PG/IS/ELC-101/13

M.Sc. 1st Semester Examination, 2013

ELECTRONICS

(*Mathematical Methods and Numerical Analysis*)

[Theory]

PAPER —ELC-101

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** questions from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1.   Answer *all* questions :   2 × 5

(*a*) Check whether $f(z) = z^3$ and z^* are analytic functions of z from Cauchy-Riemann condition.

(b) State the Perseval's theorem for the Fourier Transform.

(c) Write a short note on 'Arrays' in C with suitable example.

(d) Write Bessel's equation of order n. What do you mean by Bessel's functions ?

(e) Explain the following C statement

$$X = Y \& \& W > = Z.$$

2. (a) Evaluate approximately, by Trapezoidal rule, the integral

$$\int_0^1 (4x - 3x^2) dx$$

by taking $n = 10$. 5

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

$$2x + 2y + z + 2t = 7$$
$$-x + 2y = -2$$
$$-3x + y + 2z + t = -3$$
$$-x + 2t = 0.$$

5

(Continued)

3. (a) State convolution theorem in Laplace transform and show its commutativity. $2 + 2$

(b) For $F(t) = t^a$, $a(t) = t^b$, $a > -1$, $b > -1$

(i) Show that the convolution ∞

$$F * a = t^{a+b+1} \int_0^1 y^a (1-y)^b \, dy$$

(ii) By using Convolution Theorem, show that

$$\int_0^1 y^a (1-y)^b \, dy = \frac{a! \, b!}{(a+b+1)!} \qquad 3 + 3$$

4. (a) Develop the Fourier transform for the concept of Dirac delta function. 6

(b) Show that Fourier transform of a Gaussion is a Gaussian. 4

5. (a) Using the residue theorem, evaluate

$$I = \int_0^{2\pi} \frac{d\theta}{5 + 4 \cos\theta} \qquad 5$$

(*b*) Evaluate

$$\int_0^6 \frac{dx}{1+x^2}$$

by using trapezoidal rule correct to four decimal places dividing the interval $(0, 6)$ into six parts each of width $h = 1$. 5

6. Write three programs in C languages that compute and print the value of a square of a factorial of any given number using (*i*) do-while loop (*ii*) while loop and (*iii*) factorial function to be called from the main block. Comment on your programs briefly through comparison at critical points. 3 + 3 + 3 + 1

[*Internal Assessment* : 10 Marks]