

This question paper contains 5 printed pages.]

Your Roll No.

1405

A

B.Sc. (Hons.)/II
ELECTRONIC SCIENCE – Paper 2, 7 (XIV)
(Numerical Analysis)

Time : 3 Hours

Maximum Marks : 38

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt five questions in all, including
Question No. 1 which is compulsory.
Use of non-programmable scientific
calculator is allowed.*

1. Attempt any five of the following :

(a) Write FORTRAN expressions corresponding to each of the following :

(i) $\sqrt{5x^2 + 8y^2}$

(ii) $\sin(x - 2y) + e^x - |x^2 - y^2|$

(iii) $\log_e(a - b)^2$

(iv) $4x^2y - 8xy - 7yz^3$

[P.T.O.]

(b) Suppose the first four data on the data deck are as follows :

11.22.3.3.4.4

5.5.6.6.77

88.99.2.34

5.67.8.90.123.456

Find the value assigned to the variables if the following READ statements are executed :

(i) READ (*, *) J, K, A, B, C

READ (*, *) L, M, X

(ii) READ (*, *) J, K, A

READ (*, *) B, C, L, M

READ (*, *) X, Y

(c) (i) Suppose I = 222, J = 333, K = 444, L = 555 and M = 666 respectively. Determine the output if the following statement pair is executed.

WRITE (*, 60) I, J, K, L, M

60 FORMAT ('0', 18/19)

- (ii) Suppose $ID = 82637$, $M = 151$ and $A = 256.174$

Determine the output if following statement pair is executed.

```
WRITE (*, 11) ID, M, A
```

```
11 FORMAT ('1', 110, 16, F8.1)
```

- (d) Suppose a linear array A with N elements is in memory. Write a program segment which, interchanges A_1 and A_2 only if A_2 is larger than A_1 , interchanges A_1 and A_4 only if A_4 is larger than A_3 and so on. Assume N is even.
- (e) In each of the cases given below state for what values of x we get poor results in computation. Provide an alternate expression for each that can avoid the problem.

(i) $\cos(x) - 1$

(ii) $(x - (x^2 + a)^{1/2}) / (x + (x^2 - a)^{1/2})$

- (f) (i) Write an arithmetic IF statement equivalent to

```
GO TO (20, 30, 40), IM
```

- (ii) Write a set of logical IF statement equivalent to

```
GO TO (47, 33, 55, 77), K
```

(5 × 2)

[P.T.O.]

2. (a) Write an FORTAN program which prints all the 3 digit prime numbers using nested DO loop. (3)
- (b) Write a FUNCTION subprogram to evaluate a 2nd order determinant and use this it to evaluate third order determinant. (4)
3. (a) Derive the Newton Raphson formula for finding the roots of algebraic and transcendental equation and also find the root of the equation

$$f(x) = x^3 - 3x + 2$$

using Newton Raphson Method. (4)

- (b) Find the root of the equation

$$2x = \cos x + 3$$

Correct to three decimal places by the iteration method. (3)

4. (a) Show how, in Gauss-elimination method a system of linear equations can be reduced to an equivalent upper triangular system and subsequently can be solved by back substitution. (3)
- (b) Solve the following :

$$2x + y + 4z = 12$$

$$8x - 3y + 2z = 20$$

$$4x + 11y + z = 33$$

by Gauss Seidel iteration method. (4)

5. (a) Derive the Newton's Divided difference interpolation formula. (3)

- (b) Find the cubic polynomial which takes following values :

$$y(0) = 1, \quad y(1) = 0, \quad y(2) = 1 \quad \text{and} \quad y(3) = 10 \quad (4)$$

Hence, or otherwise, obtain $y(4)$.

6. (a) Derive the (i) Trapezoidal formula and (ii) Simpson's formula for numerical integration. (4)

- (b) The velocity of a train which starts from rest is given by following table, the time being reckoned in minutes from the start and the speed in Km/hour.

t (minutes)	2	4	6	8	10	12	14	16	18	20
v (km/hour)	16	28.8	40	46.4	51.2	32.0	17.6	8	3.2	0

Estimate approximately the total distance run in twenty minutes. (3)

7. (a) Derive the 2nd order Runge Kutta method for solving a 1st order differential equation. (3)

- (b) Solve the following differential equation

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

for $x = 0.4$ by taking $h = 0.2$ by 4th order Runge Kutta Method. (4)