



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF TECHNICAL & ENGINEERING EDUCATION & TRAINING

Bachelor of Education Honours Degree in Mechanical Engineering

MANUFACTURING SYSTEMS

PTE 4249

SECOND SEMESTER EXAMINATION

MAY 2019

This examination paper consists of 4 pages

Time Allowed: 3 hours
Total Marks: 100
Special Requirements: None
Examiner's Name: Eng. T R Chikowore

INSTRUCTIONS AND INFORMATION TO CANDIDATE

1. Answer any four (4) questions
2. Each question carries 25 marks
3. Graph Paper

Question 1

- a) There are 5 generic production processes. Using the Product-Process matrix describe each process. [15]
- b) List and explain the implications of each process choice to the business. [10]

Question 2

- a) Using examples to aid your answer explain the following terms:
 - i) Machine centres, [2]
 - ii) Mixed mode assembly. [2]
- b) With the aid of appropriate diagrams, explain the following layouts:
 - i) Process layout, [5]
 - ii) Product layout, [5]
 - iii) Cellular layout [5]
- c) A manufacturing company has been operational since 1980. Management is now considering layout redesign as way of improving productivity. Outline three challenges that the company might face and suggest ways management might overcome these. [6]

Question 3

- a) Outline five advantages of systematic layout planning (SLP). [5]
- b) Explain what is meant by buffer storage and outline its importance in manufacturing. [5]
- c) The new Health-care facility is targeted to serve seven census tracts in Midlands. Table Q3 shows the coordinate location of each census tract, along with the projected populations, measured in thousands. Customers will travel from the seven census tract centres to the new facility when they need health-care. Two locations A and B being considered for the new facility are located at (5.5, 4.5) and (7, 2) respectively.
 - i) Using the Centre of Gravity method, find the best location for the Health-care facility. [10]
 - ii) Sketch the graph to show the best location of the healthcare facility relative to each census tract. [5]

Table Q3: Census Tract Details

Census Tract	Location (X,Y)	Population
1	(2.5, 4.5)	2
2	(2.5, 2.5)	5
3	(5.5, 4.5)	10
4	(5.0, 2.0)	7
5	(8.0, 5.0)	10
6	(7.0, 2.0)	20
7	(9.0, 2.5)	14

Question 4

- a) A 20-station transfer line is being proposed to machine a certain component currently produced by conventional methods. The proposal received from the machine tool builder states that the line will operate at a production rate of 50 pc/hr at 100% efficiency. From similar transfer lines, it is estimated that breakdowns of all types will occur with a frequency $F = 0.10$ breakdown per cycle and that the average downtime per line stop will be 8.0 min. The starting casting that is machined on the line costs \$3.00 per part. The line operates at a cost of \$75.00/hr. The 20 cutting tools (one tool per station) last for 50 parts each, and the average cost per tool = \$2.00 per cutting edge. Based on this data, compute the following:
- i) Production rate, [8]
 - ii) Line efficiency, and [3]
 - iii) Cost-per unit piece produced on the line. [5]
- b) Give brief explanations of the following three methods of work transportation:
- i) Synchronous transfer [3]
 - ii) Asynchronous transfer [3]
 - iii) Continuous transfer [3]

Question 5

An assembly line consists of eight work elements as shown in Table Q5. Assuming a cycle time of 20 minutes, you are required to design a well-balanced assembly line.

Table 5: Task data for Question 5

	Processing time (minutes)	Immediate Predecessor
1	11	-
2	8	1
3	9	2
4	5	2
5	8	3
6	12	3,4
7	10	5
8	3	6

- a) Use the Largest candidate rule to balance the line. [11]
- b) Use the Kilbridge and Westers method to balance the line. [11]
- c) Suggest the best method between the two. Give reasons for your choice. [3]

END OF EXAMINATION