National Exams May 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) What is the "Semi-Generative Approach" to process planning? How does it overcome the problems encountered in a fully generative process plan?

2) An on-line manufacturing work cell performs a series of four quality control tests on a manufactured product. Design a PLC (Programmable Logic Controller) that will simultaneously examine the results of all four tests and decide into which of the three output containers the piece will drop. A, B, C and D are identified as four tests. Bins 1, 2, and 3 are classified as outputs. A conveyer is used to move the part between the four inspection spots. It stops for 100 sec at each spot for an inspection to be carried out before moving to the next stop. The motor for the belt is started by a normally open start switch and stopped by a normally closed switch. If the product passes either two or three tests, bin 1 will receive the part. If it passes one of the tests, Bin 2 will be open. Bin 3 accepts perfect units only.

3) What approach would you use to calculate EOQ's (Economic ordering quantity) for

   a) 50 items shipped weekly to a branch warehouse?

   b) A highly seasonal item?

   c) A part purchased as a casting, put in raw material inventory, machined in an automatic chucking machine, held in a semi-finished component inventory, finished in milling and grinding machines, kept in finished component inventory and used continuously on an assembly line?

4) a) A lightweight component in an electrical assembly has a reliability of 0.70. Provision of two redundant units can be tolerated with no appreciable effect on weight specifications. If two redundant units of the same component are installed, what will be the compound reliability of the three?

   b) An assembly, through specification, can be reduced from six components to three components. The reliability of each of the six components is 0.98. Presuming no change in component reliabilities, what would be the change in the assembly reliability with reduction of components?

5) a) Define a generative process planning system.

   b) What are the objectives of a machinability data system?

   c) What are the benefits of computer-aided process planning?

6) The historical demand for a product is:

January, 80
February, 100
March, 60
April, 80
May, 90

a) Using a simple four-month moving average, what is the forecast for June? If June experienced a demand of 100, what would your forecast be for July?

b) Using single exponential smoothing with $\alpha = 0.20$, if the forecast for January had been 70, compute what the exponentially smoothed forecast would have been for the remaining months through June.

c) Using least squares regression analysis, compute a forecast for June, July, and August.

d) Using a weighted moving average with weights of 0.30, 0.25, 0.20, 0.15 and 0.10, what is June's forecast?