Daffodil International University

Department of Electrical and Electronic Engineering

Faculty of Engineering

Midterm Examination, Summer – 2026

Course Code: 0541-213
Section: A, B, C, D, E
Full Marks: 25

Course Title: Numerical Methods
Level-Term: L3-T1
Exam Date: July 01, 2026

Teacher's Initial: AKB, SP
Time: 1.5 Hours

***[Answer any Five of the Six Questions given below.** The second rightmost column indicates the COs (course learning outcomes of the course) with respective Bloom's level, and the rightmost column indicates the assigned marks.]*

Q1. The current passing through an electric device is given by the equation: $I(t) = t$, where t is the time in seconds and I is the current in amperes. The voltage across the device is given by: $V(t) = t^2 - 9t + 26 + \frac{96}{t}$. Hence, the power dissipated in the device is: $P(t) = V(t)\, I(t)$. Using the "False Position Method", **determine** the value of time t at which the power dissipated is 120 W. Take the initial guesses as a = 2.5s and b = 3.75s. Stop the iterations when the absolute difference between two successive approximations of t is less than 0.01s. — CO-1 C(3) [5]

Q2. A cylindrical conductor is designed such that its resistance depends on its length. The volume of the conductor is fixed at 500 cubic centimeters, and the radius of its cross-section is equal to the square of its length. Using an iterative method, **determine** the length of the conductor. Start with an initial guess of $L_0 = 4$ cm and perform iterations using the "Newton-Raphson Formula". Stop when the error in the solution, measured by the value of the difference between the calculated and desired volume, is less than 0.5. — CO-1 C(3) [5]

Q3. The mesh equations of an electric circuit are given below: — CO-1 C(3) [5]

$$2I_1 + 8I_2 + 2I_3 = 0$$
$$4I_1 + 2I_2 = 4$$
$$2I_3 + 4I_4 = 0$$
$$2I_2 + 8I_3 + 2I_4 = 0$$

Using the initial approximation: $I_1^{(0)} = 0$, $I_2^{(0)} = 0$, $I_3^{(0)} = 0$, $I_4^{(0)} = 0$, **perform** three (3) iterations of the "Gauss–Seidal Method" to solve for the mesh currents I_1, I_2, I_3, I_4. During the calculations, retain values up to four decimal places at each step and round off accordingly.

Q4. For the circuit shown in Fig. 1, **write** the nodal equations for the node voltages v_1, v_2, and v_3. Then **solve** the resulting simultaneous linear equations using the "Gauss-Jordan Method". — CO-1 C(4) [5]

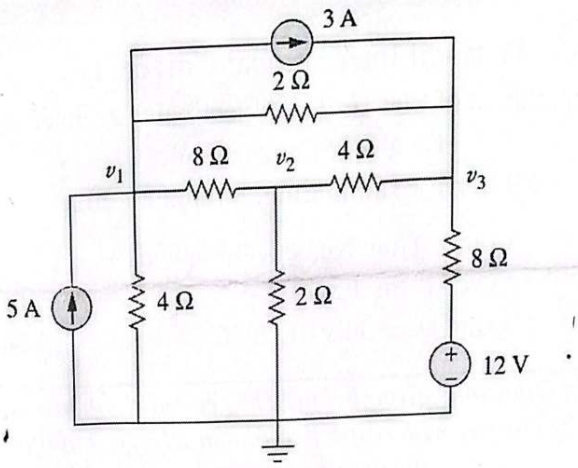

Fig. 1

Q5. The capacitance values (in μF) of capacitors, measured in a quality-control test, are given in Table 1. CO-1 C(3) [5]

Table 1: Distribution of Capacitance Values

Capacitance (μF)	35-45	45-55	55-65	65-75	75-85
Number of Capacitors	20	40	60	60	20

Estimate the number of capacitors whose capacitance lies between 42–55 μF.

Q6. An AI company provides an NLP-based text summarization service. The service uses GPU processing time to generate summaries from large text documents. The relationship between GPU processing time and the number of summaries generated is given in Table 2. CO-1 C(3) [5]

Table 2: GPU Processing Time vs. No. of Summaries Generated

GPU Processing Time (minutes)	40	60	90	120
No. of Summaries Generated	18	27	43	55

The cost of GPU processing is Tk.12 per minute, and the company charges Tk.30 for each generated summary. Using "Lagrange's Interpolation Formula", **estimate** the number of summaries generated when 100 minutes of GPU processing time is used. Hence, **determine** the profit or loss incurred by the company for using 100 minutes of GPU processing time.