



**UNIVERSITY COLLEGE TATI (UC TATI)**

**FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE : BME 4033

COURSE : MANUFACTURING SYSTEM DESIGN

SEMESTER/SESSION : 1-2023/2024

DURATION : 3 HOURS

Instructions:

1. This booklet contains 5 questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO**

**THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE**

**Answer ALL questions.**

**QUESTION 1**

Single-station manufacturing cells constitute the most common manufacturing system in the industry. They operate independently of other workstations in the factory, although their activities are coordinated within the larger production system. Single-station manufacturing cells can be manned or automated. They are used for processing and assembly operations.

- a) **Identify** three (3) reasons why single-station manned cells are a widely used production method in the manufacturing industry. (6 Marks)
- b) **Summarize** the advantages of single-station automated cells in one single paragraph. (6 Marks)
- c) **Compare** single-station manned cells and single-station automated cells in terms of worker attendance, production rate and operation. (6 Marks)

## QUESTION 2

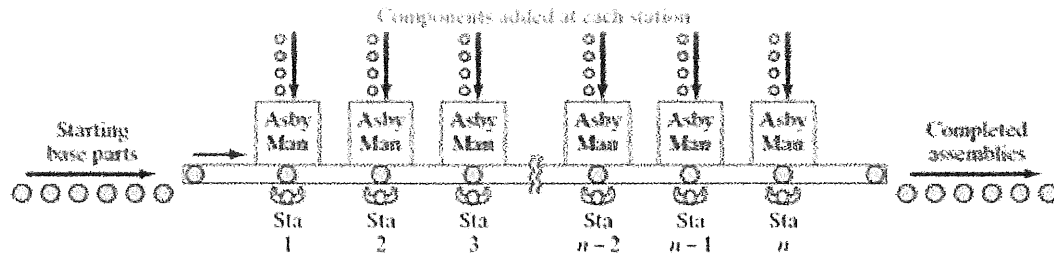


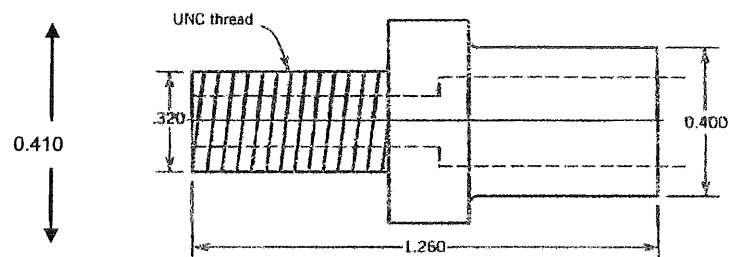
Figure 1

- a) Observe and **interpret** what is shown in Figure 1. (4 Marks)
- b) **Determine** typical operations performed on manual assembly line workers. (4 Marks)
- c) **Identify** three (3) types of mechanized work transport systems used in manual assembly lines. (6 Marks)
- d) **Illustrate** automated assembly lines that are commonly used in the manufacturing industry. (4 Marks)
- e) **Designate** two (2) possible line pacing options implemented by the manufacturing company. (8 Marks)

**QUESTION 3**

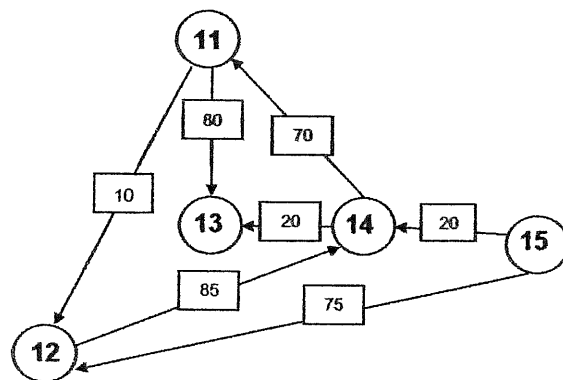
Hollier employs the use of data from "from-to" charts to effectively arrange machines and optimize the proportion of in-sequence parts within the cell.

- a) Given the rotational part design in Figure 2. By referring to Appendix 1, **determine** the suitable form code in the Opitz classification and coding system. (5 Marks)



**Figure 2: Part Design**

- b) Five machines will constitute a GT cell, as per Figure 3. By using the Hollier Method, **calculate** the percentage of in-sequence moves, bypassing moves and backtracking moves. (13 Marks)



**Figure 3: GT Cell for Five (5) Machines**

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**QUESTION 4**

A flexible manufacturing system (FMS) is a highly automated GT machine cell with one or more processing stations (typically CNC machine tools), interconnected by an automated material handling and storage system, and controlled by a distributed computer network.

- a) In your own words, **interpret** two (2) alternative approaches to FMS.

(6 Marks)

- b) Figure 4 depicts a manufacturing cell with automation, but is it a flexible manufacturing cell? **Evaluate** this circumstance by providing a thorough explanation.

(12 marks)

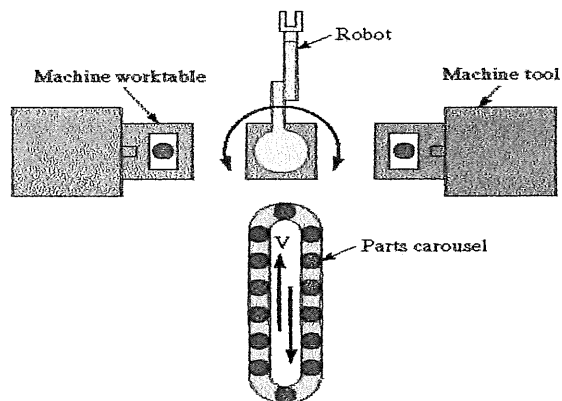


Figure 4: Automated Manufacturing Cell

**QUESTION 5**

As a production manager at Company "X", you are assigned to prepare a proposal regarding the conversion of conventional storage methods to an automated storage system. This system change needs to be implemented promptly to address issues related to the storage of work-in-process (WIP) in the warehouse. The following is a brief guide on the content of the proposal paper; **Identify** objectives and reasons for automating a company's storage operation, **illustrate** one (1) automated storage system, **distinguish** the three (3) application areas, and **justify** your selection to solve the WIP storage problems.

(20 Marks)

MANUFACTURING SYSTEM DESIGN (BME 4033)

APPENDIX 1

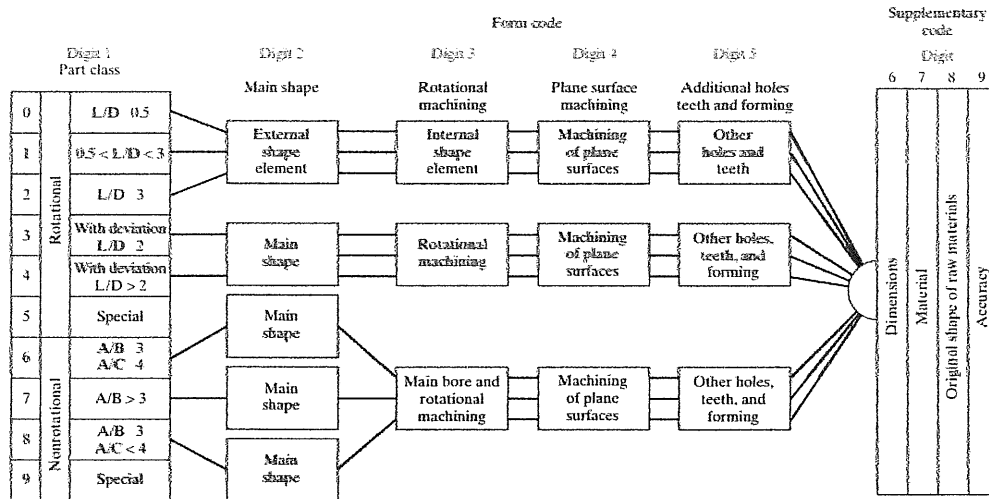


Figure 1: Basic Structure of the Opitz System of Parts Classification and Coding

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5
Part class	External shape, external shape elements	Internal shape, internal shape elements	Plane surface machining	Auxiliary holes and gear teeth
0	L/D 0.5	0	No hole, no breakthrough	0
Rotational parts	L/D 3	Smooth or stepped to one end	No shape elements	1
				1
				2
				3
Nonrotational parts	Thread	Thread	Thread	1
				2
				3
				4
Nonrotational parts	Functional groove	Functional groove	Functional groove	1
				2
				3
				4
Nonrotational parts	No shape elements	No shape elements	No shape elements	1
				2
				3
				4
Nonrotational parts	Thread	Thread	Thread	1
				2
				3
				4
Nonrotational parts	Functional groove	Functional groove	Functional groove	1
				2
				3
				4
Nonrotational parts	Functional cone	Functional cone	Functional cone	1
				2
				3
				4
Nonrotational parts	Operating thread	Operating thread	Operating thread	1
				2
				3
				4
Nonrotational parts	All others	All others	All others	1
				2
				3
				4

Figure 2: Form Code (Digits 1 through 5) for Rotational Parts in the Opitz Coding System. The First Digit of the Code is Limited to Values 0, 1, or 2.

-----End of Questions -----

