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

DECEMBER 2010

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 half an hour 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. Which of the following data type can be treated as a pointer by default:

(A) char **(B)** int
(C) double **(D)** short int

b. A number $x = 0.36132346 \times 10^7$ is subtracted to another number $y = 0.36143447 \times 10^7$. The floating point representation of $(x - y)$ in normalized form is

(A) $.11101 \times 10^4$ **(B)** 1.1101×10^3
(C) $.011101 \times 10^5$ **(D)** 11.101×10^2

c. Consider the following statements:
(i) Newton-Raphson method has quadratic rate of convergence.
(ii) If the Newton-Raphson method converges then, it is faster than the secant method
Which of the following statements are correct?

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

d. In Bisection method if the permissible errors is $\in$, then the approximate number of iterations required may be determined from relation

(A) $\frac{b_o - a_o}{2^n} \le \in$ **(B)** $\frac{b_o - a_o}{2^n} \ge \in$
(C) $\frac{b_o - a_o}{n \log 2} \le \in$ **(D)** $\frac{b_o - a_o}{n \log 2} \ge \in$

e. In partial pivoting we interchange the

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

f. Which of the following statement is / are correct?

(i) The degree of an interpolating polynomial through 3 points is less tha equal to 2.

(ii) In linear interpolation we approximate the function by a straight line.

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

g. Newton's forward difference interpolation formula

(A) Is expressed in terms of Backward differences
(B) Can also be applied to the situation when points are unequally spaced
(C) is more suitable when we have to interpolate at a point nearer to the initial point
(D) is more suitable when we have to interpolate at a point nearer to the end point

h. Which of the following statements is / are correct?

(i) In the method of undetermined coefficients we express $f^{r}(x)$ as a linear combination of values of $f(x)$ at an arbitrary chosen set of tabular points.

(ii) We assume that tabular points are equispaced.

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

i. An upper bound of the error in evaluating $\int_0^1 \frac{dx}{1+x}$ using trapezoidal rule is

(A) 1.6×10^{-1} **(B)** 1.6×10^{-2}
(C) 2.6×10^{-1} **(D)** 2.6×10^{-2}

j. The value of y(0.1) using Euler's method; given that $\frac{dy}{dx}=x^2+y, y(0)=1$, (h = 0.1) is

(A) 1.1 **(B)** 1.2
(C) 1.12 **(D)** 1.4

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 simpson's $1/3$ rule. **(8)**

b. Use Newton Raphson method to evaluate square root of 5 correct up to three decimal places. **(8)**

Q.3 a. Obtain a second degree polynomial approximation to $f(x) = \cos x, x \in [$ using the Taylor series expansion about x = 0. Use the expansion approximate $f\left(\pi/6\right)$ and find a bound of the truncation error. **(8)**

b. Use the secant method to determine the root of the equation $\cos x - xe^{x} = 0$ (3 iterations) **(8)**

Q.4 a. Solve the system of equations by LU decomposition. **(8)**

$$2x + 3y + z = 9$$
$$x + 2y + 3z = 6$$
$$3x + y + 2z = 8$$

b. Solve the following system of equations using Jacobi's method. (show upto 5 iterations) **(8)**

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

Q.5 a. Why C language is called mid level language. Justify with an example. **(8)**

b. Using sin (0.1) = 0.09983 and sin (0.2) = 0.19867, find an approximate value of sin (0.15) by lagrange interpolation. Obtain a bound on the truncation error. **(8)**

Q.6 a. For the following data, calculate the differences and obtain the forward difference polynomial. Interpolate at x = 0.25

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. Find the linear least square approximation to $f(x) = e^{x}; x \in [0,1]$. **(8)**

Q.7 a. Evaluate $\int_{0}^{3} (2x - x^2)\,dx$ taking six intervals using trapezoidal rule. **(8)**

b. Evaluate the integral $I = \int_{0}^{1} \frac{dx}{1+x}$ using Gauss-Legendre two point and three point formula. **(4+4 = 8)**

Q.8 a. use 7-point Simpson's rule with equally spaced points to solve the integral

$$\int_{1.25}^{3.5} f(x)\,dx \text{ ; where } f(x) = \begin{cases} (x+7)/3, & 1.25 \le x \le 2.0 \\ (10 - x^2)/2, & 2.0 \le x \le 3.5 \end{cases}$$ **(8)**

b. The following table of values is given:

x:	-1	1	2	3	4	5	7
f(x):	1	1	16	81	256	625	2401

Using the formula $f'(x_1) = \frac{f(x_2) - f(x_0)}{2h}$ and Richardson extrapolation, find $f'(3)$. **(8)**

Q.9 a. Given $\frac{dy}{dx} = 1 + y^2$, where $y(0) = 0$, find $y(0.4)$ using Runge kutta fourth order formula (Take h = 0.2). **(8)**

b. Using Gaussian Elimination with partial pivoting solve the system

$$x_1 + x_2 - 2x_3 = 3$$
$$4x_1 - 2x_2 + x_3 = 5$$
$$3x_1 - x_2 + 3x_3 = 8$$

(8)