National Exams May 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) A company buys 30,000 parts/year at a unit price of $10. If it costs $20 to process a purchase order, and interest and storage charges total 20 percent, what is the approximate economic order quantity?

   b) How do practical inventory control systems take account of uncertainties in demand, lead times, production rates, etc.?

   c) What difference does the type of information feedback make in an inventory control system?

   d) What is the value of classifying production-inventory systems on the basis of whether or not the system is producing for inventory?

2. The inside diameter of 20 rings was measured at the same location by each of the four inspectors using two types of bore gages. The *total* tolerance on the dimension was 0.0007 or 7.0 in units of ten-thousandths of an inch. Variability due to various causes was calculated in terms of 6 standard deviations and is summarized below:

Source	Variability
Product	4.6
Air Gage	1.1
Mechanical Gage	4.4
Inspector A	4.3
B	3.7
C	5.1
D	9.3

   a) Calculate the observed variability with the *best* combination of product gage and inspector. What percent of rings will be rejected in the long run?

   b) Calculate the observed variability with the *worst* combination of product, gage and inspector. What percent of rings will be rejected in the long run?

3. a) The time between failures (TBF) for a certain assembly is exponentially distributed with a mean of 100 hours. Suppose the TBF had been normally distributed with a mean of 100 hours and standard deviation of 20 hours. What value of mission time (TBF) based on the exponential would have the same reliability as a 100-hour mission time based on normality?

    b) It is expected that the average time to repair a failure on a certain product is 4 hours. Assume that repair time is exponentially distributed. What is the chance that the time for a repair will be between 3 and 5 hours?

4. a) What common components of demand do we wish to take into account in a forecasting system for operations?

    b) What is the general structure of adaptive forecasting systems?

    c) How is economic forecasting different from regression analysis?

5. a) An instrument has been used to measure the length of a part. The result was 2.638 inches. An error of measurement study was made on the instrument with the following results:

Accuracy: +0.001 inch (on the average, the instrument reads 0.001 inch high)
Precision: 0.0004 inch (1 standard deviation)

Make a statement concerning the true value of the part just measured. State all assumptions needed.

    b) The precision of a certain mechanical gage is indicated by a standard deviation (of individual repeat measurements) of 0.001 inch. Investigate the effect on precision of making multiple measurements. Consider 2, 3, 4, 5, 10, 20 and 30 as multiples. Graph the results.

6. 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?