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 507: PLANT FACILITIES DESIGN

DATE: 11/8/2021 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

Answer question ONE and any other two questions.

QUESTION ONE (30 MARKS)

a) Define the following terms

i. Workstation (1 mark)
ii. Time standard (1 mark)
iii. Master plan (1 mark)
iv. Anthropometry (1 mark)
v. Material handling (1 mark)

b) Consider parts A, B, C and D which are to be manufactured using machines 1, 2, 3, 4, 5, 6 and 7. The routing sequence of each part is shown in Table Q1(b).

i. Sketch a multi-column process chart for the four parts and calculate its efficiency (5 marks)

ii. Optimize the multi-column process chart sketched in the previous question and calculate the new efficiency (5 marks)

Table Q1(b)

Part Number	Weight	Routing Sequence
A	1	1253647
B	3	13257
C	5	145367
D	4	12437

c) Since space is costly, facilities design engineer needs to promote effective use of the space. Other than floor space, identify **THREE** other spaces available to facilities design engineer and discuss how they can be utilised (3 marks)

d) Imagine that a Japanese investor wants to set up a motorcycle manufacturing plant in Machakos County. Explain **THREE** factors that you think may have influenced his decision to set up the plant in Machakos County. (3 marks)

e) Differentiate between ballistic and continuous hand motions and provide **ONE** example of each type of motion (3 marks)

f) Differentiate between simulation and modelling with regards to plant facilities design (2 marks)

g) Discuss **FOUR** goals of a good plant layout (4 marks)

QUESTION TWO (20 MARKS)

a) As a plant facilities designer, you may be called upon to undertake **FIVE** different types of plant design projects. Discuss the nature of these projects (10 marks)

b) i The design of the production department of a plant begins with the design of a workstation. Highlight **SIX** items that MUST be included in the design of any workstation. (3 marks)

ii. Gravity is free power and a plant facilities designer is encouraged to use gravity as much as possible in the design of a workstation. Explain **TWO** ways in which you can employ gravity to design a workstation (2 marks)

c) Receiving and shipping are two separate departments, but they have very similar people, equipment, and space requirements. Contrast the two departments by highlighting FIVE differences in their functions (5 marks)

QUESTION THREE (20 MARKS)

a) It is crucial to design a functional plant layout right from the onset since modifying an ineffective layout is quite expensive. Name **SIX** problems that might arise if the process goes wrong (3 marks)

b) i. Using appropriate sketches, differentiate between process and product plant layouts and provide one example of a product that can be manufactured using each layout (6 marks)

ii. Explain **FIVE** advantages of using a product layout over a process layout (5 marks)

c) i. Under which circumstances is a fixed-position layout used? (1 mark)

ii. While a fixed-position layout can provide many advantages, there are several drawbacks associated with employing this layout. Highlight **FIVE** of such problems (5 marks)

QUESTION FOUR (20 MARKS)

Imagine that you are a plant facility engineer of a vehicle assembling plant and you have been tasked to formulate a material handling plan for the company

a) Discuss **FIVE** principles that you would adopt for your material handling plan (10 marks)

b) Discuss **FOUR** factors that you would consider before selecting suitable material handling equipment for the plant (8 marks)

c) List two types of material handling equipment that you would select and explain why you would select them (2 marks)

QUESTION FIVE (20 MARKS)

a) Explain **FOUR** benefits that the use of simulation and modeling has brought to the design of plant facilities (4 marks)

b) Simulation of plant design models can be done for a variety of reasons. Name and briefly explain **SIX** of these reasons (12 marks)

c) Discuss **FOUR** factors that may necessitate a plant location strategy (4 marks)