

2014

M.Sc.

1st Semester Examination

ELECTRONICS

PAPER—ELC-101

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

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

Illustrate the answers wherever necessary.

(Mathematical Methods and Numerical Analysis)

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

1. Answer all questions : 2×5

(a) Find out the Fourier and Laplace transforms of $\delta(x - a)$.

(b) Does Laplace transform exists for all functions like e^{at^2} and $\frac{1}{t-c}$? Explain w.r.t. these two junctions.

(Turn Over)

- (c) Plot the nature of Bessel junctions $J_0(x)$ and $J_1(x)$ with x showing zeroes.
- (d) What is the difference between while and do-while loop ?
- (e) What is the difference between $m++$ and $++m$?
2. (a) Write the relationship of Fourier and Laplace transforms. What is convolution theorem for Fourier transforms ?

(b) Find the Fourier transform of $f(x) = \begin{cases} 1; & |x| > a \\ 0; & |x| < a \end{cases}$ and

graph $f(x)$ and its Fourier transform for $a = 3$.

$$(2\frac{1}{2} + 2\frac{1}{2}) + (3+2)$$

3. (a) Obtain the solution of the second order ordinary differential equation for damped oscillator given as :
- $$mX''(t) + bX'(t) + kX(t) = 0$$

by the method of Laplace transform with the initial conditions $X(0) = X_0$ and $X'(0) = 0$ and symbols having usual meanings. 6

- (b) Show that Laplace transform of an integral is :

$$L\left[\int_0^t F(t)dt\right] = \frac{f(s)}{s}. \quad 4$$

4. (a) Prove that a necessary condition for $w = f(z) = u(x, y) + iv(x, y)$ to be analytic in a region is that the Cauchy-Riemann equations

$$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}, \quad \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x} \text{ be satisfied in the region.} \quad 5$$

(b) Evaluate : $\int_0^{2\pi} \frac{d\theta}{5 + 3 \sin \theta}$. 5

5. (a) Find $f(x)$ as a polynomial in x by using the following table : 5

x	-1	0	1	2	3	4
f(x)	-16	-7	-4	-1	8	23

- (b) Given the data points :

i	0	1	2
x_i	4	9	16
f_i	2	3	4

Estimate the function value f at $x = 8$. 5

6. (a) Using `scanf` and `printf` statements with proper conversion specifiers, write a simple C program to compute the volume and surface area of a sphere of a given radius.

(b) Explain the Runge-Kutta method to numerically solve ordinary differential equations briefly with a suitable example.

(c) Prove the recurrence relation :

$$2J_n'(x) = J_{n-1}(x) - J_{n+1}(x)$$

where $J_n(x)$ is Bessel function of order n . 3+4+3

Internal Assessment — 10 Marks
