



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

**TRADE DIPLOMA IN ELECTRICAL ENGINEERING (ELECTRICAL &
RENEWABLE) - STAGE 4**

EEE544 RENEWABLE ENERGY TECHNOLOGIES

FINAL EXAMINATION – TRIMESTER 1, 2019

Duration: 3 hours and 10 minutes

Total Marks: 100

DATE/DAY: TBA TIME: TBA

ROOM: AS PER TIMETABLE

INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes extra reading time during which you are NOT to write.
2. Begin each SECTION on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each attached sheet.
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. ANSWER ALL QUESTIONS
9. Show all working where necessary.
10. ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM

SECTION A**[40 Marks]**

1. Discuss two economic impacts and three environmental impacts of renewable energy technologies.
[5 marks]
2. Why should we promote and adapt Renewable Energy Technologies?
[2 marks]
3. Sketch the power curve of a wind turbine clearly labelling 'cut-in', 'cut-out' speed and rated speed.
[3 marks]
4. The daily DC requirement is 140Wh, and daily AC requirement is 850Wh. You are told that the inverter has an efficiency of 90%. What is the total energy requirement for the day?
[3 marks]
5. Illustrate and explain the following systems:
 - i) Stand-alone PV system [5 marks]
 - ii) Solar Water Pumping [2 marks]
 - iii) Grid connected PV system [5 marks]
6. State five factors that affect the output power of the solar module?
[5 mark]
7. You have been asked by the Department of Energy to carry out a complete feasibility study of hydropower station for a remote rural community. List the main features of such a study, and briefly outline the amount of information you will present as part of your report.
[5 marks]
8. Explain why batteries should be raised off the ground or concrete floor?
[2 marks]
9. Outline three fuel properties of bio-diesel.
[3 marks]

SECTION B**[25 Marks]**

1. A portion of an electricity bill for a domestic dwelling is given below:

Tariff Description	Reading type	Meter Number	Reading		Usage	Billed Days
			Present	Previous		
Domestic	Normal Reading	18656:1	00007765	00007685	80	30

Figure 1.0

You are provided with the following information:

- Customers whose monthly usage is less than or equal to 85kWh will be charged 33.10 cents/kwh but will qualify for a Government subsidy of 15.90 cents
- Customers whose monthly usage is more than 85kWh will not qualify for the Government subsidy and will therefore pay the full amount of 33.10 cents/unit.

For the information provided above, calculate the bill for the domestic dwelling that has an opening balance of \$5.00 CR showing a step by step calculation and also taking VAT into account.

[6 marks]

2. The annual energy production from a HAWT is 5.66GWh. Given a 3-bladed 15m radius wind turbine operating in a wind regime with an average wind speed of 15m/s, estimate the power coefficient if it is operating under standard conditions.

[4 marks]

3. For the system specs given below, carry out system sizing showing the possible arrangement of batteries and solar PV panels.

[15 marks]

Inverter Efficiency = 90%

Location = Nakasi

Inverter Voltage = 24V

BP Solar panel 125W, I = 6.56A

Battery DOD = 60%

Peak sun hour = 4 hrs.

Battery Capacity = 100Ah @ 12V

Consecutive days without sun light = 2

Load table:

Appliance	AC/DC	Watts	Duty cycle hour/day
6 Lights@ 5W each	AC	30	6
TV	AC	50	4
Phone Charger	AC	15	2
Radio	AC	40	5
Lights	DC	10	4

Table: 2.0

SECTION C**[35 Marks]**

1. Find the declination angles and the length of the day on 28th September, 2018 in:
 - (a) Suva (latitude 18.2° South)
 - (b) South Korea (latitude 36° North)

[10 marks]

2. State the four factors to take note of whilst installing the PV inverter?

[4 marks]

3. Explain the two types of terrains. Comment on the effects of a man-made structure located very near to a wind turbine.

[5 marks]

4. A catchment area of 20km long and 10km width is needed to build a hydro system. With a head height of 300m to dam the turbine can be installed to produce power from the dam. If the region has an annual rainfall of 1100mm, consider the yield factor of 50% and load factor of 60%, calculate the power produced and the capacity of the power plant if the power plant has an efficiency of 80%.

[6 marks]

5. A hydro power scheme consists of a storage dam located 65m above the power station. If the head loss in the penstock is 5m,
 - i) What is the velocity of the jet? **[2 marks]**
 - ii) If the total power delivered by the jets to the 3-jet Pelton Wheel turbine is 500kW, what is the radius of each jet? **[5 marks]**

6. Turbines are classified into two groups. Elaborate with examples on the two types of turbines.

[3 marks]

END OF EXAMINATION