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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAM
JULY 2010 SESSION

SUBJECT CODE	:	FGB 20203
SUBJECT TITLE	:	CNC AND CAD/CAM TECHNOLOGY
LEVEL	:	BACHELOR
TIME / DURATION	:	4.00pm – 6.30pm (2.5 HOURS)
DATE	:	10 NOVEMBER 2010

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 6 questions. Answer ONLY 5 questions
6. Answer all questions inEnglish.

THERE ARE 3 PAGES OF QUESTIONS AND 1 PAGES OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Choose and answer five (5) questions

Question 1

(a) State two (2) advantages of CNC machines over conventional cutting machines.

(4 marks)

(b) Briefly explain the difference between NC and CNC technologies.

(4 marks)

(c) List four important technical specifications when acquire a CNC milling machine.

(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 2

(a) Name and briefly describe the three types of chip that occur in metal cutting.

(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 'plastic deformation' in tool wear mechanism.

(4 marks)

(d) Name two cutting tool materials that are used as inserts in metal cutting.

(2 marks)

(e) State two of the important properties that is required in a tool material.

(4 marks)

Question 3

An orthogonal cutting operation is performed using a rake angle of 14°, chip original thickness of 0.5mm and width/depth of cut of 3mm. The chip thickness ratio is 0.6. Determine:

a) The chip thickness after cut

(4 marks)

b) The shear angle

(4 marks)

c) The friction angle

(4 marks)

d) The coefficient of friction

(4 marks)

e) The shear strain

(4 marks)

Question 4

A CNC worktable is driven by a closed-loop positioning system consisting of a dc servomotor, lead screw and optical encoder (position sensor) as shown in Figure 1 below. The lead screw has a pitch of 3mm and is coupled to the motor shaft with a gear ratio 5:1 (5 turns of motor for 1 turn of the lead screw). The optical encoder generates 180 pulses/rev of the lead screw. The table has been programmed to move a distance of 100mm at feed rate of 0.5m/min.

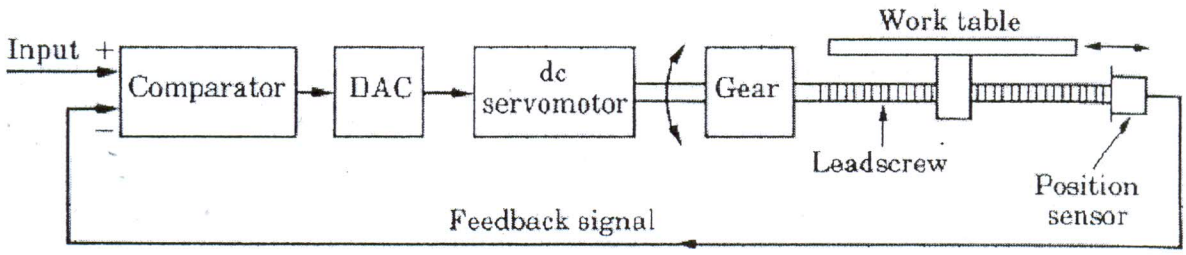


Figure 1

Determine :

a) How many pulses are received by the control system to verify the work table has moved exactly 100mm.

(8 marks)

b) Pulse rate

(6 marks)

c) Motor speed that corresponds to the specified feed rate.

(6 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)

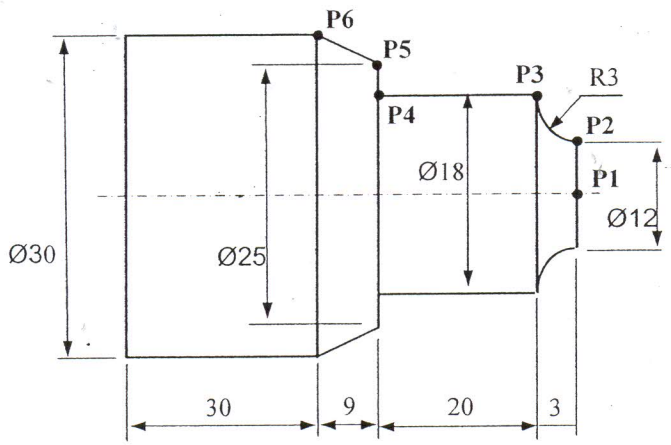


Figure 2

(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)

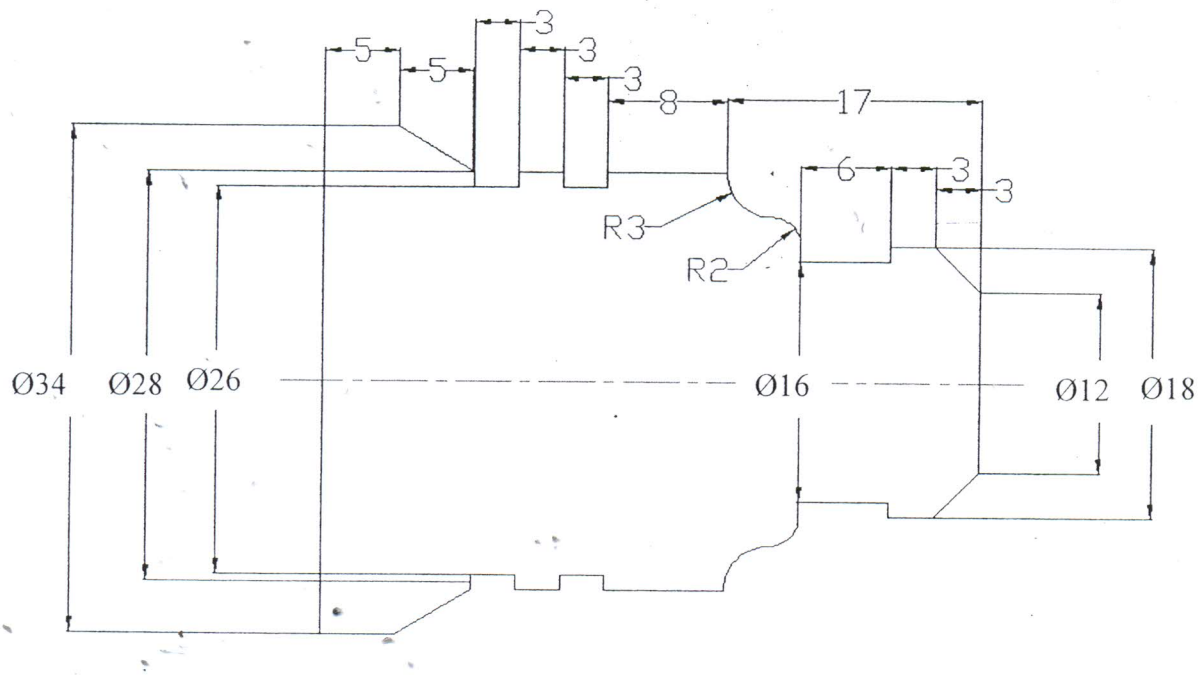
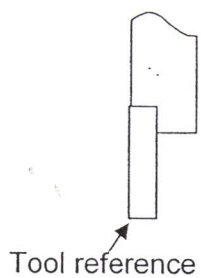


Figure 3

Given information:

Drawing:	Not to scale
Raw material:	Aluminium Alloy, diameter 35mm x 80mm billet
Cutter available:	T2 – Lefthand external cutter
	T4 – 60° external thread cutter
	T5 - 60° internal thread cutter
	T10 – 3mm groove cutter as shown below



Appendix : Formulae

$$\alpha = \frac{360^0}{n_s} \qquad A = n_p \alpha \qquad x = \frac{pA}{360^o} \qquad n_p = \frac{360^0 x}{p\alpha} \qquad N = \frac{60 f_p}{n_s}$$

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

$$r = \frac{t_0}{t_c} \qquad \tan\phi = \frac{r\cos\alpha}{1 - r\sin\alpha} \qquad \tau = \frac{F_s}{A_s} \qquad A_s = \frac{t_o w}{\sin\phi} \qquad \phi = 45^0 + \frac{\alpha}{2} - \frac{\beta}{2}$$

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

$$N = \frac{v}{\pi D_o} \qquad f_r = Nf \qquad MRR = vfd \qquad T_m = \frac{t + A}{f_r} \qquad A = 0.5\tan(90^0 - \frac{\theta}{2})$$

END OF QUESTIONS