

**National Exams December 2016**

**07-Mec-B4, Integrated Manufacturing Systems**

3 hours duration

**Notes:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is an OPEN BOOK exam. Any non-communicating calculator is permitted.
3. Any five (5) questions constitute a complete paper. Only the first five (5) questions as they appear in your answer book will be marked.
4. All questions are of equal value.
5. Some questions require an answer in essay format. Clarity and organization of the answer are important.

1. A manufacturing concern has four departments, and the flow between combinations of departments is as follows:

From	To			
	A	B	C	D
A		2		2
B	2		4	
C		3		1
D	2		1	

- a) Using the operation sequence analysis technique, how should the departments be arranged?
- b) Now suppose that the area requirements are as follows:

Department A – 3600 sq. ft.

Department B – 2400 sq. ft.

Department C – 2400 sq. ft.

Department D – 1600 sq. ft.

Sketch the block diagram based on your answer in part a.

2. a) What are some of the objectives of materials handling?
- b) What should an effective inventory control system accomplish? What vital areas should be considered in developing a comprehensive control system?
- c) List some factors which influence the selection of a forecasting model.
3. a) Discuss a manufacturing situation in which centralized inspection would be particularly desirable.
- b) In what ways may the use of data processing equipment and computers be of value in the quality control program?

c) In what way can statistical quality control aid in promoting the understanding and appreciation of quality control?

4. a) The annual amount ordered from one raw material supplier is \$260,000. Order costs are 1% of the value of each order, and carrying costs are 18% of the average inventory level. How many weeks of supplies should be ordered at one time?

b) Parts used in assembly work are purchased from a supplier who has a remarkable record for prompt delivery. The inventory history closely follows an instantaneous replenishment pattern. However, to be on the safe side, a policy is followed of never planning an inventory level below 500 parts. The following costs are applicable:

procurement cost = \$60.00 per order

carrying cost = \$0.20 per unit per year based on an average inventory

If the demand is 40,000 parts per year used at a steady rate, what is the total annual inventory cost?

5. The following matrix specifies the usage of machines  $M_1$ ,  $M_2$ ,  $M_3$ , and  $M_4$  by four different part types  $p_1$ ,  $p_2$ ,  $p_3$  and  $p_4$  in a system. The entry corresponding to  $p_i$  and  $M_j$  ( $i, j = 1,2,3,4$ ) is equal to 1 if  $p_i$  requires  $M_j$  for a particular operation and 0 otherwise.

$$\begin{vmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{vmatrix}$$

There is one machine of each type in the above system. It is required to obtain a group technology layout with two cells for the above system. Suggest an appropriate cellular layout. Note that shuffling of the rows and columns will help. Can you devise general algorithms for obtaining cellular layouts from a matrix specification such as above?

6. a) Discuss in greater detail why the volume to be produced has little effect on the design and operation of a system of production planning and control.

b) Assume you are organizing a small plant for the manufacture of flashlights. How many of the different types of orders would you use? Explain your use of each type.

c) Compare the advantages of centralized dispatching with those of decentralized dispatching.