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3 (Sem-1/CBCS) ELE HC 2

2021

(Held in 2022)

ELECTRONICS

(Honours)

Paper : ELE-HC-1026

(Mathematics Foundation for Electronics)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×7=7

(a) Write down the order and the degree of the differential equation

$$x^2 \left(\frac{d^2 y}{dx^2} \right)^3 + y \left(\frac{dy}{dx} \right)^4 + y^4 = 0.$$

Contd.

(d) Show that $\lim_{z \rightarrow 0} \frac{1}{z}$ does not exist.

3. Answer **any three** of the following questions : $5 \times 3 = 15$

(a) Solve the differential equation

$$y \sin 2x dx - (y^2 + \cos^2 x) dy = 0$$

(b) Solve the system of linear equation

$$x + y + z = 6$$

$$3x + 3y + 4z = 20$$

$$2x + y + 3z = 13$$

using the Gauss elimination method.

(c) Show that the series

$$\frac{1}{(\log 2)^p} + \frac{1}{(\log 3)^p} + \dots + \frac{1}{(\log n)^p} + \dots$$

diverges for $p > 0$.

(d) Find the residues of

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

at all its poles in the finite plane.

(e) Express $2 - 3x + 4x^2$ in terms of Legendre polynomial.

4. Answer **any three** of the following questions : $10 \times 3 = 30$

(a) Find the power series solution of the differential equation

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

in powers of x .

(b) Find the inverse of the matrix

$$A = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}$$

using LU decomposition method.

(c) Show that the sequence $\{r^n\}$ converges if and only if $-1 < r \leq 1$.

(d) Evaluate $\oint_C \frac{e^{3z}}{z - \pi i} dz$ if C is

(i) a circle $|z - 1| = 4$

(ii) the ellipse $|z - 2| + |z + 2| = 6$

5+5=10

(e) (i) Find the orthogonal trajectories of family of curves $y = ax^2$, a being a parameter. 5

(ii) Show that $x^3 = \frac{2}{5}P_3(x) + \frac{3}{5}P_2(x)$.

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(f) Evaluate $\frac{1}{2\pi i} \oint \frac{e^z}{z^2(z^2 + 2z + 2)} dz$ around the circle C with equation $|z| = 3$.
