



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE  
ENERGY TECHNOLOGY AND MANAGENT**

**3<sup>RD</sup> YEAR 1<sup>ST</sup> SEMESTER 2018/2019 ACADEMIC YEAR**

**CENTRE: MAIN CAMPUS**

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**COURSE CODE: TET 3311**

**COURSE TITLE: PHOTOVOLTAIC TECHNOLOGY**

**EXAM VENUE: STREAM: BSc REN ENERGY TECH & MGT**

**DATE: ../12/2018 EXAM SESSION:**

**DURATION: 2 HOURS**

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### **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) Describe the following expression in relation to power generation in a solar cell;
  - i. Charge generation (2mks)
  - ii. Charge separation (2mks)
  - iii. Charge collection (2mks)
- b) As a project manager of the upcoming solar project in Marsabit County, Kenya briefly explain solar insolation and how it will affect solar power generation (7mks)
- c) Define Photon energy in relation to solar and explain its role in charge generation in a typical silicon solar cell (7mks)
- d) The main challenge that solar cell companies experience is on how to minimize optical losses and maximize the light absorption, as a Renewable Energy expert, discuss how you would minimize optical losses in order to increase the energy conversion efficiency of solar panel (10mks)

#### QUESTIO TWO

- a) The Kenya government intends to set up a solar cell manufacturing plant in collaboration with Kisumu county, as an upcoming renewable energy expert what are the factors you would consider during economic evaluation of the project (6mks)
- b) Discuss in detail the socio-economic and environmental benefits of the proposed solar cell manufacturing plant to Kisumu residents and the national government (7mks)
- c) As a stakeholder, briefly explain the main environmental impacts that are likely to affect the surrounding ecosystem during actual implementation stage (7mks)

#### QUESTION THREE

- a) The World Energy Council in consultation with relevant stakeholders in renewable energy sector proposed and formulated a policy framework for the solar energy technology, what was the rationale behind this proposal (6mks)
- b) Using examples briefly outline the framework for the solar energy technology (8mks)
- c) As the project manager for the proposed Marsabit solar farm, explain the merits and demerits of using tracking systems during installation of solar panel (6mks)

#### QUESTION FOUR

- a) Briefly define solar resource in relation silicon solar cell (3mks)
- b) After installation of solar panel on rooftop of buildings in Kisumu residential estate, using illustration depict how light is absorbed, transmitted and reflected (7mks)
- c) After installation of solar panel on rooftop of buildings in Kisumu residential estate, using illustration depict how light is absorbed, transmitted and reflected (7mks)

QUESTION FIVE

- a) Explain the main factors that affect solar cell power output (4mks)
- b) The Kenya government in collaboration with Marsabit county government intends to set up a solar farm. As a result how much energy will a 2.2 kWp Photovoltaic array that will be installed produce in a year? (Consider, an average solar insolation  $4\text{kWh}/\text{m}^2$  /day from the sun) (8mks)
- c) Using above results calculate the area of land needed, given: (An energy burn rate of  $3.5 \times 10^{13}$  kWh/yr; An insolation value of  $6\text{ kWh}/\text{m}^2$ /day; System conversion efficiency of 12%) (8mks)