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Nafat 251 EEE

T1

# Daffodil International University

Department of Electrical and Electronic Engineering

Faculty of Engineering

**Midterm Examination, Spring – 2026**

Course Code: 0541-223 | Course Title: Numerical Methods | Teacher's Initial: AKB, SP

Section: A, B, C, D | Level-Term: L2-T1 | Time: 1.5 Hours

Full Marks: 25 | Exam Date: February 24, 2026

***[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: $I(t) = e^{-t} - t$, where t is the time in seconds and I is the current in amperes. The voltage-current relationship of the device is: $V(t) = t\,I(t)$. 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 200 W. Take the initial guesses as a = 5s and b = 6s. 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]

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

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. **Solve** the following set of simultaneous linear equations by the "Gauss-Jordan method". CO-1 C(3) [5]

$$V_1 + V_2 - V_3 = 1$$
$$V_1 + 2V_2 - 2V_3 = 0$$
$$-2V_1 + V_2 + V_3 = 1$$

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Q5. In a quality-control test, the measured inductance values (in mH) of inductors are given in Table 1. CO-1 C(3) [5]

Table 1: Distribution of Inductance Values

| Inductance (mH) | 35-45 | 45-55 | 55-65 | 65-75 | 75-85 |
|---|---|---|---|---|---|
| Number of Inductors | 20 | 40 | 60 | 60 | 20 |

**Estimate** the number of inductors whose inductance lies between 75–80 mH.

Q6. A power distribution company generates electricity using natural gas as fuel. The relationship between the amount of fuel consumed and the electricity generated is given in Table 2. CO-1 C(3) [5]

Table 2: Fuel Consumption vs. Electricity Generation

| Fuel Consumed (CFT) | 50 | 60 | 90 | 110 |
|---|---|---|---|---|
| Electricity Generated (units) | 6 | 7 | 10 | 11 |

The cost of natural gas is Tk. 1.13 per CFT, and the selling price of electricity is Tk. 16 per unit. Using "Lagrange's Interpolation Formula", **estimate** the amount of electricity generated when 100 CFT of natural gas is used. Hence, **determine** the profit or loss incurred by the company for using 100 CFT of natural gas.