

**SIR ARTHUR LEWIS COMMUNITY COLLEGE**  
**ENGINEERING AND THE CIRCULAR ECONOMY**  
**ACADEMIC YEAR (2024/2025) - SEMESTER ONE**  
**END OF SEMESTER EXAMINATION**

TUTOR (S) : Mr. Kendall Numa  
PROGRAMME : Electrical Installation  
COURSE TITLE : Principles & Technology III  
COURSE CODE : ELE127  
LEVEL : Associate Degree/ Year Twos  
PAPER : One  
DATE : Thursday, 12<sup>th</sup> December 2024  
COMMENCEMENT TIME : 9:00 a.m.  
DURATION : Two (2) Hours  
INVIGILATOR(S) : L. Ollivierre, E. Ernest, A. Mason, C. Combie  
ROOM(S) : VAR-OR-03  
STUDENT ID :

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**GENERAL INFORMATION AND INSTRUCTIONS**

- This paper consist of Three (3) Sections (A, B and C).
- **Section A** consist of twenty-five (25) multiple choice questions. You are required to answer ALL questions. This section **MUST** be attempted on the question paper.
- **Section B** consist of three (3) questions. You are required to **answer ALL questions** on the foolscap provided.
- **Section C** consist of three (3) questions. You are required to **answer any ONE of the questions** on the foolscap provided.
- Students must sign **IN** and **OUT** on the examination class list.
- Students must **not** write their names on their answer sheets, only their ID number
- Please number your responses accurately.
- **Note: Bags, Books as well as writing paper not given by the invigilator should be deposited at the front of the examination room or as otherwise indicated.**
- **All cell phones must be turned off during the exam**

**DO NOT TURN THIS COVER SHEET UNTIL  
YOU ARE TOLD TO DO SO!!!**

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**SECTION A – Multiple Choice Questions**

(One mark is awarded for each question.)

1. Which component in the power grid steps down high transmission voltage to a safer, usable level for consumers?
  - A) Generator
  - B) Transformer
  - C) Circuit breaker
  - D) Transmission line
  
2. What is the typical voltage level of high-voltage transmission lines in St. Lucia's national power grids?
  - A) 220 kV
  - B) 66 kV
  - C) 500 kV
  - D) 11 kV
  
3. The primary purpose of a power grid interconnection is to:
  - A) Increase the generation cost
  - B) Improve grid stability and reliability
  - C) Isolate regions from each other
  - D) Limit power supply to specific areas
  
4. What is the main advantage of alternating current (AC) over direct current (DC) in power transmission?
  - A) Easier to convert to other energy forms
  - B) Higher efficiency at short distances
  - C) Easier to step up and down voltage levels
  - D) Higher reliability in power stations
  
5. Which type of substation connects the generation and transmission systems?
  - A) Distribution substation
  - B) Switching substation
  - C) Step-up substation
  - D) Step-down substation
  
6. Where is the power plant located in St. Lucia?
  - A) Union, Castries
  - B) Vieux Fort
  - C) Cul de Sac
  - D) Soufriere
  
7. Name the cable or conductor which connects the distributor to the consumer terminals.
  - A) Service Mains
  - B) Distributor
  - C) Feeders
  - D) None of them
  
8. The function of steel wire in a transmission conductor is
  - A) to take care of surges
  - B) to prevent corona
  - C) to reduce inductance and hence improve power factor
  - D) to provide additional mechanical strength.

9. Which instrument measures electrical resistance?
  - A) Ammeter
  - B) Voltmeter
  - C) Ohmmeter
  - D) Wattmeter
  
10. Which type of meter is commonly used to measure alternating current (AC) power?
  - A) Wattmeter
  - B) Ohmmeter
  - C) Voltmeter
  - D) Frequency meter
  
11. The multiplier and the meter coil in a voltmeter are in
  - A) Series
  - B) Parallel
  - C) Series-parallel
  - D) None of the above
  
12. Which instrument is best suited for measuring the power factor in an AC circuit?
  - A) Power factor meter
  - B) Oscilloscope
  - C) Voltmeter
  - D) Ammeter
  
13. What is the primary use of a megger?
  - A) To measure current
  - B) To measure insulation resistance
  - C) To measure voltage
  - D) To measure power
  
14. An oscilloscope displays measurements in the form of:
  - A) Frequency spectrum
  - B) Waveforms
  - C) Digital readouts
  - D) Single-line indicators
  
15. What unit does a digital multimeter measure current in?
  - A) Ohms
  - B) Hertz
  - C) Volts
  - D) Amps
  
16. The function of shunt in an ammeter is to
  - A) By pass the current
  - B) Increase the sensitivity of the ammeter
  - C) Increase the resistance of ammeter
  - D) None of the above
  
17. Which of the following losses varies with the load in the transformer?
  - A) Core loss
  - B) Copper loss
  - C) Both core & copper loss
  - D) None of the above

18. What is the main function of a transformer?
  - A) Convert AC to DC
  - B) Change the voltage level in an AC circuit
  - C) Increase the current flow in a circuit
  - D) Regulate power factor
  
19. Which part of a transformer reduces magnetic flux leakage?
  - A) Core
  - B) Windings
  - C) Bushings
  - D) Tank
  
20. In a step-down transformer, the number of turns in the primary winding is:
  - A) Less than the secondary winding
  - B) Greater than the secondary winding
  - C) Equal to the secondary winding
  - D) Double the secondary winding
  
21. Why are transformers highly efficient in power transmission?
  - A) They operate on DC
  - B) They have low magnetic losses
  - C) They don't require moving parts
  - D) They provide reactive power compensation
  
22. Moving coil instruments typically use which type of damping?
  - A) Fluid damping
  - B) Air damping
  - C) Electromagnetic damping
  - D) None of the above
  
23. Which type of transformer is used to connect transmission systems with different voltage levels?
  - A) Isolation transformer
  - B) Step-up transformer
  - C) Auto transformer
  - D) Distribution transformer
  
24. A transformer has  $N_P = 3000$  and  $N_S = 500$ . If the primary current is 0.6 A, then the current in the secondary will be
  - A) 0.1 A
  - B) 0.6 A
  - C) 3.6 A
  - D) 9.0 A
  
25. Which type of cooling method is used in power transformers?
  - A) Natural air cooling
  - B) Oil-immersed cooling
  - C) Water cooling
  - D) Forced air cooling

**[25 marks]**

### SECTION B

Answer **ALL** questions on the foolscap provided.

1. A single phase motor takes 40 A at a power factor of 0.7 lagging from a 230 V, 60 Hz supply. Determine
  - a) The current taken by a capacitor connected in parallel with the motor to correct the power factor to unity, and
  - b) The value of the supply current after power factor correction. **[6 marks]**
  
2. The power taken by a C – R series circuit, when connected to a 200 V, 6 kHz supply, is 1.5 kW and the current is 25 A. Calculate
  - a) the resistance,
  - b) the impedance,
  - c) the reactance,
  - d) the capacitance,
  - e) the power factor,
  - f) the phase angle between the voltage and the current.
  - g) the apparent power and
  - h) the reactive power

**[16 marks]**

3. A 250 kVA rated transformer has a full load copper loss of 1.8 kW and an iron loss of 1.2 kW. Determine the transformer efficiency at half full load and 0.9 power factor.

**[8 marks]**

### SECTION C

Answer any **ONE** of the questions on the foolscap provided.

1. A 415 V a.c. voltage is applied across a 2.5 k $\Omega$  resistor. Calculate:
  - a) the current (I),
  - b) the maximum voltage ( $V_M$ ),
  - c) the peak to peak voltage ( $V_{P-P}$ ),
  - d) the average voltage ( $V_{AV}$ ),
  - e) the maximum current ( $I_M$ ),
  - f) the peak to peak current ( $I_{P-P}$ ),
  - g) the average current ( $I_{AV}$ )
  - h) the power (P).

**[16 marks]**

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2. A coil of resistance  $60\ \Omega$  and inductance  $150\ \text{mH}$  is connected in series with a  $22\ \mu\text{F}$  capacitor. The circuit is connected to a  $30\ \text{V}$ ,  $100\ \text{Hz}$  supply. Calculate:
- a) the capacitive reactance
  - b) the inductive reactance
  - c) the impedance
  - d) the total current
  - e) the voltage across the coil
  - f) the voltage across the capacitor
  - g) the phase angle
- [16 marks]**
3. A  $50\ \Omega$  resistor is connected in parallel with an inductance of  $2.5\ \text{mH}$  across a  $230\ \text{V}$ ,  $1\ \text{kHz}$  supply. Calculate:
- a) The current in each branch
  - b) The supply current
  - c) The circuit phase angle
  - d) The circuit impedance
  - e) e. Draw the phasor diagram
- [16 marks]**

**END OF EXAMINATION!!!**