



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

FIFTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

EMM 505: MANUFACTURING SYSTEMS DESIGN

DATE: 13/8/2021

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer question ONE and any other two questions.

QUESTION ONE (30 MARKS)

- a) Differentiate manufacturing systems from production systems (2 marks)
- b) Manufacturing systems are divided into three categories, according to worker participation. Briefly describe the three categories. (6 marks)
- c) Computers may be seen as machines that automatically process information, as do automated production machines process materials. Discuss a possible definition of manufacturing as “the processing of information and materials for the efficient (profitable) fabrication and assembly of products.” (7 marks)
- d) With the help of sketches briefly describe the THREE types of system configurations in an automated production line (6 marks)
- e) A transfer machine with 12 stations has an ideal cycle time of 39 seconds. The frequency of line stops is 0.085 stops per cycle. When a line stop occurs, the average downtime is 5.5 minutes. Determine;
 - i. The average production rate in parts per hour (3 marks)
 - ii. Line efficiency (3 marks)
 - iii. Proportion downtime (3 marks)

QUESTION TWO (20 MARKS)

- a) Briefly describe the term organization as used in manufacturing system design (2 marks)
- b) Discuss any Four principles of organization (8 marks)
- c) Within the arena of manufacturing, a number of new approaches have revolutionized thinking toward designing and controlling manufacturing organizations. Describe the following Japanese philosophies and how they have been deployed to improve the performance of organizations elsewhere.
 - i. Kaizen (5 marks)
 - ii. Kanban (5 marks)

QUESTION THREE (20 MARKS)

- a) With the help of well labeled sketches, differentiate between flexible manufacturing and a manufacturing cell. (4 marks)
- b) Briefly describe the three types of machine cells as used in Manufacturing system design (6 marks)
- c) Trace the evolution of manufacturing systems with emphasis in the scientific management and contributions made by management thinkers (6 marks)
 - i. Define the term automation migration strategy in a manufacturing systems (1 mark)
 - ii. Explain the three phases of a typical automation migration strategy (3 marks)

QUESTION FOUR (20 MARKS)

- a) Define the term plant layout (1 mark)
- b) Briefly explain the significance of plant layout optimization (4 marks)
- c) With the help of diagrams describe the following types of plant layouts
 - i. Process layout (3 marks)
 - ii. Product layout (3 marks)
 - iii. Group technology layout (3 marks)
- d) Design a facility layout for establishing a new mango, and oranges processing plant in Kalamba locality within Makueni County. Take into consideration the seasonal yields, small scale farms, increasing demand in the commodity alternative uses (6 marks)

QUESTION FIVE (20 MARKS)

- a) With emphasis in ergonomics and anthropometrics, explain the steps in workstation design (6 marks)
- b) Briefly describe the following terms as used design product layouts
- i. Line balancing (1 mark)
 - ii. Cycle time (1 mark)
 - iii. Forecasting (1 mark)
- c) Following your recruitment in a new company, the first task is to set up an electric fan assembly line with the following tasks as shown in Table Qn 5 (b)

Table Qn. 5 (b)

Task	Time (Mins)	Description	Predecessors
A	2	Assembly frame	None
B	1	Mount switch	A
C	3.25	Assemble motor housing	None
D	1.2	Mount Motor housing in frame	A, C
E	0.5	Attach blade	D
F	1	Assemble and attach safety grill	E
G	1	Attach cord	B
H	1.4	Test	F, G

- i. Draw a precedence diagram to display elemental tasks and sequence requirements (5 marks)
- ii. Determine the cycle time (3 marks)
- iii. Calculate the production rate for the production line (3 marks)