

**National Exams May 2014**

**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 questions constitute a complete paper. Only the first five (5) questions as they appear in your answer book will be marked.
4. Each question is of equal value.
5. Some questions require an answer in essay format. Clarity and organization of the answer are important.

**Question 1:**

Given the following ten continuous time observations (time in hundredths of minutes) for five work elements:

Cycle #	Element #				
	1	2	3	4	5
1	23	36	52	62	74
2	94	108	129	139	150
3	171	187	205	214	224
4	243	258	275	285	298
5	320	335	353	362	374
6	393	406	425	437	448
7	469	485	502	511	524
8	547	564	582	593	605
9	625	641	660	670	681
10	704	721	741	750	763

- a. Compute the average time.
- b. Compute the normal time.
- c. Compute the standard time.
- d. Compute the number of cycles to observe given a 95 percent confidence level and an acceptable error.

**Question 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?

**Question 3:**

- a) The cost of producing between 1,500 units and 2,500 units of a product consists of \$25,000 fixed cost and \$10-per-unit variable cost. With the selling price at \$20 per unit, what is the break-even point? Suppose the price per unit was increased to \$25. How does this affect the break-even point?
- b) A new machine has a cost of \$24,000, an estimated economic life of eight years, and a salvage value of \$4,000 at the end of the eight-year period. Assume that the annual operating costs will be \$3,000 per year and the going rate of interest is 10 percent. What is the present value of new expenditures for the machine?

**Question 4:**

The requirements for a motor drive unit to be assembled into a dictating machine follow the assembly schedule for the completed unit. The assembly schedule requires motor drive units with the timing shown in Table 1. Other data for the motor drive unit are: average requirements are  $\bar{R} = 116.7$  units per week,  $c_p = \$400$  per lot, and  $c_r = \$4$  per unit per week. What is the inventory record and total incremental cost under each of the following lot size policies?

- a) Economic lot size  
 b) Economic periodic reorder model  
 c) Part-period total cost balancing

**TABLE 1**  
**Requirements Schedule for a Motor Drive Unit**

Week number	1	2	3	4	5	6	7	8	9	10	11	12
Requirements, units	25	30	75	125	200	325	400	100	0	100	0	100

Total requirements for 12 weeks, 1390 units.

**Question 5:**

A time study was made of an existing job to develop new time standards. A worker was observed for a period of 45 minutes. During that period, 30 units were produced. The analyst rated the worker as performing at a 90 percent performance rate. Allowances in the firm for rest and personal time are 12 percent.

- a. What is the normal time for the task?
- b. What is the standard time for the task?
- c. If the worker produced 300 units in an eight-hour day, what would his/her day's pay be if the basic rate was \$6.00 per hour and the premium payment system paid on a 100 percent basis?

**Question 6:**

A large manufacturer of watches makes some parts and buys some other parts from a vendor. The vendor submits lots of parts that meet the specifications of the horologist. The vendor thus wishes to keep a continuous check on production of watch parts. One gear has been a special problem. A check of 25 samples of 5 pieces gave the following data on a key dimension:

$$\bar{X} = 0.125 \text{ inch}$$

$$R = 0.002 \text{ inch}$$

What criterion should be set up to determine when the process is out of control? How should this criterion compare with the specifications? What are the alternatives if the criterion is not compatible with the specification?

**Question 7:**

- 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 computer 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?

**Question 8:**

- a) Discuss the advantages of a Computer Aided Process Planning (CAPP) system
- b) Discuss the various levels of coding of parts in a computer integrated manufacturing system
- c) Discuss the main stages in a Computer Aided Design (CAD) system