



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
3RD YEAR 1ST SEMESTER 2017/2018 ACADEMIC YEAR
CENTRE: MAIN CAMPUS

COURSE CODE: TET 3311

COURSE TITLE: PHOTOVOLTAIC TECHNOLOGY

EXAM VENUE: WS

STREAM: BSc REN ENERGY TECH & MGT

DATE: 11/12/2017

EXAM SESSION: 9.00 – 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**

1. (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, explain Solar insolation and how it affects solar power generation (**8mks**)
(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 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**)

2. (a) The National government intend to set up a solar cell manufacturing plant in collaboration with Kisumu county, as a 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 the project manager, briefly explain the main environmental impacts that are likely to affect the surrounding ecosystem during implementation stage (**7mks**)

3. (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**)

- 4.(a) Briefly define solar resource in relation to silicon solar cell (**3mks**)
(b)After installation of solar panel on rooftop of a building, show using illustrations depict how light is absorbed, transmitted and reflected (**7mks**)
(c) The proposed solar farm project in Marsabit county will have a huge positive impact to the national economy, however the electricity generation from solar cell is not reliable. Describe the causes of intermittency and variation in solar resource (**10mks**)

5. (a) Explain the main factors that affect solar cell power output (**4mks**)
b) How much energy will a 2.2 kWp Photovoltaic array produce in a year? (Consider, an average solar insolation $4\text{kwh/m}^2/\text{day}$ from the sun) (**8mks**)
b) Using results in 5(b), calculate the area of land needed, given: (An energy burn rate of 3.5×10^{13} kwh/yr; An insolation value of $6\text{ kwh/m}^2/\text{day}$; System conversion efficiency of 12%) (**8mks**)