B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

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

Course Title : Mathematics Foundation for Electronics

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

The figures in the 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 Cauchy's integral theorem?

(b) Give the definition of beta function $[\beta(m,n)]$.

(c) Give an example of row matrix.

(d) What is a simple pole? Give one example of it.

(e) When a differential equation is called a linear equation?

(f) Give one application of Laplace Theorem.

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

(a) Obtain the polar representation of any complex function $f(z)$, where $f(z) = z = x + iy$.

(b) What is removable singularity? Give one example of it.

(c) What is a partial differential equation? Give one example of it.

(d) Show that a square matrix A and its transpose have the same eigenvalues.

(e) Prove that $\frac{m+n}{m}\beta(m+1,n) = \beta(m,n)$.

(f) Show that $v(x,y) = 3x^2y - y^3$ is a harmonic function.

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

(a) Using the method of separation of variables find general solution of the equation

$$\frac{\partial^2 y}{\partial t^2} = c^2\frac{\partial^2 y}{\partial x^2}.$$

(b) Find the eigenvectors and the eigenvalues of the given matrix

$$A = \begin{pmatrix} 5 & -3 \\ -6 & 2 \end{pmatrix}.$$

(c) (i) Locate and name all the singularities of

$$f(z) = \frac{z^8 + z^4 + 2}{(z-1)^3(3z+2)^2},$$

in the finite z plane, where 'z' is complex.

(ii) Find the points where *C–R* equations are satisfied for the function

$$f(z) = w(x, y) = u(x, y) + iv(x, y) = xy^2 + ix^2y.$$ 2½+2½=5

(d) Considering the value of $\Gamma\left(\frac{1}{2}\right) = \frac{\sqrt{\pi}}{2}$, plot the graph of the gamma function for $n = -\infty$ to $+\infty$.

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

(a) Show that

$$\Gamma\left(n + \frac{1}{2}\right) = \frac{\Gamma(2n+1)\Gamma\left(\frac{1}{2}\right)}{2^{2n}\left(\Gamma(n+1)\right)}$$

(b) Constract the recurrence relation by solving the given differential equation using "*Frobenius*" power series method.

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

(c) State Cauchy's integral formulae and apply it to find the integral

$$I = \int_C \frac{z^2 - z + 1}{(z - 1\,)}dz,$$

where C is the circle for $|z| = 1$.