



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL AND
ELECTRONICS ENGINEERING

EED 115: SOLAR TECHNOLOGY SYSTEMS

DATE:

TIME:

INSTRUCTIONS

Question One Is **Compulsory**, Answer Any Other **Two**

1.
 - a) Explain briefly the main solar energy technologies (4 marks)
 - b) Explain why dissimilar PV modules should not be connected in series. (4 marks)
 - c) A battery is supplying electrical energy to an appliance. If the percentage voltage drop is 5.56% and the battery voltage at the terminals is 12.6V, calculate the voltage at the appliance. (3 marks)
 - d) The solar irradiance is 1000w/m and the ambient temperature is 30 C. Calculate the approximate cell temperature. (3 marks)
 - e) State the steps involved in sizing a solar PV installation system. (6 marks)

- f) The table below shows loads supplied by a 12V solar battery with a 60% depth of discharge. If the number of days of autonomy is 4 and battery efficiency is 80%.

Loads	Quantity	Rating	Daily usage	Weekly use
Lights	4	10W	4 hours	6 Days
T.V	2	40W	2 hours	5 Days

Size the system appropriately using the steps in (e) above. (10 marks)

2.
 - a) With an aid of a well labelled diagram, explain the following terms;
 - Solar constant
 - Direct radiation
 - Diffuse radiation

(6 marks)
 - b) Calculate the direct irradiance if the total measured irradiance is 950w/m and the measured diffuse irradiance is 65w/m

(4 marks)
 - c) Explain the different types of PV modules, stating their efficiencies.

(10 marks)
3.
 - a) Explain any five technical specifications of a PV module.

(10 marks)
 - b) With an aid of a diagram, explain the I – V curve and the important points.

(6 marks)
 - c) Calculate the approximate power conversion efficiency of a poly-crystalline PV module at an ambient temperature if the solar irradiance is 950w/m, I_{mp} is 5.00A, V_{mp} is 17.8V and the size of the module is 0.68m.

(4 marks)
4.
 - a) Define the following terms;
 - i. Tilt angle
 - ii. Azimuth angle
 - iii. Days of autonomy
 - iv. Depth of discharge

(8 marks)

- b) Explain how sulfation and stratification are prevented. (4 marks)
- c) A battery is rated 6V, 200AH. If three of the rated battery are connected in
- i. Series
 - ii. Parallel

Sketch the arrangement and determine the voltage and capacity in each case. (8 marks)

5. (a) With the aid of a well labeled diagram, explain the construction of a lead acid battery. (8 marks)
- (b) Explain the function of a charge controller. (2 marks)
- (c) Explain the function of an inverter. (2 marks)
- (d) With the aid of a well labeled diagram, explain **Any three** types of inverters. (8 marks)