

National Examinations May 2018
17-Ind-B2, Manufacturing Processes

3 hours duration

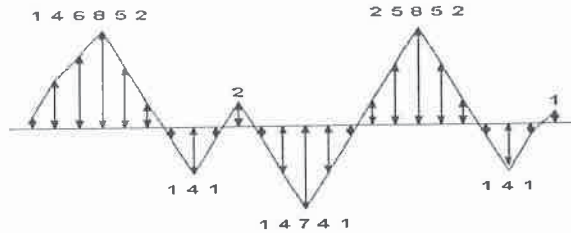
Notes:

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. Please note that deductions will be made for any irrelevant issues that you included in your answer. So please be concise.

Marking Scheme (marks)

1.	(i) 7	(ii) 6.5	(iii) 6.5
2.	(i) 10	(ii) 10	
3.	(i) 12	(ii) 8	
4.	(i) 8	(ii) 6	(iii) 6
5.	(i) 7	(ii) 6.5	(iii) 6.5
6.	(i) 6	(ii) 6	(iii) 8
7.	(i) 8	(ii) 6	(iii) 6

1. (i) Write the typical density ranges of metal, ceramic, plastic/polymer, and plastic/polymer composite.
 (ii) Write the typical melting-temperature ranges of metal, ceramic, and plastic/polymer.
 (iii) Write the typical thermal-conductivity ranges of metal, ceramic, and plastic/polymer.
2. (i) Define the surface roughness R_a and calculate the R_a of the following surface.



- (ii) What are the typical surface roughness R_a of sand casting and investment casting, respectively?
3. (i) Briefly describe the processing steps of the investment casting technology using figures and schematics.
 (ii) Describe why the heat transfer rate in investment casting during the solidification stage is slow.
4. (i) Explain why the warpage/bending is unavoidable from the injection molded parts (in other words, why the injection-molded parts cannot have a good dimensional stability/accuracy).
 (ii) Describe why a high pressure is required for injecting the molten polymer into the cavity?
 (iii) Briefly describe why packing is helpful in injection molding.
5. (i) Describe briefly the filament winding process.
 (ii) Describe briefly the sheet molding compound.
 (iii) Describe briefly the spray layup (or spray-up) process.
6. (i) If a manufacturing engineer prefers forging/stamping to casting in producing crankshafts, what could be the most important reason(s) for his choice?
 (ii) Briefly describe work-hardening.
 (iii) What are the advantages and disadvantages of performing metal forming processes at elevated temperatures?

7. (i) Draw a schematic of orthogonal cutting in a typical machining setting. Show the depth of cut, the rake angle, the relief angle, the shear angle, the chip, the chip thickness, the work piece (the part to be cut) and the cutting tool bit.
- (ii) Briefly describe why you cannot increase the rake angle very much despite a number of advantages of a large rake angle, such as the formation of a continuous chip, the removal of the built-up edge (BUE), and so on.
- (iii) Briefly describe why a chip-breaker is used (to break the chips) in machining.