



School of Computing and Engineering Sciences

Master of Science in Energy Transitions

End of Semester Examination

MSSET 8204: Energy Systems Analysis and Decision-making

Date: 11th December 2023

Time 18:00-20:30 Hours

Instructions: Answer Question **ONE** and any other **TWO** Questions

Question ONE (20 Marks) (Compulsory)

a. Imagine you're embedded into the traffic planning department in your city. You have been tasked with the responsibility of estimating the average commute time of drivers going from the east side of the city to the west. You don't know how long it takes on average, but you do know that it will depend on a number of factors like the distance driven, the number of stoplights on the route, and the number of other cars on the road. Explain how you will proceed to tackle your assignment and describe the model that will apply in the scenario.

[5 marks]

b. A sample of 10 households were monitored for one year. The household income (in \$1000s) and the amount of energy consumed (in 10^{10} joules) were determined. The results recorded were as follows:

Income	31	40	28	48	195	96	70	100	145	78
Energy	16	40	30	46	165	92	96	77	115	67

i. From the data set, establish regression line that can be used for predicting energy consumption from income within the city

[5 marks]

ii. Predict the energy consumption for a family whose income is \$50,000.

[3 marks]

- iii. Determine the correlation coefficient between income and energy consumption. What does the results from the correlation coefficient indicate about income and energy consumption in the city? [5 marks]

Question TWO (15 Marks)

You are tasked with a responsibility of conducting an energy demand modeling study for a rapidly growing city in Kenya. The city is experiencing increased industrialization, a rising population, and a push for sustainability. Develop a plan outlining the key steps and considerations you would take in modeling and analyzing the energy demand for this city.

[8 marks]

Question THREE (15 Marks)

- a. You are part of a renewable energy planning team in Kenya aiming to increase its share of renewable energy in the overall energy mix. The government has set ambitious renewable energy targets to enhance energy security, reduce greenhouse gas emissions, and promote sustainable development. As part of this initiative, your task is to develop a renewable energy forecasting scenario to optimize the integration of renewable sources into the existing energy infrastructure.

Describe the key components/steps to consider so as to achieve the task. [7 marks]

- b. The number of power blackouts recorded per week in a particular area is known to follow a Poisson distribution with mean 0.5. Find the probability that in a particular week there will be in

i. Less than 2 power blackouts [3 marks]

ii. More than 2 power blackouts [3 marks]

What is the probability that in a three-weeks period, there will be no power blackouts? [2 marks]

Question FOUR (15 Marks)

- a. The impact of wind and solar forecasting on power system operations can be significant, as these renewable energy sources are inherently variable and dependent on weather conditions. Nonetheless, accurate forecasting can play a crucial role in ensuring the stability, reliability, and efficiency of power systems. What the impact would wind and solar energy forecasting have on Kenya? [7 marks]
- b. A company dealing with solar technology installation imports solar panels in large boxes of 200. Over the years, the quality control department has noticed that the probability of a solar panel imported being substandard is 0.006. The department has developed a policy of selecting a panel at random to check if the imported consignment meets the standards. What is the probability that a box selected at random contains at most two solar panels which are substandard? [8 marks]