



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR CERTIFICATE IN

ELECTRICAL AND ELECTRONICS ENGINEERING

EPC 119: SOLAR INSTALLATION SYSTEMS

DATE: 30/5/2017

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Two 12V, 75Ah, @ C10, 2Ω internal resistance, are connected in series and parallel to form battery banks A and B respectively. Use the information to fill the table below (6 marks)

Battery Bank	Total voltage (V)	Capacity (Ah)	Capacity (Wh)	Total internal resistance (Ω)
A				
B				

- b) State any 4 energy regulations applied in Kenya. (4 marks)
- c) State the steps involved in sizing a solar installation system. (6 marks)
- d) 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. (4 marks)

- (e) 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, determine the battery capacity.

Loads	Quantity	Rating	Daily usage	
Lights	4	10W	4 hours	
T.V	2	40W	2 hours	

(10 marks)

QUESTION TWO (20 MARKS)

- (a) With an aid of a diagram, explain the following terms;
- Solar constant
 - Direct radiation
 - Diffuse radiation
- (6 marks)
- b) Explain why the global radiation is less than the solar constant. (4 marks)
- c) Explain the different types of Pv modules, stating their efficiencies. (10 marks)

QUESTION THREE (20 MARKS)

- (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. (10 marks)

QUESTION FOUR (20 MARKS)

- a) Define the following terms;
- i. Tilt angle
 - ii. Azimuth angle
 - iii. Stratification
 - iv. Sulfation
- (8 marks)
- b) Explain how sulfation and stratification are prevented. (4 marks)
- c) Explain the following systems;
- i. Stand-alone (3 marks)
 - ii. Hybrid – PV generator system (3 marks)

QUESTION FIVE (20 MARKS)

- (a) Explain the importance of the following
- i) Low voltage disconnect in a charge controller
 - ii) Blocking diodes (4 marks)
- (b) Explain Any three types of inverters (6 marks)
- (c) A 12 dc home solar system supplies a load which consists of four 10 watt lamps and an 80 watt television set. If the daily use for each appliance is 2 hours, determine the,
- (i) Total daily energy demand
 - (ii) Daily system charge requirement (10 marks)