Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	DIGITAL MANUFACTURING
COURSE CODE	:	BDX 31503
PROGRAMME	:	BDX
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **FOUR (4)** QUESTIONS FROM FIVE (5) QUESTIONS 0NLY 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Your company appointed you as a head in one new project. The project was to setup a new manufacturing process plan for machining metal-based aircraft components by implementing digital manufacturing concept. The concept must be the latest technology in industrial manufacturing. Suggest a systematic approach for your digital manufacturing concept. Support your answer with a simple example.

(15 marks)

(b) Digital Threat and Digital Twin is applied in an aircraft manufacturing. Describe this technology based on an appropriate example and sketch.

(10 marks)

Q2 (a) An aircraft industry manufactures fastener for aircraft purpose like rivet, screw and others in mass production. A new engineer attempts to explore intelligent knowledge-based manufacturing system. Analyze the available information to develop the system.

(10 marks)

(b) **Figure APPENDIX A.1** shows a schematic diagram for an automated feeding and cutting mechanism. Assume that the cutter is moving downward for cutting materials. The materials are moving forward (horizontally) based on intermittent feeder. The cutting process starts when a sensor detects the incoming pre-cut materials and running automatically until X number of cut. Propose a control system using Electro Pneumatic technology. Support your answer with the step-displacement, pneumatic circuit and electrical circuit diagrams.

(15 marks)

Q3 In Virtual Manufacturing Aircraft production line, a photo electric sensor is used to ensure the turbine blade parts has uniform size in an automatic quality inspection process as shown in **Figure APPENDIX B.1**. If the sensor detects the part, that's mean the part has unacceptable height and must be rejected. Once the rejected part is being detected, a double acting pneumatic cylinder which is attached near the sensor push the rejected part off the conveyor into rejected box. Otherwise the turbine blade parts continue moving on the conveyor and the cylinder remain inactive. If the cylinder rejects more than 10 parts, an emergency indicator emits red light to show that the rejected parts have reached the limit so the system could stop the entire system for 5 minutes and before continuing. Select the Programmable Logic Controller (PLC) system including pneumatic diagram, motion diagram, electrical diagram and ladder diagram for this automation system according to ISO 1219 standard respectively. All components require 12VDC supply voltage.

(25 marks)

Q4 (a) In Digital Manufacturing, there are two type of Radio Frequency Identification (RFID) which are active and passive system. Differentiate the technological principle between both RFID systems.

(12 marks)

(b) Virtual Manufacturing (VM) is one of the important element in Industrial Revolution (IR) 4.0. Virtual manufacturing is a new concept in aircraft manufacturing. However, some aircraft companies are still not fully applied this new concept in modern manufacturing system.

(i) What is the definition of Virtual Manufacturing? Differentiate **THREE (3)** classification of VM to support your answer.

(7 marks)

(ii) Manufacturing systems have some weakness. VM is the best solution to the new era of manufacturing process. Evaluate **THREE (3)** factors that influence manufacturing systems.

(6 marks)

Q5 (a) Industrial revolution 4.0 (IR 4.0) also sometimes referred to as internet of thing (IOT) or smart manufacturing system to create a more holistic and better connected ecosystem for companies that focus on aircraft manufacturing and technologies. Analyze **THREE (3)** core technologies that play important roles in IoT that can benefit the aircraft manufacturing industry to understand the value of IR4.0 in manufacturing cases with example of application.

(12 marks)

(b) The internet of things (IoT) operates around a vast network. Various components are involved which work together to form a cohesive system. The IoT is seen as the key ingredient for the development of smart environments. The situation presents a challenge to identify the most suitable IoT communication solutions for a particular smart environment. Propose **FOUR (4)** major of smart environment in IoT and sketch the example of application to represent the IR 4.0 concept.

(13 marks)

- END OF QUESTION -

APPENDIX A

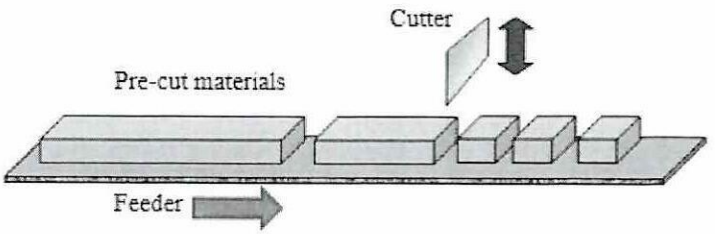

Figure APPENDIX A.1

APPENDIX B

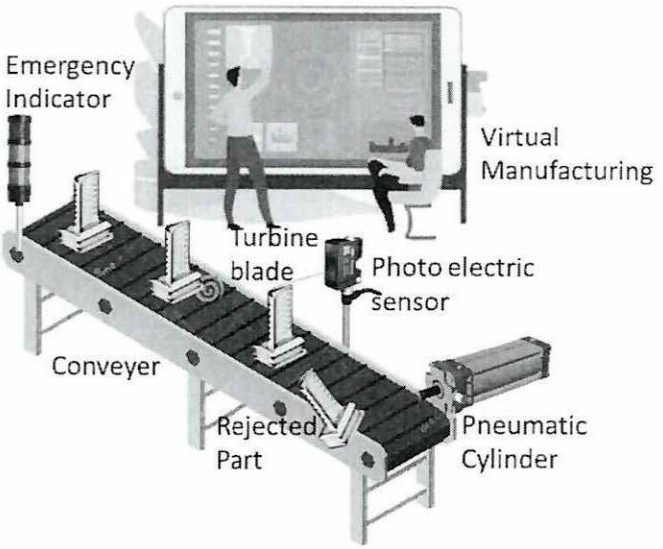

Figure APPENDIX B.1