ROLL NO. ___________________

Code: AE07 Subject: NUMERICAL ANALYSIS & COMPUTER PROGRAMMING

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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. Consider the following statements:
(i) A function with void return type can be used only as a stand-alone statement.
(ii) The initialization, test condition and increment parts may be missing in a for statement.
Which of the following statements are correct?

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

b. Given $x = 0.123 \times 10^3$ and $y = 0.456 \times 10^2$. The chopped floating point representation of $(x + y)$ in normalized form is

(A) 0.168×10^3 **(B)** 0.169×10^3
(C) 0.1686×10^3 **(D)** 1.686×10^2

c. Which one of the following is a programming language?

(A) C **(B)** COBOL
(C) FORTRAN **(D)** All of above

d. Consider the following statements:
(i) Secant method is not guaranteed to converge.
(ii) If secant method converges then the rate of convergence in secant method is less than that of bisection method.
Which of the above statements are correct?

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

e. If A is a strictly diagonally dominant matrix, then consider the following statements:
(i) The Jacobi iteration scheme converges for any initial starting vector.
(ii) The Gauss-Seidel iteration scheme converges for any initial starting vector.
Which of the above statements are correct?

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

f. In which year "C" language was developed?

(A) 1960 | **(B)** 1965
(C) 1968 | **(D)** 1972

g. When the same number of tabular points are used, all interpolating polynomials are

(A) different | **(B)** identical
(C) approximately correct | **(D)** truncated

h. In interpolation methods, if the order of derivative increases then the error of approximation

(A) increases | **(B)** decreases
(C) has no effect | **(D)** None of these

i. The approximate value of $\int_0^1 \frac{\sin x}{x} dx$ using two-point open-type rule is

(A) 0.9589 | **(B)** 0.9546
(C) 0.9590 | **(D)** 0.9545

j. Runge-Kutta methods use

(A) single slopes | **(B)** weighted average of slopes
(C) simple average of slopes | **(D)** None of these

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

Q.2 a. Write a program in C to find the inverse of a matrix

$$A = \begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix}$$

using Gauss-Jordan method and verify you result. **(8)**

b. Given the following equation $x - e^x = 0$, determine the initial approximations for finding the smallest positive root. Use these to find the root correct to three decimal places with secant method. **(8)**

Q.3 a. Prove that Newton-Raphson method has quadratic rate of convergence. **(8)**

b. Solve the following system of equations using Gauss-seidel method (show upto 5 iterations)

$$6x_1 - 2x_2 + x_3 = 11$$
$$x_1 + 2x_2 - 5x_3 = -1$$
$$-2x_1 + 7x_2 + 2x_3 = 5$$

(8)

Q.4 a. Describe the two ways of passing parameters to functions. When do you prefer to use each of them? **(8)**

b. Construct the divided difference table for the data:

x:	0.5	1.5	3.0	5.0	6.5	8.0
$f(x)$:	1.625	5.875	31.0	131.0	282.125	521.0

Hence, find the interpolating polynomial and an approximation to the value of f(7). **(8)**

Q.5 a. Obtain the least square polynomial approximation of degree 2 for $f(x) = x^{1/2}$ on [0, 1]. Hence, find P(0.7). **(8)**

b. By use of repeated Richardson extrapolation, find $f'(1)$ from the following values:

x:	0.6	0.8	0.9	1.0	1.1	1.2	1.4
$f(x)$:	0.707178	0.859892	0.925863	0.984007	1.033743	1.074575	1.127986

Apply the approximate formula

$$f'(x_o) = \frac{f(x_o + h) - f(x_o - h)}{2h}$$

with h = 0.4, 0.2, 0.1. **(8)**

Q.6 a. Evaluate the integral $I = \int_1^2 \frac{2x}{1+x^4} dx$, using Gauss-Legendre 3-points quadrature rule. **(8)**

b. Compute $I = \int_0^1 \frac{x}{x^3+10} dx$ using Simpson's rule taking eight intervals. **(8)**

Q.7 a. The following data for the function $f(x) = x^4$ is given

x:	0.4	0.6	0.8
$f(x)$:	0.0256	0.1296	0.4096

Find $f'(0.8)$ and $f''(0.8)$ using quadratic interpolation. Compare with the exact solution. Obtain the bound on the truncation errors. **(8)**

b. Given the initial value problem

$$\frac{du}{dt} = -2tu^2, u(0) = 1$$

with h = 0.2, use the fourth-order Runge-Kutta method to find u(0.2) and u(0.4). **(8)**

Q.8 a. Solve the system of equations

$$x_1 + x_2 - x_3 = 2$$
$$2x_1 + 3x_2 + 5x_3 = -3$$
$$3x_1 + 2x_2 - 3x_3 = 6$$

by the LU decomposition method. **(8)**

a. Write a simple program to illustrate the method of sending an entire structure as a parameter to a function. **(8)**

Q.9 a. Find the inverse of the matrix

$$A = \begin{pmatrix} 2 & 1 & 1 & -2 \\ 4 & 0 & 2 & 1 \\ 3 & 2 & 2 & 0 \\ 1 & 3 & 2 & -1 \end{pmatrix}$$

using partition method. Hence, solve the system of equations $Ax = b$, where $b = (-10,8,7,-5)^T$. **(8)**

b. Find the smaller root of the equation

$$x^2 - 400x + 1 = 0$$

using four digit arithmetic. **(8)**