CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JULY 2010 SESSION

SUBJECT CODE	:	FMB 21202
SUBJECT TITLE	:	MACHINE TOOL DESIGN
LEVEL	:	BACHELOR
TIME / DURATION	:	4.00 pm – 6.00 pm (2 HOURS)
DATE	:	21 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 paper consists of TWO (2) sections. Section A and B. Answer All questions in Section A. For section B, answer THREE (3) questions only.

6. Answer all questions in English.

THERE ARE 3 PAGES OF QUESTIONS AND 2 PAGES OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(a)   What are the features of special purpose machine tools ?

(4 marks)

(b)   Why productivity is one of the important factor during designing the machine tools?

(4 marks)

(c)   What is range ratio?

(4 marks)

(d)   Why geometric progression is commonly use in machine tool ?

(4 marks)

(e)   What are the various factors that can improve the stiffness of machine tool structure?

(4 marks)

(f)   What are the commonly used column section in machine tools?

(4 marks)

(g)   Where the dovetail slideways are mostly used?

(4 marks)

(h)   What are the requisites of a good control system?

(4 marks)

(i)   What are the differences between hydrostatic bearings and rolling contact bearings?

(4 marks)

(j)   What are the various mechanisms used for translatory motion?

(4 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only .

Please use the answer booklet provided.

Question 2

(a)   Draw the speed chart for the speed box if the number of steps are 6, N_{min} = 50 rpm, N_{max} = 160 rpm and no of stages = 2. Motor rpm is 700. Also calculate the transmission ratio for all shafts by using maximum transmission ratio = 4 – 0.5 . What conclusion can you make based on the calculated transmission ratio.

(20 marks)

Question 3

(a)   Design a round column for a drilling machine, if column height is 1.5 m, maximum torque = 7 kgm, feed force = 400 kg. Distance of drill center from column (throat) = 300 mm. Given E = 0.79 x 10^4.

(10 marks)

(b)   While turning a 700 mm long workpiece of 100 mm diameter between centers, the radial cutting force was found to be 150 kgf when the tool was 500 mm from the headstock. Calculate the machine tool and system compliances if the stiffness of the saddle, headstock and tailstock are 2000, 3000 and 1500 kgf/mm respectively.

(10 marks)

Question 4

(a) A turning lathe is required to machine Mild steel and aluminium workpieces of 110 mm diameter with 6 mm roughing cut at 30 m/min speed. A V-belt is used for drive, from motor to the gearbox input shaft at overall efficiency of 90%. The gearbox reduces the spindle speed further to required value. If the material removal rate is 0.808cc, find the power rating of motor. Taken specific power =2.8kw/cc.sec

(10 marks)

(b) Find the tool radial displacement for one flatway one veeway combinations guideways if b = 200 mm , h = 150 mm ; $P_A = 0.12$ kg/mm^2, $P_B = 0.15$ kg/mm^2, $P_C = -0.08$ kg/mm^2, = 60°, = 30°, guideway thickness = 25 mm and saddle length = 100 mm. Also find the rigidity if Fz = 160 kg and Fy = 120 kg.

(10 marks)

Question 5

Explain of the following:

(a) Automatic machine tools

(5 marks)

(b) Material for spindles

(5 marks)

(c) Computer Numerical control

(5 marks)

(d) Plastic slideways

(5 marks)

END OF QUESTION

Appendix

Table 1: Wall thickness (t) and size factor (s)

Size factor (s)	0.4	0.75	1.0	1.5	1.8	2.0	2.5	3		4.5
Wall thickness External (t_e)	6 [.24"]	8 [.31"]	10 [.39"]	12 [.47"]	14 [.55"]	16 [.63"]	18 [.71"]	20 [.79"]		25 [.98"]
Internal (t_i)	5 [.2"]	7 [.27"]	8 [.31"]	10 [.39"]	12 [.47"]	14 [.55"]	16 [.63"]	16 [.63"]		20 [.79"]

Table 2 : Comparison of machine tool drives

Sr. No.	Drive Type	Speed Range m/sec Max. Ideal	Transmission Ratio $i = \dfrac{N_{in}}{N_{out}}$	Efficiency %	Remarks
1	Belts	5—30	17—22.5	—	For 180° Arc of Contact
	Flat		$25 - \dfrac{1}{4}$	97%	Flat Belts

Sr. No.	Drive Type	Speed Range m/sec Max. Ideal	Transmission Ratio $i = \dfrac{N_{in}}{N_{out}}$	Efficiency %	Remarks
2	Vee		$20 - \dfrac{1}{3}$	92%	'V' Belts
				85%	Variable speed drives [Refer Table 2.8 for other angles]
	Roller	Up to	Up to		Sprocket
	Chains	20	12	$7 - \dfrac{1}{3}$	80	Engagement should be above 120°
3	Toothed	Up to	Up to	$\dfrac{1}{10} - 14$	70	for open
	Gears	20	6			gears
	Straight Spur		$4 - \dfrac{1}{2}$		For
	Helical				Compact gear
	Spur		$4 - \dfrac{1}{2.5}$		boxes
4	Hydraulic	Up to	Suction	—	60	Gear pumps
	system	20	0.8	—	75	Vane pumps
			Pipes 5—6	—	85	Piston pumps
5	Electric	750 to 3000 R.P.M.	1500 R.P.M.	—	90	Min
	motor				95	Max