WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 1st Semester Examination, 2019

ELSACOR02T-ELECTRONICS (CC2)

Time Allotted: 2 Hours | Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

GROUP-A

1. Answer any ***five*** questions : 2×5 = 10

(a) Find the degree and order of differential equation

$$\sqrt{3\frac{d^3y}{dx^3}} + 6x^2\frac{dy}{dx} + \cos x = 0$$

(b) State polar and exponential form of complex number.

(c) What is analytic function?

(d) Prove that $\log(1+i) = \frac{1}{2}\log 2 + \frac{i\pi}{4}$.

(e) What are Hermitian and Skew-Hermitian matrices?

(f) Write down differential equation of a linear harmonic oscillator. Mention all the parameters.

(g) Prove that the series $\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \infty$ is convergent and converges to 1.

(h) Show that $(1+i)$ and $(1-i)$ are the eigen values of the matrix

$$\begin{pmatrix} 1 & i \\ i & 1 \end{pmatrix}$$

GROUP-B

Answer any *six* questions 5×6 = 30

2. Find $\frac{\delta z}{\delta s}$ and $\frac{\delta z}{\delta t}$, if $z(x, y) = xy$, $x = s - t$ and $y = \sin(s+t)$. 5

3. In an electric circuit, containing a resistance (R), an inductance (L) and a capacitance (C) in series, a source of alternating voltage $E_0\sin(\omega t)$ is applied. Calculate the current (i) at any instant. 5

4. Find power series solution of the equation 5

$$\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$$

5 If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, show that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$. 5

6. Diagonalize the following matrix: 5

$$A = \begin{bmatrix} 3 & i \\ -i & 3 \end{bmatrix}$$

7. Solve the following equations by Gauss-Elimination method 5

$$x + 4y - z = -5$$
$$x + y - 6z = -12$$
$$3x - y - z = 4$$

8. Find the eigen values and eigen vectors of the matrix 5

$$A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

9. (a) Give one each example of convergent, divergent and oscillating sequence. 1+1+1

(b) Show that the series $1^2 + 2^2 + 3^2 + \cdots + n^2$ is divergent. 2

10. Show that $e^x(\cos y + i\sin y)$ is analytic and find its derivative. 2+3

11. Solve $\frac{dy}{dx} = (4x + y + 1)^2$ if $y(0) = 1$. 5

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