2017

ELECTRONICS

(*Mathematics Foundation for Electronics*)

[Honours]

(CBCS)

[First Semester]

PAPER – C2T

Full Marks : 40

Time : 2 hours

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 any *five* questions : 2×5

(*a*) Does Laplace transform exist for all function ? Explain with example.

(*Turn Over*)

(*b*) Write down cauchy-Riemann conditions for a function $f(z)$ to be analytic in a certain region of copmplex plane.

(*c*) Find the residue of

$$\frac{\ln z}{z^2+4} \; at \; z = 2e^{\pi i}$$

(*d*) State the 'transforms of integral's property of laplace transform.

(*e*) Define orthogonal matrix

(*f*) Find the general solution of

$$y'' + 2y' + 2y = 0.$$

(*g*) Show tha matrix multiplications is associative $(AB)c = A(BC)$

(*h*) Find

$$L\left\{\frac{\sin at}{t}\right\}.$$

2. Answer any *four* questions : 5 × 4

(*a*) What type of singularity has the following function ?

$$\frac{e^{2z}}{(z-1)^4}$$

(*b*) Show that

$$L^{-1}\left\{\left(s^2+a^2\right)^{-2}\right\}=\frac{1}{2a^3}\sin at-\frac{t^2}{2a^2}\cos at.$$

(*c*) Show that the matrices

$$A=\begin{pmatrix}0 & 1 & 0\\ 0 & 0 & 0\\ 0 & 0 & 0\end{pmatrix},\ B=\begin{pmatrix}0 & 0 & 0\\ 0 & 0 & 1\\ 0 & 0 & 0\end{pmatrix},$$

$$C=\begin{pmatrix}0 & 0 & 1\\ 0 & 0 & 0\\ 0 & 0 & 0\end{pmatrix}$$

Satisfy the commutation relations $[A, B]=C$, $[A, C]=0$ and $[B, C]=0$.

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

(*e*) Find the eigenvalues and corresponding normalized eigenvector of the matrix

$$A = \begin{pmatrix} 5 & 0 & 2 \\ 0 & 1 & 0 \\ 2 & 0 & 2 \end{pmatrix}$$

(*f*) Solve the equation :

$$(xy^2 - y)dx + xdy = 0$$

3. Answer any *one* questions : 10 × 1

(*a*) (*i*) Find the analytic function

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

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

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

(*ii*) Using the residue theorem, evaluate,

$$I = \int_0^{2\pi} \frac{\cos 3\theta}{5 - 4\cos\theta}\, d\theta \qquad 4+6$$

(*b*) (*i*) Find the Laplace tranform of the square wave (period a) defined by

$$f(t) = \begin{cases} 1 & , 0 < t < a/2 \\ 0 & , a/2 < t < a \end{cases}$$

(*ii*) Using partial fraction expansion, show that for $a^2 \neq b^2$

$$L^{-1}\left\{\frac{1}{(s^2 + a^2)(s^2 + b^2)}\right\} = \frac{1}{a^2 - b^2}\left\{\frac{\sin at}{a} - \frac{\sin bt}{b}\right\}.$$

6 + 4
