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Daffodil International University

Department of Electrical and Electronic Engineering

Faculty of Engineering

Final Examination, Spring – 2025

Course Code: 0542 221 | Course Title: Probability and Statistics

Section: A,B,C, D | Level-Term: L2-T2 | Teacher's Initial: MAR, JA

Full Marks: 40 | Exam Date: June 23, 2025 | Time: 2.00 Hours

*** ***Answer all of the following questions sequentially.***

[The figures in the right-hand margin indicate marks allocated for that question.]

[COs represent learning outcomes of the course.]

[All the symbols carry their usual meaning.]

Q1. An Electrical and Electronic Engineering (EEE) student records the temperature of a transformer winding (in °C) at different load currents (in Amperes): CO-2 C(4) 10

Load Current (A)	10	20	30	40	50
Temperature (°C)	45	55	65	75	85

i. **Analyze** the correlation by drawing the scatter plot.

ii. **Calculate** the estimated regression model.

iii. **Explain** the value β_0 and β_1.

iv. **Conclude** the transformer temperature when the load current is 60 A.

Q2.a. In an electronic experiment, the resistance (R) in a circuit is modeled with a mean 50 Ω and a variance 4 Ω. For reliable operation, the resistance must stay between 47 Ω and 53 Ω. Using the normal distribution, **Calculate**: CO-3 C(3) 5

i. The probability that resistance exceeds 53 Ω.

ii. The percentage of readings within the acceptable range $47\ \Omega \leq R \leq 53\ \Omega$.

iii. If 800 measurements are taken, how many are expected to be unreliable?

Using the standard normal table,
$P(Z < 1.5) = 0.9332$
$P(Z < -1.5) = 0.0668$

b. An EEE student is testing signal amplifiers used in communication systems. Each amplifier has a 10% chance of failure during the initial test phase. The student tests 12 amplifiers. **Apply** an appropriate distribution to find the probability that, CO-3 C(3) 5

i. All 12 amplifiers pass the test successfully?

ii. At least 10 amplifiers pass successfully?

iii. At most 2 amplifiers pass successfully?

iv. What is the expected number of amplifiers that pass?

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Q3. An Electrical and Electronic Engineering (EEE) researcher is investigating the power efficiency of two newly developed microcontroller units (MCUs) under identical operating conditions. The researcher records the current consumption (in mA) of both MCUs when running the same fixed task. CO-3 C(3) 10

The collected sample data is as follows:

- MCU Model X: {13.8, 14.1, 14.0, 13.9, 14.2, 14.0, 14.1, 14.3, 14.2}
- MCU Model Y:{13.4, 13.6, 13.7, 13.5, 13.6, 13.4, 13.5, 13.6, 13.5, 13.7, 13.6}

Apply two-sample t-test (Assuming equal variances) at $\alpha = 0.05$ to determine whether there is a statistically significant difference in the average current draw between Model X and Model Y.

Using t-table,
$t_{0.025, 18} = 2.12$

Q4. A survey was conducted among 120 Electrical Engineering students regarding their preferences for Solar Photovoltaic (PV) Systems and Solar Thermal Systems. The students are from three specialization groups: CO-3 C(3) 10

Group	Solar PV System	Solar Thermal System
Renewable Energy	30	15
Power System	20	25
Smart Grid	10	20

i. **Solve** the probability that a randomly selected student prefers Solar PV System?
ii. **Calculate** the probability that a student is from the Smart Grid group?
iii. **Identify** the probability that a student is from the Power System group and prefers Solar Thermal System?
iv. **Compute** the probability that a student is from the Renewable Energy group, given that they prefer Solar PV System?
v. **Identify** the probability that a student is either from the Renewable Energy group or prefers Solar Thermal System?
vi. **Identify** whether the preference for Solar PV System and Solar Thermal System are independent events.