M.Sc 1st Semester Examination, 2010

ELECTRONICS

(Mathematical Methods and Numerical Analysis)

PAPER—ELC-101

(Theory)

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** 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 x 5

(*a*) State the sufficient conditions for existence of Laplace transform.

(*b*) Let $F(w)$ be the Fourier (exponential) transform of $f(x)$ and $G(w)$ be that of $g(x) = f(x + a)$. Show that

$$G(w) = e^{-iaw} F(w).$$

(*c*) Write down Cauchy-Riemann conditions for a function $f(z)$ to be analytic in a certain region of complex plane.

(*d*) Round off the following numbers correct upto four decimal places.

2·587682, 8·75945, 0·009998, 4·3856522

(*e*) Write all the logical and relational operators in C language.

2. (*a*) Find the Laplace transform of $J_0(t)$ by using initial value theorem.

(*b*) Prove Parseval's theorem for the Fourier transform. State its significance. 5 + (4 + 1)

3. (*a*) State Cauchy's integral theorem and apply the Cauchy-Riemann condition to prove it.

(*b*) Describe Gauss-Jordan iteration method to solve a system of linear equations. (1 + 5) + 4

4. (*a*) State and prove convolution theorem concerning on Fourier transform.

(*b*) Show that

$$\int_{-1}^{1} P_n(x)\,dx = \begin{cases} 0, & \text{when } n \neq 0 \\ 2, & \text{when } n = 0. \end{cases}$$

(*c*) Solve the following ODE by Laplace transform

$$y''(t) + a^2 y(t) = f(t),$$

subject to $y(0) = 1$, $y'(0) = -2$. 4 + 2 + 4

5. (*a*) Describe bisection method to solve the equation $f(x) = 0$, when a root lies between a and b. What is the draw back of this method ?

(*b*) Solve the differential equation

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

by fourth order Runge-Kutta method for $x = 0{\cdot}2$. (4 + 1) + 5

6. (*a*) Explain 'if-else' statement in C. Also draw the flowchart of this statement. When this statement becomes simple 'if' statement ?

(*b*) The function $f(x)$ is defined as follows :

$$f(x) = \begin{cases} x^2 + \sin x, & 0 \le x < 2 \\ e^{-x} + x^2, & 2 \le x \le 5 \end{cases}$$

Find the values of $f(x)$ for $x = 0{\cdot}0, 0{\cdot}5, 1{\cdot}0, 1{\cdot}5, 2{\cdot}0$. $(2 + 2 + 1) + 5$

[*Internal Assessment* : 10 Marks]