



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

FIRST YEAR SEMESTER ONE EXAMINATIONS

**FOR THE DEGREE
OF**

**BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL
ENGINEERING/BACHELOR OF SCIENCE IN MECHANICAL
AND INDUSTRIAL ENGINEERING/BACHELOR OF SCIENCE
IN ELECTRICAL AND COMMUNICATION ENGINEERING**

COURSE CODE: ECC 103

COURSE TITLE: INTRODUCTION TO ENGINEERING

DATE: 16TH DECEMBER

TIME: 12 – 2 P.M.

INSTRUCTIONS:

1. This paper contains **FOUR** questions
2. Attempt a total of **THREE** questions only.
3. **QUESTION ONE IS COMPULSORY**
4. Marks for each question are indicated in the parenthesis.
5. Examination duration is 2 Hours
6. Do not write on the question paper.

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

Question ONE (40 marks)

- (a) An "engineer" is defined as a person who uses scientific knowledge to design, construct, and maintain engines, gadgets and machines or structures and equipment such as phones, aircraft, cars, solar lights, roads, railways, airports and bridges. An engineer is also regarded as a problem solver. (6 marks).
- (i) List the four main fields of engineering. (2 marks)
- (ii) Which profession was recognized as the first engineers or problem solvers? (2 marks)
- (iii) The first documented engineer known by name and achievement was *Imhotep*, builder of the Step Pyramid at Şaqqārah, Egypt, probably about 2550 BC. Explain the field of engineering for Eng. Imhotep and sketch what we would visualize as a step-pyramid. (2 marks)
- (b) During the COVID-19 pandemic many innovative methods were adopted or utilized to address the level of hygiene which was the main target area for intervention measures. As the newly appointed Cabinet Secretary for Health Services you have to allocate the scarce resources for development of the methodologies in a prioritized approach. This requires that to appraise the different techniques and apply engineering problem solving techniques. After much brainstorming by a team of experts you have selected six technologies as shown in Figure Q1. The 10-point criteria is shown in Table Q1 below.

Table Q1: Criteria in the Selection of Appropriate Methodology in COVID-19 Pandemic

SN	Description
1	Cost of equipment and materials
2	Re-usability of components
3	Maintenance of hygiene standards
4	Resilience and durability
5	Functional performance
6	Product lifespan
7	Local manufacturing capacity
8	Mass productivity of parts
9	Safety issues
10	Health concerns

- (i) By using the Direct Tap (DT) as the baseline methodology in the Pugh's or T-Chart method, select the most suitable method to address the COVID-19 Pandemic. (10 marks)
- (ii) By use of the Weighted Decision Matrix, select the most appropriate mode of communication from the six technologies listed in Figure Q1. Base the decision on the ten criteria in Table Q1 and use your discretion to assign weighting scale of 1-5 for each criteria and a score of 1-10 for each alternative methodology. (20 marks)
- (iii) Compare and contrast the results from the two methodologies. (4 marks)

Question TWO (15 marks)

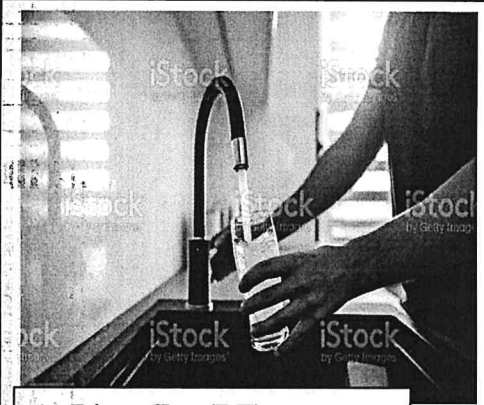
- (a) Explain the following terms used in Engineering Design Process:
- (i) Constraint
 - (ii) Optimization
 - (iii) Engineering
 - (iv) Evaluation (4 marks)
- (b) List and relate the six basic steps in Engineering Design Process (6 marks)
- (c) (i) A standard 5-seater saloon car has a tyre pressure of 35 psi. Convert this pressure into N/mm^2 . [Hint: Use $1 \text{ lb} = 0.453592 \text{ Kg}$, $1 \text{ ft} = 12 \text{ inches} = 0.3048 \text{ m}$, $g = 9.81 \text{ ms}^{-2}$.] (3 marks)
- (ii) Hence show that $1 \text{ psi} = 241 \text{ KN/m}^2$. (1 marks)
- (iii) If the saloon car at full tyre pressure passes over black cotton soil surface with bearing capacity of 150 KN/m^2 and over granite rock whose bearing capacity is 1200 KN/m^2 explain on which of the two surfaces the saloon car will leave tyre marks. (1 marks)

Question THREE (15 marks)

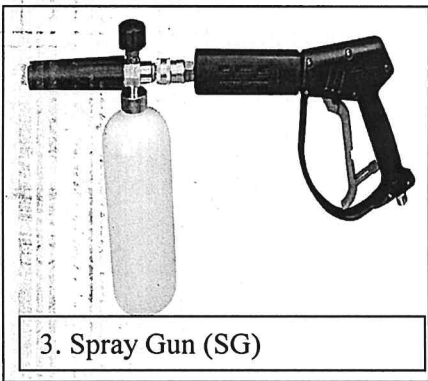
- (a) Explain the framework for training a professional engineer in Kenya by clearly outlining the duration, structure and supervisory arrangements for engineering education and experiential engineering training. (4 marks)
- (b) Outline the role, if any, of the Commission for University Education (CUE) and the Engineers Board of Kenya (EBK) at each stage of engineering education and training. (3 marks)
- (c) Justify why Engineering is a Professional Programme. (2 marks)
- (d) Use of suitable examples from your engineering programme at MMUST to explain the following terms:
- (i) Engineering programme
 - (ii) Course
 - (iii) Credit Hour
 - (iv) Core engineering course
 - (v) mathematical science
 - (vi) Basic course (6 marks)

Question FOUR (15 marks)

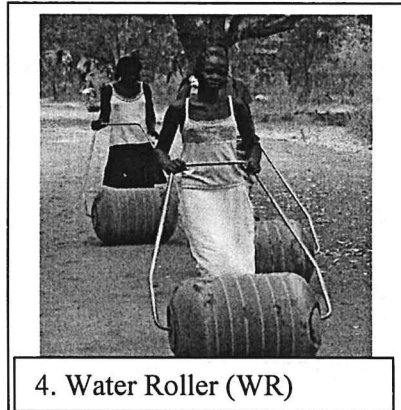
- (a) Explain the following meanings of the symbols from the Greek Alphabet and indicate where the symbol is applied in Engineering:
- (i) Ω (ii) ρ (iii) κ (iv) ϕ (v) λ (vi) β (3 marks)
- (b) Use suitable illustration to explain the difference between the following engineering terms:
- (i) Basic science and applied science.
 - (ii) Dimension and unit (4 marks)
- (c) With reference to examples of your own choice list 5 marvels of modern engineering innovations and 5 disasters in engineering works. (8 marks)



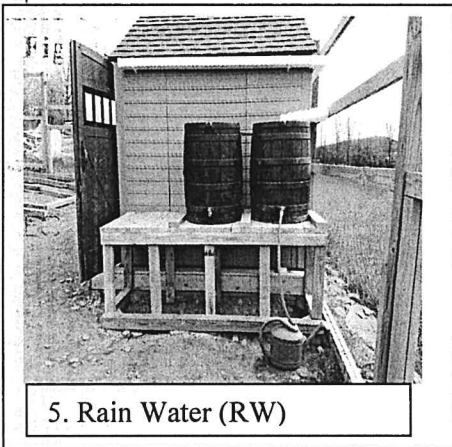
1. Direct Tap (DT)



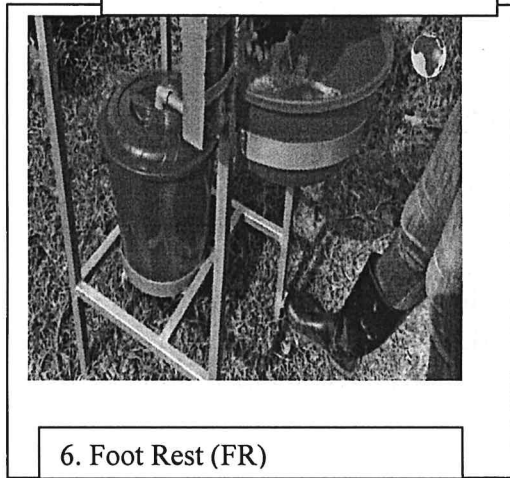
3. Spray Gun (SG)



4. Water Roller (WR)



5. Rain Water (RW)



6. Foot Rest (FR)

Figure Q1: Alternative Water Handling Methodologies During COVID-19 Pandemic