Gauss-Legendre integration method

(ii) Inverse interpolation

Unit – III

5. (a) Write short notes on the following :

(i) Partial and complete pivoting

(ii) Ill-conditioned equations

(b) Apply Runge-Kutta fourth order method to find an approximate value of y when $x = 0{\cdot}2$ in step of $0{\cdot}1$. Given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$.

6. (a) Find the solution of the system of equations :

$$83x + 11y - 4z = 95$$
$$7x + 52y + 13z = 104$$
$$3x + 8y + 29z = 71$$

using Gaussian-elimination method.

(b) Using Runge-Kutta fourth order method find y when $x = 1{\cdot}2$ in steps of $0{\cdot}1$, given that :

$$\frac{dy}{dx} = x^2 + y^2 \text{ and } y(1) = 1{\cdot}5$$

Unit–IV

7. (a) The following data are the number of seeds germinating out of 10 on damp filter for 80 sets of seeds. Fit a binomial distribution to these data :

x	f
0	6
1	20
2	28
3	12
4	8
5	6
6	0
7	0
8	0
9	0
10	0

(b) Find the point of inflexion of the normal curve :

$$y = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-m}{\sigma}\right)^2}$$

8. (a) From records of Army Corps kept over 20 years, the following data was obtained, showing the number of deaths caused by the kicks of a horse. Calculate the theoretical Poisson frequencies :

No. of Deaths	Frequency
0	109
1	65
2	22
3	3
4	1
Total	200

[given $e^{-0.61} = 0.5436$]

(b) Five dice were thrown 192 times and the number of times 4, 5 or 6 were as follows :

No. of dice throwing 4, 5, 6	f
5	6
4	46
3	70
2	48
1	20
0	2

[redacted]

Unit—V

9. (a) For a random sample of 10 pigs fed on diet A, the increases in weight in pounds in a certain period were :

10, 6, 16, 17, 13, 12, 8, 14, 15, 9 lbs.

For another random sample of 12 pigs fed on diet B, the increases in weight in the same period were :

7, 13, 22, 15, 12, 14, 18, 8, 21, 23, 10, 17 lbs.

Show that the estimate of population variance in the two samples was not significantly different (for $\nu_1 = 11, \nu_2 = 9$, the 5% value of F = 3·112).

(b) Ten individuals chosen at random from a population of their heights are found to be in inches 63, 63, 64, 65, 66, 69, 69, 70, 70, 71. Discuss the suggestion that the mean height in the universe is 65 inches. Given that for 9 degress of freedom, the value of Student's t at 5% level of significance is 2·262.

10. (a) Show that in 2×2 contingency table wherein the frequencies are $\begin{array}{c|c} a & b \\ \hline c & d \end{array}$

$$\chi^2 = \frac{(a+b+c+d)(ad-bc)^2}{(a+b)(c+d)(b+d)(a+c)}$$

(b) Write short notes on the following :

(i) Normal distribution

(ii) Comparison of large samples

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–204(O)

M. C. A. (Second Semester)
EXAMINATION, May/June, 2006
(Old Scheme)
COMPUTER ORIENTED NUMERICAL ANALYSIS
[MCA–204 (O)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) If $x = 0{\cdot}876543\,E - 5$ and $y = 0{\cdot}299600\,E - 3$, find the values of $x + y$, $x - y$, $x \cdot y$ and x/y using floating point arithmetic.

   (b) Describe the relationship between significant digits and round off error.

   (c) Given that $u = \dfrac{5xy^2}{z^2}$ and Δx, Δy and Δz denotes the errors in x, y and z respectively such that $x = y = z = 1$ and $\Delta x = \Delta y = \Delta z = 1$, find the relative maximum error in u.

   (d) Distinguish between round off error and truncation error.

2. (a) Using Newton-Raphson formula establish the iterative formula $x_{n+1} = \frac{1}{2}\left(x_n + \frac{N}{x_n}\right)$ to calculate the square root of N. Hence compute $\sqrt{8}$.

   (b) Use secant method to determine the root of the equation $\cos x - x e^x = 0$.

3. (a) Write a C/C++ program to compute the root of the equation $f(x) = 0$ using bisection method.

   (b) Find the real root of the equation $x \log_{10} x - 1{\cdot}2 = 0$ correct to five decimal places by Regula-Falsi method.

4. (a) Solve the following system of equations by Gauss elimination method :

$$4{\cdot}12x - 9{\cdot}68y + 2{\cdot}01z = 4{\cdot}93$$
$$1{\cdot}88x - 4{\cdot}62y + 5{\cdot}50z = 3{\cdot}11$$
$$1{\cdot}10x - 0{\cdot}96y + 2{\cdot}72z = 4{\cdot}02$$

   (b) Solve the following equations by Gauss-Seidel iteration method :

$$5x_1 + x_2 + x_3 = 10$$
$$x_1 + 4x_2 + x_3 = 12$$
$$x_1 + 2x_2 + 6x_3 = 23$$

5. (a) Derive Newton's forward interpolation formula.

   (b) Find $f(8)$ from the following data :

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

6. (a) Find the values of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1{\cdot}1$ from the following data :

x	y
1·0	0
1·2	0·128
1·4	0·544
1·6	1·296
1·8	2·432
2·0	4

(b) Establish Newton-Cotes quadrature formula and deduce trapezoidal rule and Simpson's $\frac{1}{3}$ rule.

7. (a) Find $y\,(0{\cdot}1)$ from the equation :

$$\frac{dy}{dx} = x + x^2 y, \quad y\,(0) = 1$$

using Picard's method.

(b) Find the values of $y\,(0{\cdot}2)$ and $y\,(0{\cdot}4)$ using Runge-Kutta method of fourth order with $h = 0{\cdot}2$, given that $\frac{dy}{dx} = \sqrt{x^2 + y}$, $y\,(0) = 0{\cdot}8$.

8. Write short notes on any *two* of the following :
   (a) Gauss-Legendre integration method
   (b) Inverse interpolation
   (c) Rate of convergence

Total No. of Questions : 8] [Total No. of Printed Pages : 4

MCA–204

M. C. A. (Second Semester) EXAMINATION, June, 2005

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Distinguish between roundoff errors and truncation errors.
   (b) Explain the concepts of overflow and underflow.
   (c) Explain arithmetic operations for normalized floating point numbers giving examples.
   (d) What is chopping ? When does it occur ?
   (e) If 0·333 is the approximate value of 1/3, find absolute, relative and percentage errors.

2. (a) Show that Newton-Raphson method is quadratic convergent.
   (b) Using Newton-Raphson method, find the real root of the equation $3x = \cos x + 1$ correct to five decimal places.
   (c) Use Regula-Falsi method to determine the root of the equation $\cos x - x e^x = 0$ correct to five decimal places.

P. T. O.

3. (a) Write an algorithm to find a root of the equation $f(x) = 0$ using bisection method.

(b) Find the smallest positive root of the equation $x^3 - 3x^2 + x + 1 = 0$ using second method.

(c) Solve the equation :

$$e^{-x} - x = 0$$

by Bisection method.

4. (a) Solve the following system of equations using Gauss-Seidel method :

$$27x + 6y - z = 85$$
$$6x + 15y + 2z = 72$$
$$x + y + 54z = 110$$

(b) Solve the following equations using partial pivoting technique :

$$1{\cdot}4x + 2{\cdot}3y + 3{\cdot}7z = 7{\cdot}4$$
$$3{\cdot}3x + 1{\cdot}6y + 4{\cdot}3z = 9{\cdot}2$$
$$2{\cdot}5x + 1{\cdot}9y + 4{\cdot}1z = 8{\cdot}5$$

5. (a) Derive Newton's forward interpolation formula and use it to estimate the value of $f(1{\cdot}25)$ from the following table :

x	$f(x)$
1·0	4·00
1·5	18·25
2·0	44·00
2·5	84·25

(b) Apply Bessel's formula to find y_9, given that :

$$y_4 = 54,\ y_8 = 362,\ y_{12} = 744,\ y_{16} = 1192$$

6. (a) Find the polynomial of the lowest degree by using Newtons divided difference formula for the following data :

x	$f(x)$
0	8
1	11
4	68
5	123
7	163

(b) Find $f(9)$ from the following table :

x	$f(x)$
5	150
7	392
11	1452
13	2366
17	5202

7. (a) Find $\frac{dy}{dx}$ at $x = 1{\cdot}5$ from the following table :

x	y
1·5	3·375
2·0	7·0
2·5	13·625
3·0	24·0
3·5	38·875
4·0	59·0

(b) Evaluate :

$$\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$$

(i) Using Simpson's $\frac{1}{3}$ rule

(ii) Using Weddle's rule

P. T. O.

8. (a) Find $y(2 \cdot 2)$ using Euler's method for $\frac{dy}{dx} = -xy^2$ where $y(2) = 1$.

(b) Using Runge-Kutta method of fourth order, solve :

[redacted]

at $x = 0 \cdot 4$ in steps of $0 \cdot 2$.

[redacted]

Total No. of Questions : 8] [Total No. of Printed Pages : 3

MCA–204

M. C. A. (Second Semester) EXAMINATION, Dec., 2005

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) What is floating point representation of numbers ? Describe in detail.

   (b) What is a sign bit ? How does the computer store a negative number ?

   (c) Explain Absolute error and Relative error giving examples.

   (d) What is chopping ? When does it occur ?

2. (a) Using Newton-Raphson formula establish the iterative formula :

$$x_{n+1} = \frac{1}{3}\left(2x_n + \frac{N}{x_n^2}\right)$$

   to calculate the cube root of N. Hence find the cube root of 12.

(b) Find the root of equation $x^3 + x^2 - 1 = 0$ that lies between 0 and 1, correct to four places of decimals using Muller's method.

3. (a) Write a C/C++ program to compute the root of the equation $f(x) = 0$ using Regula-Falsi method.

(b) Find the root of the equation $x^3 - 9x + 1 = 0$ which lies between 2 and 4 using bisection method correct to four decimal places.

4. (a) What is meant by ill conditioning of system and refinement of solution ? Explain giving examples.

(b) Solve the systems of equations :

$$9x + 2y + 4z = 20$$

$$x + 10y + 4z = 6$$

$$2x - 4y + 10z = -15$$

by Gauss-Seidel iteration method.

5. (a) Solve the following equations using partial pivoting :

$$1{\cdot}4x + 2{\cdot}3y + 3{\cdot}7z = 7{\cdot}4$$

$$3{\cdot}3x + 1{\cdot}6y + 4{\cdot}3z = 9{\cdot}2$$

$$2{\cdot}5x + 1{\cdot}9y + 4{\cdot}1z = 8{\cdot}5$$

(b) Find a cubic polynomial from the following data :

x	:	0	1	2	3
$f(x)$	:	1	2	1	10

6. (a) Find the value of x when $y = 20$ from the following data :

x	:	1	2	3	4
y	:	1	8	27	64

(b) Find the value of $f'(8)$ from the following data :

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

7. (a) What do you mean by numerical integration ? Obtain Gauss quadrature formula for numerical integration and discuss usefulness of this formula.

(b) Find $y(0{\cdot}1)$, by solving the equation :

$$\frac{dy}{dx} = \frac{y-x}{y+x}, y(0) = 1, \text{ using Picard's method.}$$

8. (a) What is the advantages of Runge-Kutta formula over Taylor method ?

(b) Find the value of $y(1{\cdot}1)$ Runge-Kutta method of fourth order solving the equation :

$$\frac{dy}{dx} = y^2 + xy, y(1) = 1$$

Total No. of Questions : 8] [Total No. of Printed Pages : 2

MCA–204

M. C. A. (Second Semester) EXAMINATION, June, 2004

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA–204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. Each question carries equal marks.

1. (a) Show that the convergence of Newton-Raphson formula is quadratic.

   (b) Find any real root of $x^3 = x + y$ upto six digits using Newton-Raphson formula.

2. (a) Describe iterative method of roots of equation with convergence condition.

   (b) Find a root (near 1) of the following equation using iterative method (upto six digits) :

$$x^3 + 2x^2 + 10x - 20 = 0$$

3. (a) Explain Round-off, truncation and relative errors by choosing suitable example.

   (b) Given :

$$A_n = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots \frac{1}{2n-1}$$

   Compute A_n correct to three digits.

4. (a) Describe the Gauss-elimination method.

   (b) Solve the following equation by Gauss-elimination method :

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 2 & 1 \\ 1 & 2 & 2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \\ 7 \end{bmatrix}$$

5. (a) What is meant by ill-conditioning system ?

   (b) Solve the following system by the Gauss-Seidal method :

$$\begin{bmatrix} 10 & -5 & -2 \\ -4 & 10 & -3 \\ -1 & -6 & 10 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \\ 3 \end{bmatrix}$$

6. (a) Derive Simpson's $\left(\frac{3}{8}\right)$ rule.

   (b) Apply the Simpson's (3/8) rule to evalute the following integral (for six digits) :

$$\int_{1\cdot0}^{1\cdot30} \sqrt{x} \cdot dx$$

7. (a) Derive the (fourth order) Runge-Kutta formula.

   (b) Apply the Runge-Kutta formula to solve the following equation :

$$y' = \frac{1}{2}(1+x)y^2, \quad y(0) = 1$$

8. Write short notes on any *two* of the following :

   (a) Regula-falsi method of roots finding

   (b) Gauss-Legendre integration formula

   (c) Interpolation for unequal spacing

Total No. of Questions : 8] [Total No. of Printed Pages : 4

MCA–204

M. C. A. (Second Semester) EXAMINATION, Dec., 2004

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Explain normalization of floating point numbers.
   (b) What is symmetric roundoff ? Show that symmetric error is, at worst, one-half the chopping error.
   (c) Distinguish between roundoff errors and truncation errors.
   (d) What do you mean by relative error ? How is it important in error analysis ?
   (e) What are blunders ? How can we minimize them ?

2. (a) Prove that order of convergence of false position method is 1·618.
   (b) Find the root of the equation $x e^x - \sin x = 0$ using false position method correct to three decimal places.
   (c) Find a root of the equation $x^3 - 4x - 9 = 0$ using bisection method correct to four decimal places.

P. T. O.

3. (a) Explain the principle of secant method.

(b) Find the root of the equation $2x - \log_{10} x = 7$ using secant method correct to five decimal places.

(c) Using Newton-Raphson method find a real root of the equation :

$$3 \sin x - 2x + 5 = 0$$

Correct to four places of decimals.

4. (a) Solve the following system of equations using Gauss-Seidal method :

$$10x + y + 2z = 44$$

$$2x + 10y + z = 51$$

$$x + 2y + 10z = 61$$

(b) Solve the following system of equations using partial pivoting technique :

$$x + 2y + 3z = 14$$

$$2x + 3y + 4z = 20$$

$$3x + 4y + z = 14$$

5. (a) Find $f(1{\cdot}6)$ from the following table :

x	$f(x)$
1	3·49
1·4	4·82
1·8	5·96
2·2	6·5

(b) Derive Lagrange's interpolation formula and use it to find $f(10)$ from the ahead table :

x	$f(x)$
5	12
6	13
9	14
11	16

6. (a) Apply Stirling's formula to find y_{35}, given that :

$$y_{20} = 512,\ y_{30} = 439,\ y_{40} = 346,\ y_{50} = 243$$

(b) Determine $f(x)$ as a polynomial in x for the following data, using Newton's divided difference formulae :

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

7. (a) Find $\frac{dy}{dx}$ at $x = 1{\cdot}1$ from the following data :

x	y
1·0	7·989
1·1	8·403
1·2	8·781
1·3	9·129
1·4	9·451
1·5	9·750
1·6	10·031

(b) Evaluate :

$$\int_{0\cdot5}^{0\cdot7} \sqrt{x}\, e^{-x}\, dx$$

(i) Using Simpson $\frac{1}{3}$ rule

(ii) Using Weddle's rule

P. T. O.

8. (a) Given that $\frac{dy}{dx} = x + y^2$ and $y = 1$ when $x = 0$. Find an approximate value of y at $x = 0{\cdot}5$ by modified Euler's method.

(b) Use Runge-Kutta method to find y when $x = 1{\cdot}2$ in steps of $0{\cdot}1$, given that :

$$\frac{dy}{dx} = x^2 + y^2 \text{ and } y(1) = 1{\cdot}5$$

Total No. of Questions : 8] [Total No. of Printed Pages : 4

MCA–204

M. C. A. (Second Semester) EXAMINATION, June, 2003

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA–204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Discuss an example to show that the distributive law of arithmetic is not always satisfied in numerical computing.

   (b) (i) Show that the following rules does not generally hold good in integer arithmetic :

$$\frac{a+b}{c} = \frac{a}{b} + \frac{b}{c}$$

   (ii) Assuming that the mantissas are truncated to 4 decimal digits, compute the error in the following computations :

   (1) $5 \cdot 6789 - 1 \cdot 2345$

   (2) $5 \cdot 6789 + 9 \cdot 2345$

2. (a) What are inherent errors ? How do these arise ?

   (b) Explain briefly the three approaches used in error

3. (a) Solve $x^3 - 9x + 1 = 0$, for the root lying between 2 and 4 by regula-falsi method.

   (b) Apply Newton-Raphson method to find the root of the equation $x - 1{\cdot}5 \sin x - 2{\cdot}5 = 0$, correct to three decimal places.

4. (a) Prove that the rate of convergence of secant method is better than that of bisection method on false position method.

   (b) Solve the following system of equations using complete pivoting :

$$2x + 3y + 4z = 5$$

$$3x + 4{\cdot}5y + 5z = 6$$

$$4x + 5y + 6z = 7$$

5. (a) What is meant by ill-conditioned system ?

   (b) Solve the equations :

$$5x + 2y + z = 12$$

$$x + 4y + 2z = 15$$

$$x + 2y + 5z = 20$$

   by Gauss-Seidel method.

6. (a) Apply Runge-Kutta method to find an approximate value of y for $x = 0{\cdot}2$ in steps of $0{\cdot}1$, if $\frac{dy}{dx} = x + y^2$, given that $y = 1$, where $x = 0$.

   (b) Apply Lagrange's formula inversely to obtain the root of the equation $f(x) = 0$, given that $f(30) = -30$,

7. (a) Use Lagrange's formula to find the form of $f(x)$, given :

x	$f(x)$
0	648
2	704
3	729
6	792

(b) Given the table :

x	$\log x$
310	2·49136
320	2·50515
330	2·51851
340	2·53148
350	2·54407
360	2·55630

Find the value of log 337·5 by Everett's formula.

8. (a) The following data gives corresponding values of pressure and specific volumes of a superheated steam :

v	p
2	105
4	42·7
6	25·3
8	16·7
10	13

Find the rate of change of :

(i) pressure with respect to volume when $v = 2$

(ii) volume with respect to pressure when $p = 105$

(b) Compute $\int_{-1}^{1} e^x \, dx$ using two-point Gauss-Legendre formula.

Total No. of Questions : 8] [Total No. of Printed Pages : 2

MCA-204

M. C. A. (Second Semester) EXAMINATION, Dec., 2003

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Explain Round-off, truncation and relative errors by taking suitable example.

   (b) Given :

$$A_n = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + ... + (-1)^{n+1}\frac{1}{n}$$

   Compute A_n correct to three digits.

2. (a) Derive the Newton-Raphson formula. What is the geometric interpretation of this formula ?

   (b) Apply Newton-Raphson formula to calculate at least one root of the equation (upto six digit) :

$$x^3 + 2x^2 + 10x - 20 = 0$$

3. (a) Derive the regula falsi formula.

   (b) Write the equation $x^3 - x^2 - x - 1 = 0$ in the iterative form and find a positive root for six place accuracy.

4. (a) Approximately how many multiplications and divisions are performed in carrying out the Gauss-elimination method ?

   (b) Solve the following system by Gauss's Elimination method :

5. (a) What is meant by ill-conditioning of system ?

   (b) Solve the following system by Gauss-Seidal method :

$$\begin{bmatrix} 10 & -5 & -2 \\ -4 & 10 & -3 \\ -1 & -6 & 10 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 3 \\ 3 \end{bmatrix}$$

6. (a) Differentiate Newton's forward formula.

   (b) Derive Simpson's 1/3 rule and apply it to evaluate the following integral :

$$\int_{1\cdot00}^{1\cdot30} \sqrt{x} \cdot dx$$

7. (a) What is the advantage of Runge-Kutta formulas over Taylor method ?

   (b) Apply the Runga-Kutta formula (fourth order) to solve the following equation :

$$y' = f(x, y) = xy^{1/3}, \quad y(1) = 1$$

8. Write short notes on any *two* of the following :

   (a) Gauss-Legendre integration method

   (b) Interpolation for unequal spacing

   (c) Zeros of polynomials using bisections

Total No. of Questions : 8] [Total No. of Printed Pages : 4

MCA–204

M. C. A. (Second Semester)
EXAMINATION, June, 2002

COMPUTER ORIENTED NUMERICAL ANALYSIS.

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) What is a sign bit ? How does the computer store a negative number ?

   (b) What is chopping ? When does it occur ?

   (c) What do you mean by relative error ? How is it important in error analysis ?

   (d) Describe the relationship between significant digits and round off error.

   (e) Write the following numbers in normalised exponential forms and E-form :

   (i) 12·34

   (ii) –0·009876

2. (a) Find the root of the equation $x^3 - x - 11 = 0$, which lies between 2 and 3 using bisection method correct to three decimal places.

   (b) Find the real root of the equation $x \log_{10} x - 1 \cdot 2 = 0$ correct to four decimal places by using false position method.

   (c) Prove that bisection method is linearly convergent.

3. (a) Use secant method to compute a root of the equation $e^x - 3x = 0$.

   (b) Using Newton-Raphson method, find the root of the equation correct to three decimal places :

$$\cos x = x e^x.$$

   (c) How does the secant method compare with Newton-Raphson method ?

4. (a) Apply Gauss-Seidel iteration method to solve the equation :

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22$$

   (b) Solve the system of equations using partial pivoting

$$x_1 + 2x_2 + 3x_3 = 8$$
$$2x_1 + 4x_2 + 9x_3 = 8$$
$$4x_1 + 3x_2 + 2x_3 = 2$$

5. (a) What is iterative refinement ? An approximate solution of the system :

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

is given by $x = 2 \cdot 8$, $y = 1$, $z = 1 \cdot 8$. Using above iteration method improve this solution.

(b) Estimate the values of $f(22)$ and $f(42)$ from the following available data :

x	$f(x)$
20	354
25	332
30	291
35	260
40	231
45	204

6. (a) Find the polynomial of the lowest degree by using Newtons divided difference formula for the following data :

x	$f(x)$
−1	− 21
1	15
2	12
3	3

(b) Apply Lagrange's method to find the value of x when $f(x) = 15$ from the following data :

x	$f(x)$
5	12
6	13
9	14
11	16

7. (a) Derive a three point difference formula for estimating the first derivative of a tabulated function.

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's rule taking $h = 1/6$. Hence compute an approximate value of π in each case.

(c) Use Gauss-Legendre three point formula to evaluate :

$$\int_2^4 (x^4 + 1)\, dx$$

Given :

$w_1 = 0{\cdot}55556$ $\quad z_1 = -0{\cdot}77460$

$w_2 = 0{\cdot}88889$ $\quad z_2 = 0{\cdot}0$

[redacted] $\quad z_3 = -z_1$

8. (a) Use Runge-Kutta method to estimate $y(1)$ of the equation :

$$\frac{dy}{dx} = y - x^2, y(0) = 1$$

with $h = 0{\cdot}5$.

(b) Apply fourth order Runge-Kutta method to equation $\frac{dy}{dx} = \mu y, y(x_0) = y_0$ and show that the range of absolute stability is $-2{\cdot}78 < \mu h < 0$.

[redacted]

Total No. of Questions : 8] [Total No. of Printed Pages : 4

MCA–204

M. C. A. (Second Semester) EXAMINATION, Dec., 2002

COMPUTER ORIENTED NUMERICAL ANALYSIS

(MCA – 204)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) Illustrate with examples the concept of overflow and underflow.

   (b) Assuming that the mantissas are truncated to 4 decimal digits, compute the error in the following computations :

   (i) $5 \cdot 6789 - 1 \cdot 2345$

   (ii) $5 \cdot 6789 + 9 \cdot 2345$

2. (a) What are blunders ? How can we minimize them ?

   (b) Describe the relationship between significant digits and the following :

   (i) round off errors

P. T. O.

(ii) accuracy

(iii) precision

3. (a) Find by Regula-Falsi method, the real root of the equation $x^3 - x^2 - 2 = 0$, correct to three decimal places.

(b) Use Newton-Raphson method to find the real root of the equation $x \log_{10} x = 1 \cdot 2$, correct to three decimal places.

4. (a) Show that the Newton-Raphson method converges to solution quadratically.

(b) Using Gauss elimination with partial pivoting, solve the following system of equations :

$$x + y - 2z = 3$$

[redacted]

$$3x - y + 3z = 8$$

5. (a) Can we solve an ill-conditioned system ? If yes, how ?

(b) Solve the following system of equations by Gauss-Seidel iteration method :

[redacted]

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110$$

6. (a) Using Runge-Kutta method of order 4, find $y(0 \cdot 2)$ given that $\frac{dy}{dx} = 3x + \frac{1}{2}y$, $y(0) = 1$, taking $h = 0 \cdot 1$.

(b) The following table gives the values of x and y :

x	y
1·2	4·2
2·1	6·8
2·8	9·8
4·1	13·4
4·9	15·5
6·2	19·6

Find the value of x corresponding to $y = 12$. using Lagrange's technique.

7. (a) Obtain a polynomial of minimum degree approximating the following data :

x	y
1	1
2	− 3
3	− 1
4	13

(b) Given the values :

x	$f(x)$
5	150
7	392
11	1452
13	2366
17	5202

Evaluate $f(a)$ using Lagrange's divided difference formula.

P. T. O.

8. (a) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time t seconds. Find the velocity of the slider and its acceleration when $t = 0{\cdot}3$ seconds.

(b) Use Gauss-Legendre three-point formula to evaluate :

$$\int_2^4 (x^4 + 1)\, dx$$

Given :

$w_1 = 0{\cdot}55556$ [redacted]

$w_2 = 0{\cdot}88889$ $z_2 = 0{\cdot}0$

$w_3 = 0{\cdot}55556$ $z_3 = 0{\cdot}77460$