M.Sc. 1st Semester Examination, 2015

ELECTRONICS

(Mathematical Methods and Numerical Analysis)

[Theory]

PAPER – ELC-101

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.   (*a*) Consider $F(t) = \frac{1}{2}t^2$. Obtain its Laplace transform by applying the property of the transform of derivatives.   2

(**2**)

(*b*) Check whether $f(z) = z^2$ and z^* are analytic functions of z from the concept of Cauchy-Riemann condition.   2

(*c*) If $F(w)$ and $G(w)$ are Fourier transform of $f(x)$ and $g(X)$ respectively, where $g(X) = f(x + a)$, show that

$$G(w) = e^{-iaw} F(w)$$ 2

(*d*) Which of the following numbers has the greatest precision :   2

(*i*) 3·3201
(*ii*) 3·32
(*iii*) 3·320106

(*e*) What is the syntax of conditional operator statements ? What is its function ?   2

2. (*a*) Prove Parseval's theorem for the Fourier transform of a function. State its significance.   4 + 2

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

3. (a) State and prove the convolution theorem in Laplace transformation. $1 + 6$

   (b) Solve for $X(t)$ which satisfies the equation using convolution theorem,

$$X(t) = t^2 + \int_0^t \sin(t - u) \, X(u) \, du \qquad 3$$

4. (a) State Cauchy's integral theorem in complex variable analysis and apply the Cauchy-Riemann condition to prove it. $1 + 5$

   (b) Develop the second derivative of a function $F(x)$, numerically in terms of $F(x_i)$, $F(x_{i+1})$ and $F(x_{i-1})$ with comments where $(i-1)$, i and $(i+1)$ are points on the X-axis. 4

5. (a) Explain the Regula-Falsi method to determine, approximately, a single root of an equation $f(x) = 0$. 5

   (b) What are absolute error, relative error and percentage error ? 2

   (c) Write B essel's equation of order n. What do you mean by Bessel's functions ? 3

(**4**)

6. (a) Write down the geometrical interpretation of Trapezoidal rule for numerical integration. 3

   (b) Write a short note on 'Array's in C with suitable example. 2

   (c) Write a program in C to evaluate ten values of cos*x* with the help of sine series, taking accuracy of 0·000001. 5

[*Internal Assessment* : 10 Marks]