



KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE (RENEWABLE ENERGY)

SECOND SEMESTER 2021/2022

(FEBRUARY – JUNE, 2022)

PHRE 324: SOLAR PHOTOVOLTAIC ENERGY CONVERSION II

STREAM: Y3 S2

TIME: 2 HOURS

DAY: THURSDAY, 12:00 PM – 2:00 PM

DATE: 26/05/2022

INSTRUCTIONS

- 1. Do not write anything on this question paper.**
- 2. Attempt Question one (compulsory) and any other two.**

QUESTION ONE [30 Marks] (Compulsory)

- Discuss solar cell fabrication technology under the following sub-headings; (8 marks)
 - Silicon
 - Thin film photovoltaic
 - Organic photovoltaic
 - PV Array mounting
- Discuss the merits and demerits of Smart Grid technology. (6 marks)
- Explain factors you would consider when making decision to procure and install photovoltaic solar power generating plant/station. (6 marks)
- Sketch I-V curves for a PV module at different operating conditions. (4 marks)

- e) Under which condition do we prefer Nickel-Cadmium batteries in PV applications instead of Lead-acid batteries? Explain your answer. (3 marks)
- f) Proper inverter system should include MPPT. Explain the essence of this component. (3 marks)

QUESTION TWO [20 Marks]

- (i) Explain five properties of anode materials used in batteries and electrochemical cells. (5 marks)
- (ii) Identify five areas of photovoltaic applications. (5 marks)
- (iii) BOS components typically constitutes about 30% of total PV system installation giving any two examples of such components. (5 marks)
- (iv) Explain the following terms as used in solar fabrication technology; (5 marks)
- Wafering
 - A cell
 - Photolithography
 - Modules
 - Arrays

QUESTION THREE [20 Marks]

- (a) Explain the following terms as used in solar fabrication technology; (3 marks)
- PV System
 - Doping
 - biasing
- (b) Explain the merits and demerits of Monocrystalline cells (7 marks)
- (c) List any four types of thin film solar cell. (4 marks)
- (d) Name and describe two major categories of Lead acid batteries use in PV system giving examples in each category. (6 marks)

QUESTION FOUR [20 Marks]

Describe with illustrational diagrams where possible the following
Classification of Inverters and the terminologies associated to the inverters

- (i) Single Phase Series Inverter
- (ii) Single Phase Full Bridge Inverter
- (iii) Single Phase Inverter Output Voltage Control
- (iv) Single Pulse Width Modulation,
- (v) Multiple Pulse Width Modulation

QUESTION FIVE [20 Marks]

a) Briefly highlight and discuss five areas of application of single cell crystal technology of photovoltaic science. (15 marks)

b) Explain any three typical electrical informations supplied by the module manufacturer essential to consumers. (5 marks)