2018

M.Sc. 1st Seme. 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

Group–A

1. Answer any *four* questions : 4×2

(a) Write down the change of scale property of Laplace transform.

(b) Show that $\begin{pmatrix} i & 0 \\ 0 & 1 \end{pmatrix}$ is a unitary matrix.

(c) State Liouville's theorem.

(d) State convolution theorem in Laplace transform.

(e) Round of the following numbers correct up to 4-decimal places :
(i) 40.35856 (ii) 2.789654 (iii) 0.560012 (iv) 0.003156

$\frac{1}{2} \times 4$

(f) What do you mean by relative error and percentage error ?

1+1

(g) If $\Delta x = 0.005$ and $\Delta y = 0.001$ be the absolute errors in $x = 2.11$ and $y = 4.15$, find the relative error in computation of $x + y$.

(h) If $y = 4x^6 - 5x$, find the percentage error in y at $x = 1$, if the error in $x = 0.04$.

Group–B

2. Answer any *four* questions : 4×4

(a) Find the analytic function

$$w(z) = u(x, y) + iv(x, y)$$

if $u(x, y) = x^3 - 3xy^2$ and

$v(x, y) = e^{-y} \sin x$.

(b) Using the convolution Integral, calculate

$$L^{-1}\left\{\frac{s}{(s^2 + a^2)(s^2 + b^2)}\right\}, \quad a \neq b.$$

(c) Prove that the recurrence relation

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

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

(d) If $F(t) = t^a$ and $G(t) = t^b$, $a > -1$, $b > -1$ show that the convolution $F * G$ is given by

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

(e) Describe the graphical interpretation of Bisection method.

(f) Find a position root of $x + \ln x - 2 = 0$, by Newton-Raphson method, correct to six significant figures.

(g) Evaluation $\int_0^{\pi/2} \sqrt{\sin x}\, dx$, taking n = 6, correct up to four significant figures by Simpson's one-third rule.

(h) Compute the root of the equation $2x - \log_{10} x - 7 = 0$, by Regula-Falsi method, which is in between 3 and 4, correct to three decimal places.

Group-C

3. Answer any *two* questions : 2×8

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

(ii) Expand $\frac{1}{(1-Z)}$ in a Taylor's series about $Z_0 = i$.

(2+4)+2

(b) (i) State and prove the convolution theorem for Fourier transform.

(ii) Find the Fourier sine transform of $\frac{e^{-ax}}{x}$. (2+3)+3

(c) Compute y(0.6), by Range-Kutta method correct to five decimal places, from the equation

$$\frac{dy}{dx} = xy \text{ , } y(0) = 2, \text{ taking } h = 0.2.$$

(d) Solve the system of equations, by Gauss elimination method

$$\begin{aligned} 3x_1 + 9x_2 - 2x_3 &= 11 \\ 4x_1 + 2x_2 + 13x_3 &= 24 \\ 4x_1 - 2x_2 + x_3 &= -8 \end{aligned}$$

[Internal Assessment — 10 Marks]

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