

**National Examinations December 2015**  
**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 calculations.

**Marking Scheme (marks)**

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

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1. (i) (i) How does steel differ from cast iron?  
(ii) State the factors that govern the properties and behavior 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) Explain the two trends that are having a large impact on the casting industries.  
(ii) What is plaster-mold casting process? Briefly explain the process.  
(iii) State the most significant design considerations that are given for designing expandable-mold casting.
3. (i) A 6 in. long,  $\frac{1}{2}$  in. diameter 304 stainless steel rod is being reduced in diameter to 0.480 in. by turning on a lathe. The spindle rotated at 400 rpm, and the tool is traveling at an axial speed of 8 in./min. Calculate the cutting speed and the material removal rate.  
(ii) Explain the different types of metal chips and which one of them is the best?  
(iii) What is a built-up edge and how it affects metal cutting operation? How can it be eliminated or minimized?
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 factors that should be considered in the selection of a welding process for a particular operation.  
(ii) Explain the characteristics of the following welding processes including their general chemical expressions or equations, where applicable: (1) oxyacetylene, (2) arc, and (3) resistance.  
(iii) What is the basic difference between oxyfuel gas cutting and arc cutting? State the different types of arc cutting.
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) What are the elements of statistical process control?  
(ii) What is acceptance sampling? State your understanding of acceptance quality level (AQL).  
(iii) Explain the essentials of Deming and Taguchi methods of quality control/engineering.