National Exams December 2017

16-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) Distinguish between pure and mixed strategies in production planning.

   b) What are the general conditions for which preventative maintenance is appropriate?

   c) What are the categories of forecasting techniques? Generally, how do they differ from each other?

2. a) A line is defined by its end points (0,0) and (2,3) in a two- dimensional graphics system. Express the line in matrix notation and perform the following transformations on this line:
   - i) Scale the line by a factor of 2.0
   - ii) Scale the original line by a factor of 3.0 in the x-direction and 2.0 in the y-direction
   - iii) Rotate the original line by 45° about the origin
   - iv) Translate the original line by 2.0 units in the x-direction and 2.0 units in the y-direction

   b) A line in two-dimensional space has end points defined by (1,1) and (1,3). It is desired to move this line by a series of transformations so that its end points will be at (0,1) and (0,5).

   i) Describe the sequence of transformations required to accomplish the movement of the line as specified.

   ii) For each transformation in the sequence, write the transformation matrix.

3. 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 R = 116.7 units per week, c_p = \$400 per lot, and c_H = \$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

4. The transportation and processing costs for the three final candidate locations for a manufacturing plan are roughly equal. The critical qualitative factors have received the following weights and evaluation scores on a 5-point scale (5 = excellent) from the site selection committee. Select the best site on the basis of the weighted scores.

Factor	Weight	Location		
		A	B	C
Labour supply	0.02	5	4	4
Labour relations	0.03	3	4	5
Supporting services	0.25	5	3	3
Waste disposal	0.15	4	4	4
Community attitude	0.10	5	4	3

5. a) What re the advantages of CAD systems over traditional methods of design. Are there any limitations?

   b) Describe the purposes of process planning. How are computers used in such planning?

   c) Explain the features of two types of CAPP systems?

   d) Describe the features of a routing sheet. Why is it necessary?

   e) What is group technology? Why was it developed? Explain its advantages.

6. a) The specifications on the diameter of a wrist Pin are 1.000 inch ± 0.002 inch. Twenty samples five pins show the average to be 1.001 inches and the average of the twenty ranges to be 0.002 inch. Are the specifications capable of being met by the process that makes the wrist pins? What assumption is necessary?

   b) The head of an automobile engine must be machined so that both the surface that meets the engine block and the surface that meets the valve covers are flat. These surfaces must also be 4.875 inches ± 0.001 inch apart.
   Presuming that the valve cover side of the head is finished correctly, compare the capability of two processes for performing the finishing of the engine block side of the head. A broach set up to do the job gave an average thickness of 4.877 inches with an average range of 0.0005 inch for 25 samples of 4 each. A milling machine gave an average of 4.875 inches and average range of 0.001 inch for 20 samples of 4 each.

7. A large number of semiautomatic machines produce identical products. Time studies reveal the following time in minutes for one man to service one machine:

Load machine	3.1
Remove finished product	0.6
Inspect finished product	2.4
Pack finished product	1.9
Walk to next machine	0.4

The machine takes 41.3 minutes to produce a finished product. Machine operators are paid $4.90 per hour and the burden rate for the machine is $18.00 per hour. What is the lowest cost per unit to produce the product with the optimum ratio of men to machines?