



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY EXAMINATION FOR THE DEGREE IN SCIENCE IN RENEWABLE
ENERGY TECHNOLOGY AND MANAGEMENT**

4TH YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TEB 1401

COURSE TITLE: ELECTRIC POWER SYSTEMS

EXAM VENUE:

STREAM: BSc. REN ENGY TEC & MGT

DATE: 6 /1/2025

EXAM SESSION:9-11.00 AM

DURATION: 2 HOURS

Instructions

- 1. Answer question 1 (Compulsory) and ANY other two questions**
- 2. Candidates are advised not to write on question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE

- a) State **THREE** advantages of three phase over single phase (3 Marks)
- b) Sketch the following (3 Marks)
- i. *Star*
 - ii. *Delta*
 - iii. *Mesh*
- c) Given the following $P_A = V_\phi I_\phi \cos \phi$, $V_\phi = V_L/\sqrt{3}$, $I_\phi = I_L$ and $\phi = \angle Z_A$
Determine the total power delivered to the star load (4 Marks)
- d) State the **THREE** bus types (3 Marks)
- e) Distinguish between Earth and Neutral (3 Marks)
- f) State the Importance of Earthling (2 Marks)
- g) Explain the term power stability (2 Marks)

QUESTION TWO

- a) i. Define the term fault in an electronic power system (2 Marks)
- ii. Explain the effect of fault in power systems (3 Marks)
- iii. Identify equipment used to protect power system networks (2 Marks)
- iv. Explain **TWO** types of faults (2 Marks)
- b) Illustrate the following faults with the aid of a circuit diagram (6 Marks)
- i. *Symmetrical*
 - ii. *Unsymmetrical*
- c) The currents in **R**, **Y**, and **B** in three-phase lines under abnormal conditions are $I_R = 100 \angle 30^\circ$, $I_Y = 50 \angle 300^\circ$ and $I_B = 30 \angle 180^\circ$ A, Determine the zero current (5 Marks)

QUESTION THREE

- a) i. Explain the purpose of the lightning arrester (2 Marks)
- ii. State **TWO** factors to be considered while selecting a protective device. (2 Marks)
- iii. Discuss the following faults in generators (6 Marks)
- a. Stator Earth
 - b. Rotor ground
- b) Describe Transformer failures such as (4 Marks)
- i. *Winding*
 - ii. *Bushing*
 - iii. *Tank*
 - iv. *Cooling*
- c) i. Highlight the current transformer operation principle (3 Marks)
- ii State **THREE** types of current transformers (3 Marks)

QUESTION FOUR

- a) With the aid of a diagram distinguish AC and DC (1 Mark)
- b) Compare AC and DC in terms of (5 Marks)
- I. Load type
 - II. Polarity
 - III. Frequency
 - IV. Power Factor
 - V. Passive parameters
- c) State **TWO** advantages and disadvantages of AC system (4 Marks)
- d) Distinguish between **Single** and **Poly** phase circuits (2 Marks)
- e) Define the following Phasor diagram terms (2 Marks)
- I. Magnitude
 - II. Angle
- f) Calculate the power of a single phase circuit having a voltage of 240V, a current of $50 \times 10^{-2} \text{A}$ and power factor of 0.6 (3 Marks)
- g) Determine the power in (f) if it is a three phase circuit (3 Marks)

QUESTION FIVE

- A. A three-phase balanced load draws a line current of 80 A at 0.90 lagging power factor. Solve for the minimum size in kVAR of the capacitor bank needed to raise the power factor to 0.96 lagging, if the line to line voltage is 13.2KV. Calculate
- a. Initial Reactive Power (4 Marks)
 - b. Desired Reactive Power (3 Marks)
 - c. Reactive Capacitor size (3 Marks)
- B. a) Define power plant (1 Mark)
- b) State **THREE** thermal power plants (3 Marks)
 - c) Explain how (b) generate electricity (3 Marks)
 - d) State the need for synchronization (3 Marks)