



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

Bachelors of Engineering in Industrial and Manufacturing Engineering

Advanced Manufacturing Systems

EIE 5218

First Semester Examination Paper

March 2025

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

Examiner's Name: S Mhlanga

INSTRUCTIONS

1. Paper consists of Seven (7) Questions
2. Answer any **five (5)** questions
3. Answer **AT LEAST TWO QUESTIONS FROM EACH SECTION**
4. Each question carries 20 marks.
5. The use of calculators is permissible

Section A- LEAN MANUFACTURING

Question 1

- a) Within Six-Sigma explain White to Master Black Belt level [10]
- b) Define and discuss the following terms DMAIC and DMADV. [10]

Question 2

- a) Discuss 5S as applicable to your internship company. [10]
- b) A Computer repair shop received several complaints on the length of time it took to make repairs. The Manager responded by increasing the repair staff by 10%. Complaints about repair time quickly decreased but then complaints on the cost of repairs suddenly increased. Oddly enough when repair costs were analyzed the Manager found that the average cost of repair had decreased relative to what it was before the increase in staff. Using the 5W2H approach analyze the case and give possible solutions to the Manager. [10]

Question 3

- a) Discuss Value Stream Mapping as applicable process at your internship company. [10]
- b) Discuss Standard Kaizen as applied to your internship company. [10]

SECTION B: Industrial Internet of Things (IIoT) and Artificial Intelligence

Question 4

- a) Describe Industrial Internet of Things (IIoT) and possible application in your internship company. [15]
- b) Discuss five (5) benefits of implementation of IIoT at your company of internship. [5]

Question 5

- a) Describe two challenges in implementation of IIoT. [6]
- b) Discuss two (2) baseline technologies of IIoT and cite their presence or absence at your internship company. [8]
- c) Describe three (3) categories of sensors and applicability at your internship company. [6]

Question 6

- a) Describe three (3) characteristics of sensors as applicable to a section of inspection of beverage bottles for missing caps and under-filled bottles? [6]
- b) Discuss three (3) types of actuators that can be used on a beverage bottling line. [6]
- c) The Indanda Beverage Manager would like for you to advise him concerning network connectivity for the IIoT system in (i) they are trying to implement. [8]

Question 7

- a) Discuss the following terms:
- i) Artificial Intelligence (AI) [4]
 - ii) Machine Learning (ML) [4]
 - iii) Deep Learning (DL) [4]
- b) Write a pseudocode for one of the following in preparation for application of Neural Networks:
- i) Pairwise switch [8]
 - ii) Largest Candidate Rule [8]
 - iii) Cellular Formation [8]
 - iv) Makespan Calculation [8]
 - v) Largest Processing Rule [8]
 - vi) Rank Position Rule Line Balancing [8]

End of Examination Paper