UNIVERSITI KUALA LUMPUR
KAMPUS CAWANGAN MALAYSIAN SPANISH INSTITUTE

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE	: SMB48503
COURSE NAME	: SMART MANUFACTURING
PROGRAMME NAME	: BACHELOR OF MECHANICAL ENGINEERING
DATE	: 23 JANUARY 2026
TIME	: 9.00AM – 12.00PM
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of ONE section.
4. Answer FOUR (4) questions only.
5. Please write your answer on the answer booklet provided.
6. Please answer all questions in English only.
7. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
8. Refer to the attached Formula/ Appendices. ☐ *Tick if applicable*

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Answer FOUR (4) questions.
Please use the answer booklet provided.

Question 1

Smart factories consist of intelligent machines, devices, and control equipment that monitor essential parameters of manufacturing processes. These advancements have transformed factory floor infrastructures, fostering consistent and precise collaboration between machines, and have also changed machinery requirements, leading to a higher demand for reliable sensors.

(a) In a table compare FIVE types of position sensors based on their characteristics, materials, uses, advantages, and disadvantages.

(15 marks)

(b) Identify the materials typically used in the construction of the Hall Effect Sensor and Capacitive Sensor, and explain their significance.

(4 marks)

(c) Describe the key characteristics of the Potentiometer, LVDT and Optical Encoder sensors.

(6 marks)

Question 2

Cyber-Physical Production Systems (CPPS) represent a core pillar of Industry 4.0, comprise autonomous and cooperative subsystems that interact across multiple production levels, ranging from individual processes and machines to factory-wide operations and extended production and logistics networks.

(a) Identify TWO (2) components from the virtual world and TWO (2) components from the physical world in a Cyber-Physical Production System.

(4 marks)

(b) Explain THREE (3) main characteristics of Cyber-Physical Production Systems that enable smart and autonomous manufacturing environments.

(6 marks)

(c) Discuss FIVE (5) levels of Cyber-Physical Production Systems implementation, starting from the process or machine level up to the production and logistics network level, highlighting their roles in an Industry 4.0 environment.

(15 marks)

Question 3

In manufacturing, big data can include data collected at every production stage, including data from machines, devices, and operators. This data can be either structured or unstructured. The sheer volume and complexity of large data sets and the number of specific tools, techniques, and the best practices for working with them have led to the maturation of data science and big data analytics in and around manufacturing.

(a) Analyze the TWO (2) main types of data in big data analytics within the manufacturing industry.

(4 marks)

(b) Explain FOUR (4) uses case for big data in manufacturing. Please use and appropriate example for each case,

(16 marks)

(c) Explain how big data is collected in the manufacturing industry and provide two examples of data sources.

(5 marks)

Question 4

The Smart Manufacturing System (SMS) integrates digital technology into every aspect of manufacturing, enabling interoperability, real-time monitoring and control, flexible production processes, and swift responses to market fluctuations. The integration of various technologies within smart manufacturing has expanded its scope, offering benefits such as cost-effectiveness, time efficiency, easy configuration, improved insights, rapid market response, flexibility, and remote monitoring capabilities.

(a) Classify FIVE (5) smart manufacturing technologies currently adopted in the industry.

(5 marks)

(b) Identify FIVE (5) examples of applications where smart manufacturing technology is used in industry.

(5 marks)

(c) Discuss the impact of smart manufacturing technologies towards improving productivity.

(15 marks)

Question 5

Supply chain integration is a process where all the parties involved with the fulfilment of a product are integrated into a single system. This integration process requires significant coordination and alignment to ensure everyone effectively works toward the same goal.

(a) Differentiate THREE (3) advantages and TWO (2) disadvantages of integrated supply chain management.

(10 marks)

(b) Sustainable manufacturing addresses the production stage of the product life cycle without neglecting the economic and environmental consequences of activities in other life cycle stages. Identify FIVE (5) sustainable activities that should be initiated by manufacturing organizations.

(15 marks)

END OF EXAMINATION PAPER