National Examinations December 2014
98-Ind-B2-Manufacturing Processes
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 a Closed Book exam. Candidates may use one of two calculators, the Casio or Sharp approved models.

3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.

4. All questions are of equal value.

5. Write your answers in point-form whenever possible, but fully. Show all the calculations.

Marking Scheme (marks)

1.	(i) 7,	(ii) 7,	(iii) 6
2.	(i) 8,	(ii) 7,	(iii) 5
3.	(i) 8,	(ii) 5,	(iii) 7
4.	(i) 7,	(ii) 6,	(iii) 7
5.	(i) 7,	(ii) 6,	(iii) 7
6.	(i) 7,	(ii) 7,	(iii) 6
7.	(i) 5,	(ii) 5,	(iii) 10

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1. (i) Explain the major responsibilities of manufacturing engineers in the manufacture of a product. How do they cooperate with industrial engineering when plant floor activities are concerned?
   (ii) What are the factors considered in the selection of engineering materials for manufacturing?
   (iii) State your understanding of the annealing process. What is the purpose of the annealing process?

2. (i) State the important factors that must be considered in casting operations. Explain the reasons for using casting processes over other manufacturing methods. (ii) What is a shell molding process? State the advantages and disadvantages of this process. (iii) What are the advantages and limitations of permanent molds casting processes (die, centrifugal, etc.)?

3. (i) It is required to drill a 2½" diameter hole through a 4½" thick, soft cast iron machine part, with high speed drill bit. The following data are obtained from the machinist handbook:
   Drill bit point angle = 118°
   Drill speed, for soft cast iron (with high speed drill) = 240 rpm
   Drill feed (for 1" diameter and over drills) = 0.25 in./rev.
   Determine the cutting time (min.) for the drill press operations.
   (ii) Explain the basic cutting fluid action in metal working operations.
   (iii) Explain the effects of cutting fluids in a machining operation with particular reference to work piece material, machine tools and biological and external environment.

4. (i) State the characteristics of (a) extrusion and (b) injection molding processes used in processing plastics.
   (ii) What are the typical plastic products produced by the extrusion and injection molding processes?
   (iii) What are the unique design characteristics or properties of reinforced plastics or composites?

5. (i) State the characteristics of grinding operations and machines.
   (ii) State the specific design considerations that should be given to grinding operations.
   (iii) Discuss the economics of grinding and finishing operations in the context of surface finish and dimensional accuracy.

6. (i) What is residual stress in a welding process? What are the detrimental effects of residual stresses?
   (ii) What factors must be considered in the selection of a joint and a welding process?
   (iii) State the future trends in welding technology.

7. (i) State the characteristics of direct numerical control (DNC) and computer numerical control (CNC) machines.

(ii) What are the uses of statistical quality control in manufacturing?

(iii) Based on the following measurements, set up a variable statistical quality control (X) chart for the control of the manufacturing process: actual measurements (inches): $X_1 = 4.001$, $X_2 = 4.003$, $X_3 = 4.002$, $X_4 = 4.005$, and $X_5 = 4.000$.

(a) Compute the upper and lower control limits with limits set at 3 standard deviations and draw the control chart.

(b) Given the following sample consisting of three measurements (in inches) from an actual manufacturing process, determine if something is wrong with the process: 4.005, 4.007, and 4.006 inches.