2018

CBCS

1st Semester

ELECTRONICS

PAPER—C2T

(Honours)

Full Marks : 40

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.

Mathematics Foundation for Electronics

Group—A

1. Answer any *five* questions : 5×2

(i) State Cauchy's Integral theorem.

(ii) Find the inverse Laplace transform of $\frac{s^2 - 3s + 4}{s^3}$.

(iii) Find the eigen values of $\begin{pmatrix} 4 & -2 \\ 1 & 1 \end{pmatrix}$.

(iv) Check whether $f(z) = z^*$ is analytic function of z from Cauchy-Riemann conditions.

(v) Solve the equation $y' + x = \frac{y}{x}$.

(vi) Show that matrix multiplication is associative, $(AB)C = A(BC)$.

(vii) Is $A = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ is self-adjoint matrix?

(viii) Find the pole and its order for $f(z) = \frac{\sin z}{z^4}$

Group—B

2. Answer any *four* questions : 4×5

(i) Find the Laplace transform of the square wave (period a) defined by

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

(ii) Develop the Taylor expansion of $\ln(1+z)$.

(iii) Using partial fraction expansions, show that for $a^2 \neq b^2$.

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

(iv) Show that $(A+B)(A-B) = A^2 - B^2$ if and only if A and B commute, $[A,B]=0$.

(v) Show that the product of two orthogonal matrices is orthogonal.

(vi) Show that $\int_0^\infty e^{-x^4} dx = \Gamma\left(\frac{5}{4}\right)$.

Group—C

3. Answer any *one* questions : 1×10

(i) (a) Find the values of K such that the following system of linear equations have unique, many and so solution. 5

$$kx + y + z = 1$$
$$x + ky + z = 1$$
$$x + y + kz = 1$$

(b) Verify Cayley-Hamilton theorem on

$$\begin{bmatrix} 0 & 0 & c \\ 1 & 0 & b \\ 0 & 1 & a \end{bmatrix}$$

a,b,c are scalars. 5

(ii) (a) Solve the differential equation using power series 6

$$y'' + y' + x^2 y = 0$$
$$y(0) = 1$$
$$y'(0) = 2$$

(b) Let C devote the positively oriented boundary of the square whose sides lie along the lines $x = \pm 2$ and $y = \pm 2$. 4

Find $\int_c \frac{\tan\left(z/2\right)}{\left(z - x_0\right)^2} dz$ $\quad (-2 < x_0 < 2)$