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Daffodil International University
Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Summer – 2026

Course Code: 0542 221
Section: A,B,C,D,E,F,G
Full Marks: 40

Course Title: Probability and Statistics
Level-Term: L2-T1
Exam Date: Aug 24, 2026

Teacher's Initial: JA, TRS, IJM
Time: 2.00 Hours

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

[The second right most column indicates the course outcomes (COs) with respective Bloom's level and the right most column indicates the allocated marks.]

Q1.a) An EEE engineer is monitoring the reliability of a solar photovoltaic (PV) system. Two events are defined: CO-3 C(3) 5

- Event A: Panel overheating
- Event B: Inverter failure

The probability of panel overheating is 0.25. The probability of inverter failure is 0.30. The probability of panel overheating given that inverter failure occurs is 0.40.

i) **Calculate** the joint probability $P(A \cap B)$.
ii) **Determine** the probability that at least one of the events occurs.
iii) **Calculate** the probability of inverter failure given that panel overheating has occurred.

b) i) **Define** probability and explain the basic laws of probability. CO-1 C(2) 5
ii) **Compare** between mutually exclusive and non-mutually exclusive events with suitable examples.

Q2. An Electrical Engineering student investigates the relationship between the input voltage and the winding temperature of a transformer. The following measurements are recorded at different supply voltages: CO-2 C(4) 10

Voltage (V)	25	40	55	70	85	91
Temperature (°C)	34	47	59	73	86	95

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 winding temperature at 105 V.

Q3.a) An Electrical and Electronic Engineering student is analyzing the defect rate of circuit boards in a manufacturing process. Every hour, 25 circuit boards are inspected, and the probability that a board is defective is 15%. **Apply** an appropriate probability distribution, find the probability that: CO-3 C(3) 5

i) At most 2 effective boards are found in an hour.
ii) More than 2 effective boards are found in an hour.
iii) The expected number of circuit boards that fail in a day.

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b) An Electrical Engineering student is testing the output voltage of a solar inverter. The voltage output follows a normal distribution with a mean of 230 V and a variance of 16 V^2. For reliable operation, the voltage should remain between 224 V and 236 V. Using the appropriate probability distribution, **Calculate**: CO-3 C(3) 5

i) The probability that the voltage exceeds 236 V.
ii) The percentage of voltage readings that fall within the range 224 V to 236 V.
iii) If 2,000 voltage measurements are recorded, estimate the number of measurements that are outside the safe operating range.

Using the standard normal table,
$P(Z<1.50) = 0.9332$
$P(Z<-1.50) = 0.0668$

Q4. An Electrical and Electronic Engineering (EEE) researcher is comparing the threshold voltage of two different semiconductor transistor types under identical operating conditions. The threshold voltage (in volts) is recorded for both types during a fixed testing period. The collected sample data are: CO-3 C(3) 10

Semiconductor Type A (MOSFET): {2.4, 2.6, 2.5, 2.7, 2.3, 2.5, 2.8, 2.6}
Semiconductor Type B (IGBT): {2.1, 2.3, 2.2, 2.0, 2.4, 2.1, 2.3, 2.2, 2.5, 2.0}
State the null and alternative hypotheses. **Apply** a two-sample t-test assuming unequal variances at the 5% level of significance.
Determine whether there is a statistically significant difference in the average threshold voltage between Semiconductor Type A and Semiconductor Type B.

Using t-table,
$t_{\text{tabulated value}} = 2.13$