



**Answer all the following questions:**

**Question 1 (30 marks)**

The following are Multiple Choice Questions. Read the questions carefully and select the most appropriate answer for each question (Choose only **ONE** answer).

1. The efficiency ratio must be larger than the utilization ratio because
  - a) Effective capacity is larger than design capacity.
  - b) Actual output is larger than effective capacity.
  - c) Design capacity is larger than effective capacity.
  - d) Actual output is larger than design capacity.
2. The advantages of a process layout may include:
  - a) its flexibility
  - b) its low cost
  - c) its high equipment utilization
  - d) both (a) and (b)
3. A philosophy of continually seeking ways to improve operations is called
  - a) poka-yoke
  - b) kaizen
  - c) robustness
  - d) none of the above
4. In which one of the following types of layout the equipment, material, and people are moved as required?
  - a) Product layout
  - b) Fixed position layout
  - c) Process layout
  - d) Flexible layout
5. Which one of the following statements about cycle time is NOT correct?
  - a) It represents daily operating time divided by desired production
  - b) It is the maximum allowable time at each work station
  - c) It is the time required to complete a product from start to finish
  - d) Both (a) and (b)
6. A systems approach means that we concentrate on efficiency within subsystems and in that way the overall efficiency is guaranteed.
  - a) True
  - b) False
7. A company produces several different colors of a product on a single production line. It used to take several hours to switch colors but now it has found a way to prepare for changing colors in a few minutes. This was most likely accomplished by
  - a) line balancing
  - b) implementing Andon lights
  - c) converting internal setups to external
  - d) converting external setups to internal
8. The term that relates to matching the output rate with customer demand in a JIT system is:
  - a) kanban
  - b) takt time
  - c) pull system
  - d) push system
9. Which of the following is not a characteristic of service operations ?
  - a) intangible output
  - b) high degree of labor content
  - c) low uniformity of output
  - d) none of the above
10. A production line is to be designed for a job with four tasks. The task times are 0.5 minutes, 1.5 minutes, 2.1 minutes, and 0.3 minutes. The maximum cycle time and the minimum cycle time equal.
  - a) 2.1 and 0.3, respectively.
  - b) 4.4 and 0.3, respectively.
  - c) 4.4 and 2.1, respectively.
  - d) none of these

## Question 2 (25 marks)

- a) The utilization of a machine is 50%. The machine has a design capacity of 70 units per hour and an effective capacity of 60 units per hour. Find the efficiency of the machine. [2 marks]
- b) Compare goods production and service operations with respect to measurement of productivity and ability to patent. [2 marks]
- d) Discuss the assumptions of the locational selection using Cost-Profit-Volume analysis [2 marks]
- e) What are the limitations of the center of gravity as method for locating a distribution center? [2 marks]
- f) A location analysis has been narrowed down to two locations, X and Y. The main factors in the decision will be the supply of raw materials, which has a weight of 0.5, transportation cost, which has a weight of 0.4, and labor cost, which has a weight of 0.1. The scores for raw materials, transportation, and labor are 60, 80, and 70, respectively for X; and 70, 50, and 90, respectively for Y. Given this information, which location do you recommend? [3 marks]
- g) Briefly discuss each of the following: craft production, jidoka, agility, Sustainability [8 marks]
- h) Identify the seven wastes that should be controlled in order to apply the lean concepts in manufacturing and explain the 5S approach for workplace organization. [6 marks]

## Question 3 ( 20 marks)

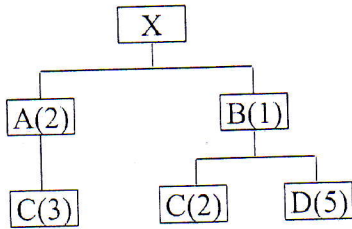
A company is designing an assembly line for a new product. The target is to produce 500 units per day within an 8 hour shift. The tasks necessary to produce this product are detailed in the table below.

Task	Immediate Predecessor	Task Time (in seconds)
A	---	15
B	A	23
C	B	17
D	B	42
E	B	15
F	C	37
G	D, E	5
H	F, G	12
I	H	34
J	H	27
K	I, J	18
L	K	7

- a) Determine the minimum number of workstations required. [2 marks]
- b) Draw the precedence diagram . [2 marks]
- c) Balance the line using the longest processing time heuristic. Use the greatest number of following tasks as a tiebreaker. If ties still exist, assume indifference in choice. [10 marks]
- d) Compute the balance delay. [2 marks]
- e) If the company decided to increase its production rate to 550 units per day, would the developed line balance stay valid? What is upper limit for the units that can be produced using the developed solution? [4 marks]

### Question 4 (25 marks)

- a) In this course, the Keynote paper entitled "Reconfigurable Manufacturing Systems" by Korn, Y., *et al.*; published in the Annals of the CIRP, Vol. 48/2/1999 has been assigned for reading and discussion. Considering this paper, answer the following:
- Compare between the dedicated and flexible manufacturing systems and highlight their main limitations. [4 marks]
  - Define a Reconfigurable Manufacturing System (RMS), discuss the technologies enabling reconfiguration and identify the key Characteristics of an RMS? [6 marks]
- b) Consider the bill of material for product X and the data given in the following table. The gross requirements include 95 units of X in week 10.



Item	On-Hand	Lead Time (Weeks)
X	50	2
A	75	3
B	25	1
C	10	2
D	20	2

- Construct the assembly time chart for product X. [2 marks]
- Develop the MRP tables for item D using the lot-for-lot lot-sizing rule. [9 marks]
- How many Cs are needed (just calculate the number- no MRP table is needed)? [4 marks]

===== End of Questions =====

*With my best wishes*  
*Dr. Omayma Nada*

This exam measures the following ILOs									
Question Number	Q1	Q1 Q2-b,g,h	Q4-a Q2 d, e	Q1 Q3-b	Q3-a	Q4-c	Q3 Q4-b	Q3	Q4-b
	a1-1	a1-2	a3-1	b1-1	b2-1	b2-2	c1-1	c1-2	c2-1
Skills	Knowledge & Understanding Skills			Intellectual Skills			Professional Skills		