

**National Examination December 2003**

**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.

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1. (i) State the factors that must be considered in defining machinability of a material.  
(ii) State the manner by which the machinability of steels can be improved.  
(iii) What are the characteristics of cutting-tool material to produce good quality and economically? State the general categories of tool materials.
  
2. (i) Explain the reasons for using casting processes over other manufacturing methods. State the important factors that must be considered in casting operations.  
(ii) What is a die casting process? Explain the difference between hot-chamber and cold chamber processes.  
(iii) What is centrifugal casting? What parts are generally cast by this process?
  
3. (i) State the general characteristics of the following forming and shaping processes: (a) forging, (b) extrusion, and (3) sheet-metal forming.  
(ii) What steps are followed in a typical forging operation?  
(iii) State the advantages and limitations of open die and closed die forging processes.
  
4. (i) During the metal cutting process material from the surface of the workpiece is removed as chips. State the major independent and dependent variables in the metal cutting.  
(ii) Show by means of a diagram a two-dimensional or orthogonal cutting process (identify chip, tool, workpiece, shear plane, shear angle, rake angle and relief or clearance angle).  
(iii) In an orthogonal metal cutting operation, the following data are obtained:  
Undeformed chip thickness = 0.0098 in.  
Diameter of shaft = 12 in.  
Actual chip thickness = 0.0169 in.  
Rake angle = 20°  
Determine the shear angle.
  
5. (i) A 6 in. long, ½ 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) What are the uses of cutting fluids in machining operations?  
(iii) What are the effects of cutting fluids on workpiece material, machine tools and operator and environment?

6. (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.
  
7. (i) State the advantages and limitations of numerically controlled machines over conventional machines.  
(ii) State the characteristics of direct numerical control (DNC) and computer numerical control (CNC) machines.  
(iii) What are the advantages of CNC over conventional NC (DNC) machines?