INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: DIPLOMA IN ELECTRICAL AND CONTROL ENGINEERING

YEAR/SEM: YEAR 1/SEMESTER 2

COURSE CODE: DEE1201

NAME: ELECTRICAL POWER I

DATE: 2025-04-23

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Answer any 2 Questions

Question 1:

a. Why is electricity transmitted at high voltages? (5 Marks)
b. Define extra-high voltage (EHV) and ultra-high voltage (UHV) transmission. (5 Marks)
c. Discuss the advantages and challenges of using high transmission voltages. (10 Marks)

Question 2:

a. Calculate the power loss in a transmission line if 100 MW of power is transmitted over a distance of 200 km at 11 kV. Assume the line resistance is 0.5 ohms per km. (10 Marks)
b. A transmission line operates at 220 kV with a current of 500 A. Calculate the total power transmitted and the power loss if the line resistance is 1 ohm per km over 100 km. (10 Marks)

Question 3:

a. What is a step-up substation, and where is it typically located? (5 Marks)
b. List the key equipment found in a substation and describe their functions. (5Marks)
c. Explain the difference between a step-down substation and a switching substation. (10 Marks)

Question 4:

a. A geothermal power plant generates 100 MW of power with an efficiency of 15%. Calculate the amount of heat energy extracted from the Earthâ??s crust. (10 Marks)
b. A solar farm with a total panel area of 1,000 mÂ² operates at an efficiency of 20%. If the solar irradiance is 1,000 W/mÂ², calculate the total electrical output of the farm. (10 Marks)

Section B Answer any 3 questions

Question 1:

a. If a factory layout positions a 33 kV transformer 500 meters from the main machinery, calculate the voltage drop in the connecting cable with a resistance of 0.02â??Î©/meter. (10 Marks)
b. A residential area has a total load of 50 kW, supplied through a 220 V system. Calculate the current and recommend an energy meter type suitable for this load. (10 Marks)

Question 2:

a. Design a basic layout of a substation to handle a load of 50 MW at 33 kV. Include necessary equipment and explain their placement. (10 Marks)
b. A utility company is planning to switch from overhead lines to underground cables for a 10 km section. If the cost of overhead lines is $10,000/km and underground cables cost $50,000/km, calculate the total cost difference and discuss whether this switch is justified. (10 Marks)

Question 3:

a. A wind turbine has a rotor diameter of 50 m and operates at 35% efficiency. If the wind speed is 10 m/s, calculate the power generated by the turbine. (10 Marks)
b. Compare the annual fuel costs of a diesel power plant (fuel cost: $0.5 per liter, efficiency 40%) and a gas turbine plant (fuel cost: $0.3 per mÂ³, efficiency: 50%) for generating 1 GWh of electricity. (10 Marks)

Question 4:

a. A factory requires a power supply of 100 kW at 415 V. Calculate the current drawn by the factory and suggests an appropriate conductor size for the supply point. (10 Marks)
b. Design a simple factory layout with labelled components such as transformers, bus bars, and distribution panels. Justify the placement of each component. (10 Marks)