**UNIVERSITI SAINS MALAYSIA** **APEX**™

Second Semester Examination
2022/2023 Academic Session

July/August 2023

# EEE525 – Internet of Things Technology

Duration : 2 hours

Please check that this examination paper consists of **Five (5)** pages of printed material including appendix before you begin the examination.

**Instructions** : This paper consists of **TWO (2)** questions. Answer **Two (2)** questions.

1.  a)   In the context of Fourth Industrial Revolution (4.0 IR), smart manufacturing improves long-term competitiveness by optimising labour, energy, and materials to produce a high-quality product and respond quickly to variations in market demands and delivery time. As illustrated in Figure 1, smart factories are a new generation of production systems that support advanced technologies such as computerization manufacturing, cyber-physical systems (CPS), big data, internet of things (IoT), cloud computing, and automated and robotic systems.
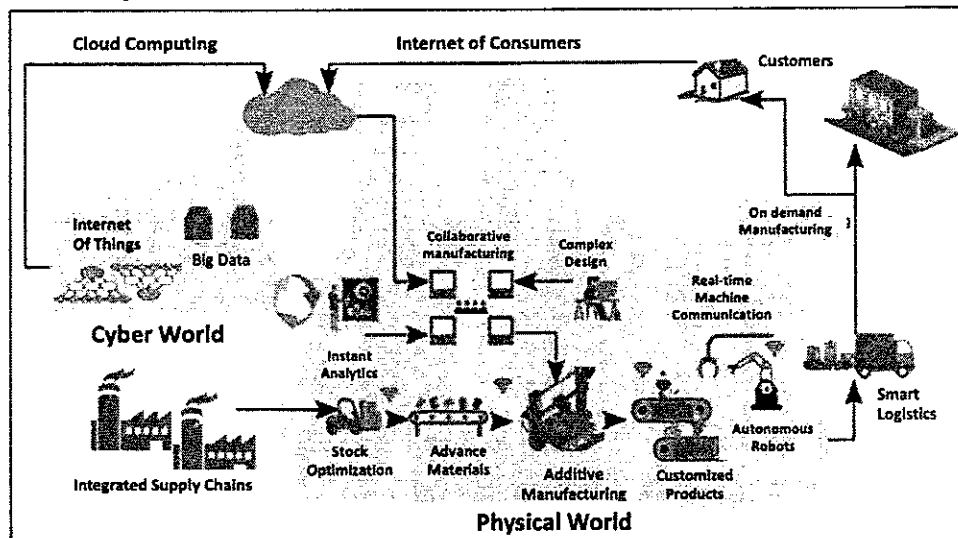


Figure 1: Illustration of components and connections for an 4.0 IR Smart Factory

Based on the current technology, **identify Five (5) potential challenges and risks associated** with 4.0 IR the widespread adoption of IoT in the Fourth Industrial Revolution?

(30 marks)

b)   Most of the security professionals consider IoT as the vulnerable point for cyber-attacks due to weak security protocols and policies. End-users could not utilize protective measures to avert data attacks. Hackers developed different kinds of malware to infect the IoT devices. Such inappropriate security practices increase the chances of a data breach and other threats. Based on this scenario, **discuss Five (5) security** implications of IoT devices with limited computing resources and **how these constraints can be exploited by attackers.**

(30 marks)

c) In the past, patients could only interact with doctors through in-person visits or limited telecommunication methods. Continuous monitoring of patients' health and personalized recommendations were not feasible. However, with the advent of the Internet of Things (IoT), healthcare has been revolutionized. IoT-enabled devices now allow for remote monitoring in the healthcare sector, enabling doctors and hospitals to continuously track patients' health and provide tailored care. This advancement has led to improved patient safety, better health outcomes, and increased satisfaction due to easier and more efficient interactions with healthcare providers. Additionally, remote monitoring helps reduce hospital stays and prevents re-admissions. IoT also plays a significant role in reducing healthcare costs while enhancing treatment outcomes.

   i. **Give** an example of smart healthcare monitoring based on the given scenario and describe it.

   (10 marks)

   ii. **Discuss the proposed methods** in terms of the simplest approach to developing the monitoring system using IoT devices.

   (30 marks)

2. a) Sensor devices play critical roles in the Internet of Things (IoT) ecosystem. They are essential component that collects data from the physical world and sends it to the cloud or other devices for further processing and analysis. **Discuss** at least **Five (5) key characteristics** that **IoT sensors** must possess in order to be effective components of the Internet of Things and **explain their importance in detail.**

   (20 marks)

   b) The combination of Artificial Intelligence (AI) and the Internet of Things (IoT) has enormous potential to revolutionize many aspects of modern life, from healthcare and transportation to manufacturing and agriculture. However, this potential is hampered by significant challenges related to the 3Vs of IoT data - volume, variety, and velocity. **Discuss Three (3)** specific **challenges posed by each of the 3Vs** and **provide One (1) approach for addressing each challenge.**

   (30 marks)

c) Cloud and Edge technology are critical components for supporting IoT systems. Both Cloud and Edge computing offer different benefits and play complementary roles in processing and analyzing data from IoT devices. **Discuss Three (3) key characteristics of each technology** when they are deployed to support IoT solutions.

(30 marks)

d) The Internet of Things (IoT) has the potential to revolutionize smart manufacturing. In what ways can IoT be applied to smart manufacturing, and how can it bring about significant improvements? **Discuss at least Four (4) specific ways of how IoT can improve smart manufacturing.**

(20 marks)

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APPENDIX

| Question | Course Outcome (CO) | Programme Outcome (PO) |
|----------|---------------------|------------------------|
| 1 | 1 | PO1 |
| 2 | 3 | PO7 |