



**UTHM**  
Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2023/2024**

COURSE NAME : INDUSTRIAL ENGINEERING  
COURSE CODE : BPB 31303  
PROGRAMME CODE : BPB / BPP  
EXAMINATION DATE : JULY 2024  
DURATION : 3 HOURS  
INSTRUCTION :  
1. ANSWER ALL QUESTIONS  
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 QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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**Q1** Industrial Engineering and the Fourth Industrial Revolution, also known as Industry 4.0, are closely intertwined. Industry 4.0, on the other hand, refers to the current era of connectivity, advanced analytics, automation, and advanced manufacturing technology that has been transforming global business. The relationship between Industrial Engineering and Industry 4.0 is that the advancements in technology brought by Industry 4.0 are being leveraged by industrial engineers to optimize and improve production processes.

- (a) Discuss **TWO (2)** impacts of Industrial Engineering in the production process. (4 marks)
- (b) Discuss **TWO (2)** benefits of the Industrial Engineering perspective in today's Industrial Revolution 4.0 situation. (4 marks)
- (c) State **THREE (3)** prime objectives of Industrial Engineering. (3 marks)
- (d) Outline **TWO (2)** unique features of Industrial Engineering in achieving Industry Revolution 4.0. (6 marks)

- Q2**
- (a) Define **SEVEN (7)** Deadly Wastes in Lean Manufacturing. (7 marks)
  - (b) A machine in the Bujang Lapok Manufacturing Sdn. Bhd. has experienced the following number of breakdowns for the past 24 months is tabulated in **Table Q2.1**. Each breakdown costs the firm an average of RM 2,800.00. A scheduled preventive maintenance approach has been proposed to resolve the problem. This new approach would cost RM 1,500.00 per month and the number of breakdowns is limited to an average of once per month.

**Table Q2.1:** Maintenance Record at Bujang Lapok Manufacturing Sdn. Bhd.

<b>Number of Breakdowns</b>	0	1	2	3	4	5
<b>Frequency of Breakdowns (months)</b>	2	4	6	4	3	5

- (i) Calculate the probability of breakdown. (3 marks)
- (ii) Calculate the expected number of breakdowns per month. (3 marks)

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- (iii) Determine the costs of breakdown maintenance per year. (2 marks)
- (iv) Determine the costs of preventive maintenance per year. (2 marks)
- (c) Total Productive Maintenance (TPM) is an approach offered to increase an industrial firm's effectiveness, as well as the performance of its equipment during its use in operations, by enlisting the full participation and interest of all of its employees. TPM is a deliberate strategy aimed at production enhancement that deals with the firm's infrastructure integrity and the efficient operation of plant resources through continual employee participation and empowerment in production, maintenance, and industrial performance. The TPM terminology's main goal is to reduce waste in various activities, lowering total costs by increasing productivity and producing high-quality products. By implementing TPM, the industry's maintenance activities and machine performance might be improved. However, it is also true that numerous industries have failed to successfully deploy TPM. The plan was created by outlining elements that contribute to the installation of TPMs being successful. Additionally, it will assist firms in developing a solid plan to implement TPM in various industries. The introduction of TPM represents a significant shift in the maintenance sector that calls for a shift in employees' perspectives. The positive workplace culture helps the industries to adopt TPM successfully. Using the successful models in the maintenance industry, it claims that these models will aid in enhancing employee comprehension of the TPM, which will result in the successful implementation of TPM.

There are various challenges that these businesses encounter when implementing TPM in their maintenance and production areas to boost the sector's productivity. The result concluded that TPM is extremely difficult to execute and burdens every department in the industry. Therefore, additional work needs to be done to help people realize the value of TPM and inspire them to adopt the new practice. The need for developing and implementing complete productive maintenance was the main issue in the manufacturing companies. TPM would lower production costs in an industry and lessen the frequency of sudden failures of automated and semi-automated equipment that force a significant industry shutdown. The performance costs associated with maintenance and the advantages of implementing TPM for an increase in the manufacturing performance of the sector were the main talking points. TPM improves the effectiveness of component manufacture. Therefore, in this fiercely competitive environment, TPM offers the best means to boost an organization's productivity and profits, and it also determines whether an industry succeeds or fails. Only the industry's adoption of TPM will make these things practicable. The working environment must be changed to one that is conducive to the adoption of TPM and provides employees with a hassle-free workplace to address the problematic conditions of TPM implementation in manufacturing companies. The top management must be knowledgeable about the application of TPM in various crucial situations and establish a plan for complete staff involvement and maintenance improvement to optimize production flow, raise product quality, and lower operational costs.

(Source: Z. Cserdi and Z. Kenesei, 2021)

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Referring to the text,

- (i) Identify **THREE (3)** main objectives of TPM. (3 marks)
- (ii) Outline the main cause of TPM failures. (4 marks)
- (iii) Analyse **TWO (2)** challenges in implementing TPM. (6 marks)
- (iv) Propose a potential approach to resolve the TPM issues. (4 marks)

- Q3**
- (a) Discuss **TWO (2)** characteristics of lean production with appropriate examples. (4 marks)
  - (b) Describe **TWO (2)** characteristics of continuous improvement or Kaizen. (4 marks)
  - (c) King Toys Company decided to manufacture a new toy drone, the production of which is broken into six tasks. The demand for the toy is 4800 units per 40-hour work week. **Table Q3.1** contains information on this product's task time and precedence relationships.

**Table Q3.1:** Product task time and precedence relationships

Task	Task time(seconds)	Immediate predecessor
A	20	-
B	30	A
C	10	A
D	10	A
E	20	B, C
F	30	D, E

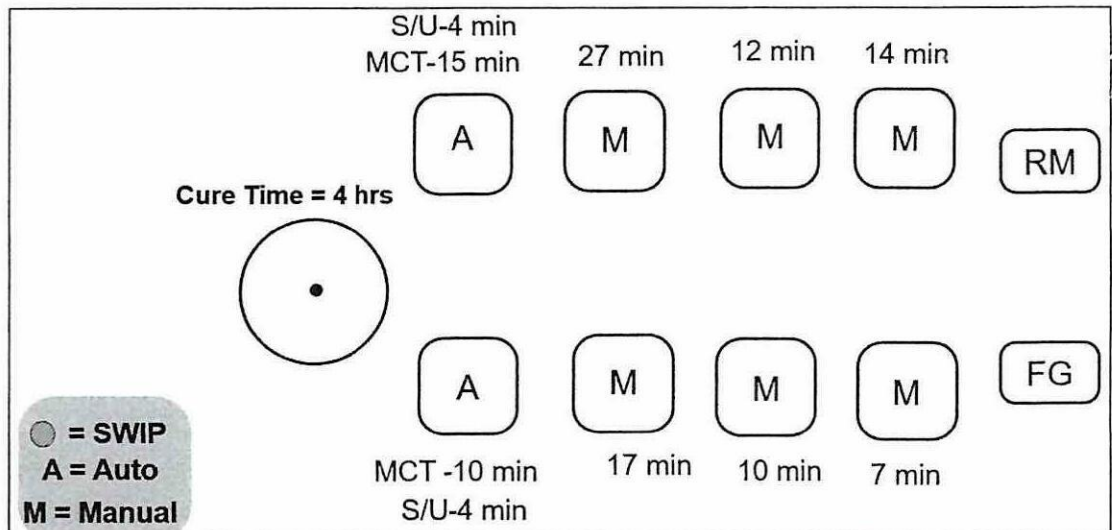
- (i) Construct the precedence diagram. (3 marks)
- (ii) Calculate the cycle time for the operation. (2 marks)
- (iii) Calculate the theoretical minimum number of workstations. (2 marks)
- (iv) Propose a balanced line of the production process. (8 marks)

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- (v) Determine the overall efficiency of the balanced assembly line. (2 marks)

- Q4** (a) Discuss **TWO (2)** elements of standard operations with appropriate examples. (4 marks)

- (b) *1 shift (10 hours)* *Requirements 300 per month*  
*Two breaks (15 minutes each)* *20 days per month*  
*One 30 minute lunch break*  
*One – 15 minutes crew meeting*  
*15 minutes of 5S activities at the end of the shift*



**Figure Q4.1:** Production Process Flow

Calculate details based on the information given in **Figure Q4.1:**

- (i) Net Operating Time (NOT) (2 marks)
- (ii) Takt Time (2 marks)
- (iii) Operator cycle time for the production process (2 marks)
- (iv) Number of operators required (2 marks)
- (v) Prepare Operator Work Sequence (4 marks)
- (vi) Construct a Bar Chart of cycle time (3 marks)

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- (c) In the field of design the safety to comfort of the workstations and the design of educational furniture for classrooms, ergonomics is the scientific disciplinary contents that refer to theories, methods, techniques, and tools for the design of items—material and virtual—with reference to their morphological features in their relationships with: the needs and behavior of users; productive, constructive, performance, security and quality features of the industrial systems; functional, ergonomic and economic, social and environmental sustainability requirements; visual languages, artistic practices, aesthetic and cultural meanings. The scientific contents refer to the theoretical and historic-critical status of the items and the specific forms of design thought as an interdisciplinary practice and a moment of synthesis for the various knowledge involved in the design of items in their life cycle, as well as the strategic reconfiguration of socio-technical scenarios and the configuration of new solutions through the application and transfer of technological innovations.

*(Source: Ergonomics Today, 2023)*

Outline ergonomic design principles to be applied to improve the safety and comfort of workstations and the design of educational furniture for classrooms.

(5 marks)

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- END OF QUESTIONS -