

## National Exams December 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:**

- (a) After inspection of 750 manufactured parts, it is found they fall into a normal distribution. How many parts will be within plus or minus three sigma?
- (b) In constructing an average-and-range chart, the grand average was computed to be 8.502 in. and the range average was 0.008 in. What would the upper and lower control limits be if the sample size were four? What would the upper limit be on the range chart?

**Question 2:**

- (a) What are some common reasons and justifications for applying computer technology in the generation of process plans?
- (b) Compare and contrast the features of a variant and a generative type of computer-aided process planning system. How are they alike and how are they different?
- (c) What type of process planning system might be appropriate for a small job shop with only a few numerically controlled machines and several manual machines?

**Question 3:**

- (a) A job can be set up on a standard jig boring machine in 1 hour. Each piece takes 6 hours for boring. If the job is done on a tape-controlled jig boring machine, 2 hours is needed for programming in the office. Then each piece can be bored in 5 hours. The shop rate is \$24/hr on the standard jig borer and \$28/hr on the numerically controlled jig borer. Office work costs \$18/hr. When is the numerically controlled machine justified?
- (b) A cast-iron compressor body requires 152 operations consisting of 50 holes drilled, 12 bored, 38 co-sunk, 36 tapped, and 16 surfaces milled. These operations can be done on NC machining centres in 1 hr/piece at a rate of \$40/hr. Programming and setup costs are negligible. Conventional machines may be tooled for the job at a cost of \$300,000. The annual charge for the tools is \$130,000, and the rate on the machines is \$24/hr, including labor and overhead. It is estimated that about 1 hour will be required per piece by this method. A transfer machine to produce 188 pieces/hr will cost \$1,800,000 with an annual charge of \$800,000. Labor and overhead rate is \$16/hr. For what quantities is each method suitable?

**Question 4:**

- (a) What are 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? What was it developed? Explain its advantages.

**Question 5:**

Develop an inventory control system for a new product just starting production when the following information is given:

- a) Production economic lot size is 1000 units.
- b) Production rate (supplied daily to inventory) is 50 units per day.
- c) Usage rate is 20 units per day
- d) Production start up takes  $10 \pm 5$  days after an order is placed.
- e) Annual cost of storing 1 unit is \$5.00
- f) Production cost of product is \$15.00
- g) 240 production and sales days per year.

**Question 6:**

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 a raw material inventory, machined in an automatic chucking machine, held in semi-finished component inventory, finished in milling and grinding machines, kept in finished component inventory and used continuously on an assembly line?

**Question 7:**

- 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?