4. Answer any *one* of the following questions : 6×1=6

(a) Evaluate the given integral using Residue Theorem :

$$I = \oint_c \frac{4-3z}{z(z-1)(z-2)}\,dz$$

, where C is a circle with radius $|z| = \frac{3}{2}$.

(b) Show by contour integration method that :

$$\int_0^\infty \frac{\cos mx}{x^2+1}\,dx = \frac{\pi}{2}e^{-m}.$$

(c) Calculate the value of the integral in complex region :

$$I = \int_{1-i}^{2+i} (2x + iy + 1)\,dz$$

, along the straight line joining the points (1–i) and (2+i).

B.Sc. 1st Semester (Honours) Examination-2022-23

ELECTRONICS

Course ID : 11712 Course Code : SH/ELC/102/C-2T

Course Title : Mathematics Foundation of Electronics (New)

Time : 1 Hour 15 Minutes *Full Marks :* 25

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.

1. Answer any *three* of the following questions : 1×3=3

(a) What is the order and degree of the given differential equation?

$$y = x\left(\frac{dy}{dx}\right) + x \Big/ \left(\frac{dy}{dx}\right).$$

(b) Give one example of partial differential equation.

(c) What is 'singular point' and 'ordinary point' in case of a second-order, homogenous, ordinary or total differential equation with variable co-efficient?

(d) What is solenoidal vector?

(e) Write down C-R equation in polar form (co-ordinate).

(f) Write down the relation between gamma function and beta function.

2. Answer **any *three*** of the following questions : 2×3=6

(a) What is an analytic function?

(b) Prove that $\Gamma(n+1) = n\Gamma(n) = n\,!$

(c) When a vector is said to be irrotational? Give its physical interpretation.

(d) State Residue Theorem and explain it.

(e) Prove that $(\vec{A}\times\vec{B}).(\vec{A}\times\vec{B}) = (AB)^2 - (A\cdot B)^2$.

(f) If $f(z) = \dfrac{4+3z}{z(z-1)(z-2)^2}$, then find the location of the various poles.

3. Answer **any *two*** of the following questions : 5×2=10

(a) Find the diagonal form of the given matrix :

$$A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}.$$

(b) Construct the recurrence relation by solving given differential equation by Frobenious power series method :

$$(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0.$$

(c) Find the Eigen values and Eigen vectors of the matrix

$$\begin{pmatrix} 4 & 5 \\ 2 & 1 \end{pmatrix}.$$

(d) Find the value $\Gamma\left(\frac{1}{2}\right)$ and hence plot the graph of gamma function for $n = -\infty$ to $+\infty$ i.e., for the whole space.