Code: AE07 **Subject: NUMERICAL ANALYSIS & COMPUTER PROGRAM**
Time: 3 Hours **Max. Marks**

JUNE 2011

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. The error which is already present in the statement of the problem before its solution is called

(A) inherent error **(B)** round-off error
(C) truncation error **(D)** relative error

b. 'C' language was developed by

(A) Donald Richie **(B)** Dennis Pierre
(C) Dennis Richie **(D)** Donald Pierre

c.
(i) In secant method we replace the function f(x) by a chord
(ii) In the Newton-Raphson method we replace the function f(x) by a normal

Which of the above statements are correct?

(A) Both (i) & (ii) **(B)** (i) only
(C) (ii) only **(D)** None of these

d. An iterative method has the rate of convergence p if p is the largest positive real number for which there exists a finite constant $c \neq 0$ such that $|\in_{k+1}| \leq c|\in_k|^p$. consider:
(i) $\in_{k+1}$ is the error at k^{th} iteration
(ii) c is called asymptotic error.
(iii) for Newton Raphson method p = 2
Which of the above statements are correct?

(A) (i) only **(B)** (ii) only
(C) (i) & (ii) **(D)** (ii) & (iii)

e. In complete pivoting we interchange the

(A) Rows only **(B)** Columns only
(C) Both rows and columns **(D)** Neither the rows nor the columns

f. Let A be a non singular matrix. Consider $(A-\lambda I)X=0$

(i) $\det(A-\lambda I)=0$ is called the characteristic equation

(ii) λ is called an eigen value of A

(iii) the smallest eigen value in modulus is called spectral radius of A.

Which of the above statements are correct?

(A) (i), (ii) & (iii) **(B)** (i) & (ii)
(C) (ii) & (iii) **(D)** (ii) only

g. (i) The degree of an interpolating polynomial through (n+1) points is less than or equal to n.

(ii) In quadratic interpolation we approximate the function f(x) by a polynomial of degree two.

Which of the above statements are correct?

(A) (i) only **(B)** (ii) only
(C) Both (i) & (ii) **(D)** None of these

h. Let P(x) be the polynomial due to linear interpolation of the function f(x). The deviation $E=f(x)-P(x)$ is called

(A) truncation error **(B)** rounding error
(C) absolute error **(D)** relative error

i. Given the following values of $f(x)=\log x$

x	:	2.0	2.2
f(x)	:	0.69315	0.78846

The approximate value of $f'(2.0)$ using the method based on linear interpolation is

(A) 0.74566 **(B)** 0.64755
(C) 0.47655 **(D)** 0.57644

j. (i) The simple trapezoidal rule is based on approximating f(x) by a straight line

(ii) The simple Simpson's $1/3$ rule is based on approximating f(x) by a quadratic curve.

In the above, which of the statements are correct?

(A) (i) only **(B)** (ii) only
(C) Both (i) & (ii) **(D)** None of these

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Write a C program to evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule. **(8)**

b. Construct a Newton Raphson iteration to the $\sqrt[p]{K}$ for a positive constant K. Hence, estimate $\sqrt[3]{11}$ by carrying out 3 iterations, starting from $x_0=2$. **(8)**

Q.3 a. Obtain a second degree polynomial approximation to $f(x) = e^x$ on [0, the Taylor series expansion about x = 0. Use the expansion to approx f(0.5) and find a bound of the truncation error.

b. Given equation $x^4 - 2x - 1 = 0$. Use secant method to find smallest positive root of the given equation correct to three decimal places. **(8)**

Q.4 a. Solve the system **(8)**

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

by the Gauss-Jordan method.

b. Solve the following system of equations by Gauss Seidel iterative method **(8)**

$$9x + 4y + z = -17$$
$$x - 2y - 6z = 14$$
$$x + 6y = 4$$

(Perform three iterations)

Q.5 a. Consider the equations

$$x + y + z = 1$$
$$4x + 3y - z = 6$$
$$3x + 5y + 3z = 4$$

Use the decomposition method to find the solution of the equation. **(8)**

b. Give the application of union data structures. **(8)**

Q.6 a. For the following data, calculate the differences and obtain the backward difference polynomial. Interpolate at x = 0.35

x:	0.1	0.2	0.3	0.4	0.5
f(x):	1.40	1.56	1.76	2.00	2.28

(8)

b. Using cos 0 = 1 and cos(1.5) = .0707, find an approximate value of cos 1 by Lagrange's interpolation. Obtain a bound of the truncation error. **(8)**

Q.7 a. Obtain a quadratic approximation of $f(x) = x^{1/2}$ on [0, 1] using the method of least squares. **(8)**

b. Evaluate the integral $I = \int_{-1}^{1} (1 - x^2)^{3/2} \cos x \, dx$ using Gauss-Legendre three point formula. **(4+4 = 8)**

Q.8 a. Evaluate the integral $I = \int_{0}^{1} \frac{dx}{1+x}$ using composite Trapezoidal rule with n = 4.

Find an upper bound of the error. **(8)**

b. From the following table of values of x and f(x), obtain $f'(1.2)$

x	f(x)
1.0	2.7183
1.2	3.3201
1.4	4.0552
1.6	4.9530
1.8	6.0496
2.0	7.3891
2.2	9.0250

Q.9 a. Given $\frac{dy}{dx} = y - x$ where $y(0) = 2$, find $y(0.1)$ and y(0.2) using Runge kutta method of order 4. (Take h = 0.1). **(8)**

b. Write a short note on partial and complete pivoting. **(8)**