



**SCHOOL OF COMPUTING AND ENGINEERING SCIENCES
MASTER OF SCIENCE IN SUSTAINABLE ENERGY TRANSITIONS
END OF SEMESTER EXAMINATION**

MSSET 8302: ENERGY PRACTICUM DESIGN

DATE: 27th August, 2024

Time: 18:00-20:30 Hours

Instructions

1. This examination consists of **FOUR** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE

(Total: 20 Marks)

- a. Prevention or control of a hazard can be illustrated using hierarchy of controls. Draw the hierarch and for each level, indicate the most ideal control measure to take. (3 Marks)
- b. Critically analyze the role of problem-solving and need recognition in the energy sector's transition to a sustainable and low-carbon future. (3 Marks)
- c. Illustrate and discuss the concept of balancing the constraints in implementing solutions to industrial related problems. (3 Marks)
- d. Develop a comprehensive roadmap solution for addressing energy-related problems in the Industry: (4 Marks)
- e. Sometimes, you may be faced with an ethical dilemma which can be referred to as on-the-Job Ethical Dilemma as it relates to the common business ethical challenge. This type of the dilemma can be categorized into 4 distinct categories. Describe these four categories. (2 Marks)
- f. Discuss the difference between portfolio management and project management in terms of the purpose, focus, planning emphasis and responsibility (2 Marks)
- g. Ethical dilemma/paradox a problem in the decision-making process between two possible options, neither of which is absolutely acceptable from an ethical perspective. Draw the ethical dilemma cycle and briefly **discuss** the **5** steps in resolving this dilemma. (3 Marks)

QUESTION TWO

(Total: 15 Marks)

Case Study 1

Study this case study and answer the following questions

Kenya Energy Solutions Ltd. (KESL), a leading company in the Kenyan energy sector, is involved in the installation, operation, and maintenance of various energy systems, including industrial power systems, power transmission and distribution networks, solar PV installations, and mechanical systems. Recently, the company has experienced several near-miss incidents and

minor accidents across different sites. The management has decided to review and reinforce their occupational health and safety practices to prevent future incidents and ensure the well-being of their employees.

- a. Describe the best practices for occupational health and safety during the installation of industrial power systems. (3 Marks)
- b. Create a safety checklist for the maintenance of systems in an industrial setup that KESL should adopt to ensure safety in the work place. For each of the items on the checklist, indicate the best solution that meets safety requirements. (4 Marks)
- c. Explain how a well-implemented occupational health and safety program can impact the success of energy projects carried out by KESL. (4 Marks)
- d. What are the regulatory requirements for emergency preparedness and response plans in the energy sector, and how does KESL ensure that its emergency response plans are up-to-date and effective? (4 Marks)

QUESTION THREE

(Total: 15 Marks)

Case Study 2

Study this case study and answer the following questions

Kenya Energy Corporation (KEC) operates a large power plant in the Eastern region of Kenya, which uses a combination of solar, wind, and biomass energy sources. The plant has a capacity of 300 MW and employs over 500 workers on a contract and casual basis. The facility includes heavy machinery and boilers that use biomass as fuel for generating electricity. Over the last few years, there have been several reported incidents leading to the injury or death of workers or contractors within the facility. Preliminary investigations have attributed these incidents to workers not following safety protocols, such as walking in non-designated areas, not wearing helmets or other protective gear, and equipment operators not observing safety procedures. However, a private investigator has highlighted issues such as low sensitivity of sensors controlling the conveyor belts that transport biomass to the boilers and outdated cranes used for loading biomass, which have occasionally malfunctioned. Additionally, there are inadequate heat isolation measures, making pathways near the boiler section dangerously hot.

- a. Discuss 3 ways in which KEC can improve compliance with safety protocols among its workers? (3 Marks)
- b. How can KEC mitigate the environmental impacts of its operations? (3 Marks)
- c. Propose a 5-step systematic approach for solving the safety issues at KEC's power plant. (5 Marks)
- d. There are three techniques that can be used to comprehensively assess the viability and effectiveness of proposed alternative solutions to the identified problems. Contextualize these techniques in case study 2. (4 Marks)

QUESTION FOUR

(Total: 15 Marks)

- a. Energy sector is marred by a number of energy related issues. Identify a case where such problem existing in the local context and evaluate the case using Design Thinking approach. (9 Marks)
- b. For the problem identified in Q4a above, identify and discuss three project constraints that must be considered in addressing the problem discussed. (4½ Marks)
- c. How should constraints identified in Q4b above be addressed? (1½ Marks)