

**National Exams December 2008**  
**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.

Front Page

**Marking Scheme (marks)**

- |    |        |         |         |
|----|--------|---------|---------|
| 1. | (i) 8, | (ii) 6, | (iii) 6 |
| 2. | (i) 7, | (ii) 7, | (iii) 6 |
| 3. | (i) 7, | (ii) 6, | (iii) 7 |
| 4. | (i) 7, | (ii) 6, | (iii) 7 |
| 5. | (i) 7, | (ii) 7, | (iii) 6 |
| 6. | (i) 7, | (ii) 7, | (iii) 6 |
| 7. | (i) 6, | (ii) 5, | (iii) 9 |

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1. (i) What are the factors considered in defining machinability of a material? State the machinability factors that are generally considered most important in a manufacturing plant.  
(ii) State the factors that influence cutting processes.  
(iii) What are the future trends in cutting processes.
2. (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 =  $20^\circ$   
Determine the shear angle.
3. (i) What is a die casting process? Explain the difference between hot-chamber and cold-chamber processes.  
(ii) What are the advantages and disadvantages of die casting?  
(iii) What is an investment casting process? What parts are generally cast by this process?
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) What is your understanding of the following forging processes: (a) open-die, (b) closed-die, and (c) impression-die?  
(ii) What factors must be considered in the selection of forging machines?  
(iii) State the favourable characteristics/properties of forged parts.
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.