National Examinations December 2011
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) 6,	(ii) 7,	(iii) 7
2.	(i) 8,	(ii) 7,	(iii) 5
3.	(i) 7,	(ii) 7,	(iii) 6
4.	(i) 7,	(ii) 6,	(iii) 7
5.	(i) 8,	(ii) 6,	(iii) 6
6.	(i) 7,	(ii) 7,	(iii) 6
7.	(i) 5,	(ii) 5,	(iii) 10

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1. (i) How does steel differ from cast iron?
(ii) State the factors that govern the properties and behaviour of metals and alloys during manufacturing and performance during their service life.
(iii) What are the important properties of metals and alloys that are greatly influenced by alloying elements and by heat treatment processes?

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) What are the different types of metal chips and which one of them is the best?
(ii) What is a built-up edge and how does it affect the metal cutting operation? How can it be eliminated or minimized?
(iii) In an orthogonal metal cutting operation, the following data are obtained:
Underformed chip thickness = 0.0098 inches
Actual chip thickness = 0.0169 inches
Rake angle = 20°
Determine the shear angle.

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) Explain the resistance welding processes and the main advantages. State the general expression (equation) for the heat generated in resistance welding.
(ii) What is the difference between resistance spot welding and resistance seam welding processes? State their advantages.
(iii) What is oxyfuel gas cutting? Explain its process capabilities.

6. (i) State the characteristics of the grinding operations: (a) surface grinding, (b) cylindrical grinding and (c) centreless grinding.
(ii) Explain the characteristics of the finishing operations: (a) coated abrasives, (b) wire brushing and (c) honing.
(iii) Explain the economics of grinding and finishing operations in the context of automating the equipment involved.

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.