



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2011 SESSION

SUBJECT CODE : FGB 20203
SUBJECT TITLE : CNC AND CAD/CAM TECHNOLOGY
LEVEL : BACHELOR
TIME / DURATION : 3.30pm – 6.00pm
(2.5 HOURS)
DATE : 14 MAY 2011

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
 2. This question paper is printed on both sides of the paper.
 3. Please write your answers on the answer booklet provided.
 4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
 5. This question paper consists of two sections, Section A and B. Answer 2 questions in Sections A. For section B answer ALL questions.
 6. Answer all questions in English.
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THERE ARE 5 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Choose and answer two (2) questions only.****Question 1**

- (a) Define the term 'machine tool', and briefly explain the different between machining and other manufacturing processes. (6 marks)
- (b) List two types of tool wear that occur around cutting edge of cutting tool in metal cutting. (4 marks)
- (c) Briefly explain the term 'abrasion' in tool wear mechanism. (4 marks)
- (d) State one (1) basic function of cutting fluid, and its effect on cutting tools. (2 marks)
- (e) State one (1) of the important properties that is required in a tool material, and name the cutting tool that most suitable for machining on super-alloys. (4 marks)

Question 2

- (a) Briefly explain two (2) contribution factors that lead to the development of CNC machine technology. (4 marks)
- (b) List two (2) modern CNC machine characteristics. (4 marks)
- (c) Explain 'surface contouring' in CNC milling process and state the type of cutter that used in this process. (4 marks)
- (d) Explain the term 'backlash' and how it is minimized in CNC machine tools? (4 marks)
- (e) State the main function of 'post processor' in a CAD/CAM system. (4 marks)

Question 3

- (a) State two types of motion control used in CNC machines. (4 marks)
- (b) A CNC machine is equipped with an open loop positioning system. The stepping motor used has 300 step angles. Its output shaft directly coupled to a lead screw with pitch = 2.5mm. The worktable of positioning system is driven by the lead screw. The table must move to a distance of 50mm from its present position at a travel speed of 0.5 m/min. Determine:
- How many pulses are required to move the table to the specified distance (8 marks)
 - The required motor speed and pulse rate ratio to achieve the desired table speed. (8 marks)

SECTION B (Total: 60 marks)**INSTRUCTION: Answer all questions.****Question 4**

A face milling operation is performed on top surface of a rectangular workpart that is 200mm long by 60mm wide. The milling cutter that is 70mm in diameter has 6 teeth, and is centered across the width of workpart, as shown in Figure 1 below. Cutting conditions are $v=75\text{m/min}$, $f=0.25\text{ mm/tooth}$, and $d=5.0\text{ mm}$.

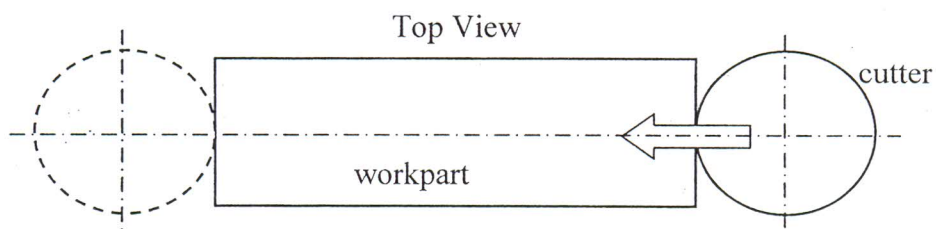


Figure 1

Determine:

- a) Time taken to make one pass across the surface.

(15 marks)

- b) Material removal rate during the cut

(5 marks)

Question 5

- (a) List the coordinate for the points P2 to P6 of the part shown in Figure 2 below by using incremental mode. Given coordinate of P1 is X=0 and Z=0.

(10 marks)

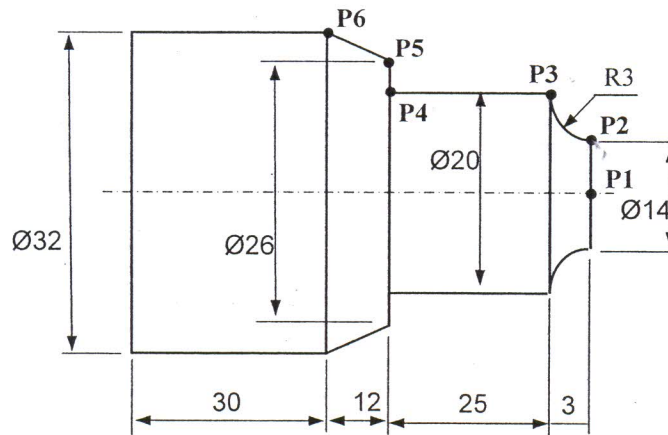


Figure 2

- (b) Give one reason on why absolute mode is preferred over incremental mode in CNC programming.
- (2 marks)
- (c) Briefly explain the difference between G codes and M codes in CNC programming, give one example of each code together with their function.
- (4 marks)
- (d) Briefly explain the difference between Machine Coordinate System (MCS) and Work Coordinate System (WCS).
- (4 marks)

Question 6

Write a CNC program for the workpiece shown in Figure 3 below using a HAAS CNC Lathe.

(20 marks)

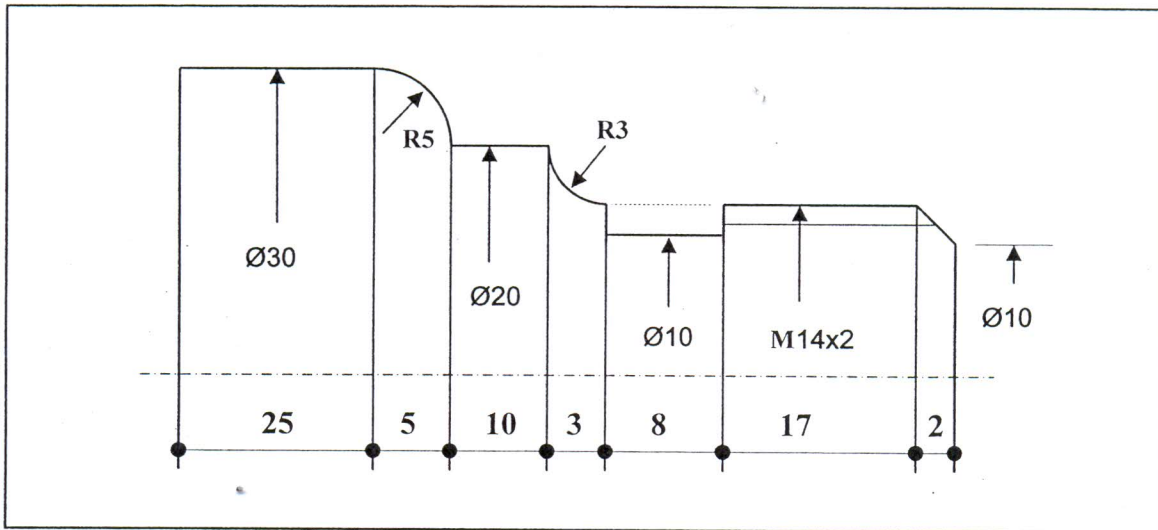


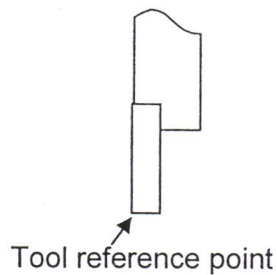
Figure 3

Given information:

Drawing: Not to scale

Raw material: Aluminium Alloy, diameter 31mm x 100mm billet

- Cutter available:
- T2 – Lefthand external cutter
 - T4 – 60° external thread cutter
 - T5 - 60° internal thread cutter
 - T10 – 3mm groove cutter as shown below



END OF QUESTION

Appendix: Formulae

$$\alpha = \frac{360^\circ}{n_s}$$

$$A = n_p \alpha$$

$$x = \frac{pA}{360^\circ}$$

$$n_p = \frac{360^\circ x}{p\alpha}$$

$$N = \frac{60f_p}{n_s}$$

$$v_t = f_r = Np$$

$$f_p = \frac{v_t n_s}{60p} = \frac{f_r n_s}{60p}$$

$$r = \frac{t_o}{t_c}$$

$$\tan \phi = \frac{r \cos \alpha}{1 - r \sin \alpha}$$

$$\tau = \frac{F_s}{A_s}$$

$$A_s = \frac{t_o w}{\sin \phi}$$

$$\phi = 45^\circ + \frac{\alpha}{2} - \frac{\beta}{2}$$

$$\gamma = \tan(\phi - \alpha) + \cot \phi$$

$$\mu = \tan \beta$$

$$A = 0.5 \tan(90^\circ - \frac{\theta}{2})$$

$$A = \sqrt{d(D-d)}$$

$$A = O = \frac{D}{2}$$

$$A = O = \sqrt{w(D-w)}$$

$$N = \frac{v}{\pi D_o}$$

$$f_r = Nf$$

$$MRR = v f_r d$$

$$T_m = \frac{L+A}{f_r}$$

$$T_m = \frac{L+2A}{f_r}$$

$$f_r = Nzf$$

$$MRR = w f_r d$$