CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
SEPT 2013 SESSION

SUBJECT CODE	:	**FFB 22102**
SUBJECT TITLE	:	**SHEETMETAL ENGINEERING**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**(2 ½ HOURS)**
DATE	:	

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 (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer three (3) question only.

6. Answer all questions in English

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

 SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a)   'Springback' must be compensated for in bending operations, otherwise the operation won't yield parts of the desired dimensions and shape.

     i.   State why it must be compensated?

     ii.   Write an issue in view to the scenario and provide a solution

(6 marks)

(b)   Cold rolling of sheets produces anisotropy because of alignment of impurities, inclusions, and voids which is called mechanical fibering. The notes described are intended to point out four issues.

     i.   State **THREE (3)** issues only

     ii.   Provide a solution in view to the issues.

(8 marks)

Question 2

Figure 1 shows one of the manufacturing processes in sheet metal industry.

(a)   Labels all the **FIVE (5)** main items in the process.

(5 marks)

(b)   Name and describe in your own word about the manufacturing process in **Figure 1**.

(6 marks)

(c)   Provide **THREE (3)** applications of the manufacturing products shown in **Figure 1**.
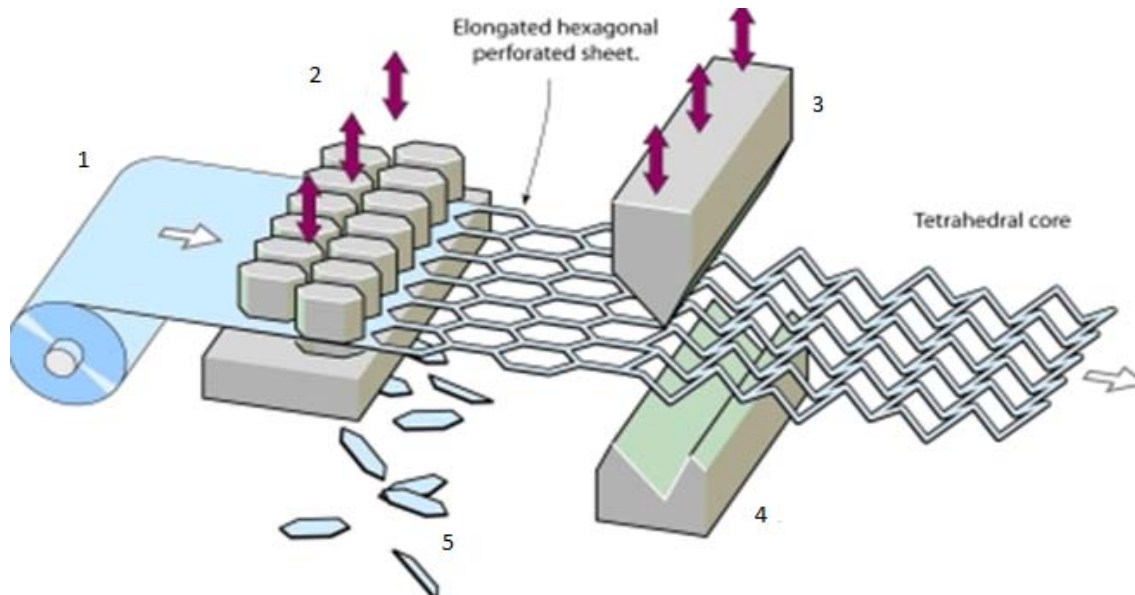
(3 marks)

Elongated hexagonal perforated sheet.

Tetrahedral core

Figure 1- Manufacturing Process

Question 3

(a)   Press machine is always a necessity in sheet metal work. What are the greatest needs in terms of problem solving that exist in the area of sheet metal and plate fabrication especially for a press machine?

(5 marks)

(b)   Press brake would normally come with a set of punches for press work. State the areas that need to be considered in the tooling management for a punching process.

(3 marks)

(c)   'Hemming' and 'Seaming' are two similar processes usually performed in sheet metal work. What is the function of 'hemming' and 'seaming'?

(4 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only.
Please use the answer booklet provided.

Question 1

(a)   In order to get the exact tonnage force, you may refer to **(Table 1)** Punching Force
Chart. By referring to the chart you will be able to calculate the tonnage needed for
the task given below;

To punch a hole on a mild steel plate.

   i. $\frac{7}{8}$ in. diameter on a $\frac{7}{8}$ in. thickness

   ii. $\frac{3}{8}$ in. diameter on a $\frac{1}{8}$ in. thickness

(8 marks)

Table 1 Punching Force Chart

Metal gage	Thickness, in.															

Force, tons, required for punching hole diameters, in., of:

Metal gage	Thickness, in.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
20	0.036	0.35	0.53	0.71	0.88	1.1	1.2	1.4	1.6	1.8	1.9	2.1	2.3	2.5	2.7	2.8
18	0.048	0.47	0.71	0.94	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.8	3.1	3.3	3.5	3.8
1/16 or 16	0.060	0.59	0.89	1.2	1.5	1.8	2.1	2.4	2.7	2.9	3.2	3.5	3.8	4.1	4.4	4.7
14	0.075	0.74	1.1	1.5	1.9	2.2	2.6	2.9	3.3	3.7	4.1	4.4	4.8	5.2	5.5	5.9
12	0.105	1.0	1.6	2.1	2.6	3.1	3.6	4.1	4.7	5.2	5.7	6.2	6.7	7.2	7.7	8.3
1/8 or 11	0.120	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.8	9.4
10	0.135		2.0	2.7	3.3	4.0	4.6	5.3	6.0	6.6	7.3	8.0	8.6	9.3	10.0	10.6
3/16	0.187		2.8	3.7	4.6	5.5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.9	13.8	14.8
1/4	0.250			4.9	6.2	7.4	8.6	9.8	11.0	12.3	13.5	14.8	16.0	17.2	18.5	19.7
5/16	0.312				7.8	9.2	10.8	12.3	13.8	15.4	16.9	18.4	20.0	21.5	23.0	24.6
3/8	0.375					11.1	13.0	14.8	16.6	18.5	20.3	22.1	24.0	25.8	27.7	29.5
1/2	0.500						17.2	19.7	22.1	24.6	27.1	29.5	32.0	34.4	36.9	39.4
5/8	0.625									30.8	33.8	36.9	40.0	43.0	46.1	49.2
3/4	0.750										40.6	44.3	48.0	51.9	55.4	59.0
7/8	0.875											51.6	56.0	60.2	64.6	69.0
1	1.00												64.0	68.8	73.8	78.8

Table 2 Chart Multiplier

Material	Chart multiplier	Ultimate strength, psi Shear	Tensile
Aluminum:			
1100-O	0.19	9,500	13,000
1100-H14	0.22	11,000	18,000
3003-H14	0.28	14,000	22,000
2024-T4.........	0.82	41,000	68,000
5005-H18	0.32	16,000	29,000
6063-T5.........	0.36	18,000	30,000
6061-T4.........	0.48	24,000	35,000
6061-T6.........	0.58	29,000	41,000
7075-T6.........	0.98	49,000	82,000

(b)   Different metal requires different punching tonnage. By referring to the chart multiplier in **Table 2** Chart Multiplier calculate the tonnage needed for punching the following hole on aluminum plate

   i.   round hole 1 in diameter on $\frac{1}{4}$ in. thick aluminum 5005-H18 plate

   ii.   round hole $\frac{5}{8}$ in. diameter on 3/16 thick aluminum 7075-T6 plate.

(8 marks)

(d)   In a shearing process most likely there will be an issue which arises from the process. One of the issues is 'secondary shear'. Describe what is "secondary shear"?

(4 marks)

Question 2

(a)   Plastic deformation, vertical burnish-cut band are 2 out of 4 inherent characteristics produced on both the parent material and cut-off part. State the other **TWO (2)** characteristic which is missing.

(6 marks)

(b)   State the **THREE (3)** factors that determine the amount of each of the characteristic produced besides material thickness, material type and hardness, and the amount of clearance between cutting edges.

(8 marks)

(a)   What is the main difference between 'punching' and 'blanking'?

(6 marks)

Question 3

(i)   When developing a flat blank length, there is a length of the part that does not change. This length is called the 'neutral axis'. With the aid of sketches describe what is known as 'neutral axis'

(6 marks)

(ii)   A 'wash trough' from a given side views were design as in **Figure 3** Wash Trough. Before it was sent to the manufacturing department it has to be calculated in order to optimize the usage of material needed. By referring to **Table 3** 'Bending Calculation Table' provide the total actual length needed to complete it. Consider the material thickness is 2.5mm and the die available is with a 20mm opening.
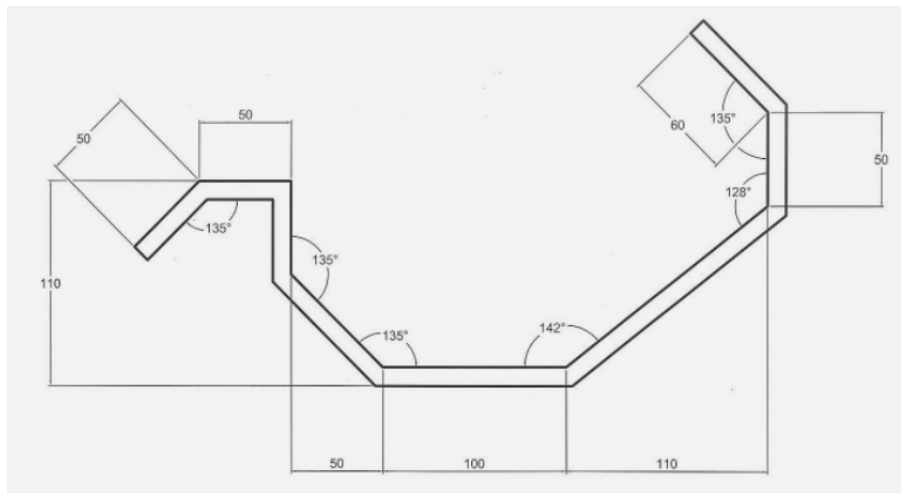

Figure 3 Wash Trough

Th	Die	Ri	F	b	Bending Angle											
mm	mm	mm	t/m	mm	165°	150°	135°	120°	105°	90°	75°	60°	45	30	15	0
	12	2	42	8.5	-0.5	-1	-1.6	-2.3	-3.3	-4.7	-4	-3.2	-2.5	-1.8	-1.1	-0.4
	16	2.6	29	11	-0.5	-0.9	-1.5	-2.3	-3.3	-4.8	-3.9	-3	-2.1	-1.2	-0.3	0.6
2.5	20	3.3	20	14	-0.4	-0.9	-1.5	-2.3	-3.4	-5	-3.9	-2.8	-1.7	-0.6	0.5	1.6
	25	4	15	17.5	-0.4	-0.9	-1.5	-2.3	-3.5	-5.2	-3.9	-2.6	-1.4	-0.1	1.2	2.5
	32	5	11	22	-0.4	-0.9	-1.5	-2.4	-3.6	-5.6	-4	-2.4	-0.8	-0.7	2.3	3.6
	16	2.6	49	11	-0.6	-1.2	-1.9	-2.8	-4	-5.7	-4.7	-3.8	-2.9	-2	-1.1	-0.1
	20	3.3	32	14	-0.5	-1.1	-1.8	-2.8	-4	-5.8	-4.7	-3.6	-2.5	-1.3	-0.2	0.9
3.0	25	4	23	17.5	-0.5	-1.1	-1.8	-2.8	-4.1	-6	-4.7	-3.4	-2.1	-0.7	-0.6	1.9
	32	5	16	22	-0.5	-1.1	-1.8	-2.8	-4.2	-6.3	-4.7	-3.1	-1.5	0.1	1.7	3.3
	40	6.5	12	28	-0.5	-1.1	-1.8	-2.9	-4.5	-6.8	-4.8	-2.8	-0.8	1.3	3.3	5.3
	20	3.3	66	14	-0.7	-1.6	-2.5	-3.7	-5.3	-7.5	-6.3	-5.2	-2	-2.8	-1.6	-0.4
	25	4	43	17.5	-0.7	-1.5	-2.5	-3.7	-5.3	-7.7	-6.3	-4.9	-3.5	-2.1	-0.7	0.7
4.0	32	5	30	22	-0.7	-1.5	-2.4	-3.7	-5.4	-7.9	-6.3	-4.6	-2.9	-1.2	0.4	2.1
	40	6.5	22	28	-0.7	-1.4	-2.4	-3.7	-5.6	-8.4	-6.3	-4.2	-2.1	0	2.1	4.2
	50	8	16	35	-0.6	-1.2	-2.4	-3.7	-5.8	-8.9	-6.4	-3.9	-1.3	1.2	3.7	6.2
Th: Thickness of plate		Die: Opening Distance of the Matrix				Ri: Internal radius of bend			F: Force to bend		b:Slant distance of vee matrix					

Table 3 Bending Calculation Table

(14 marks)
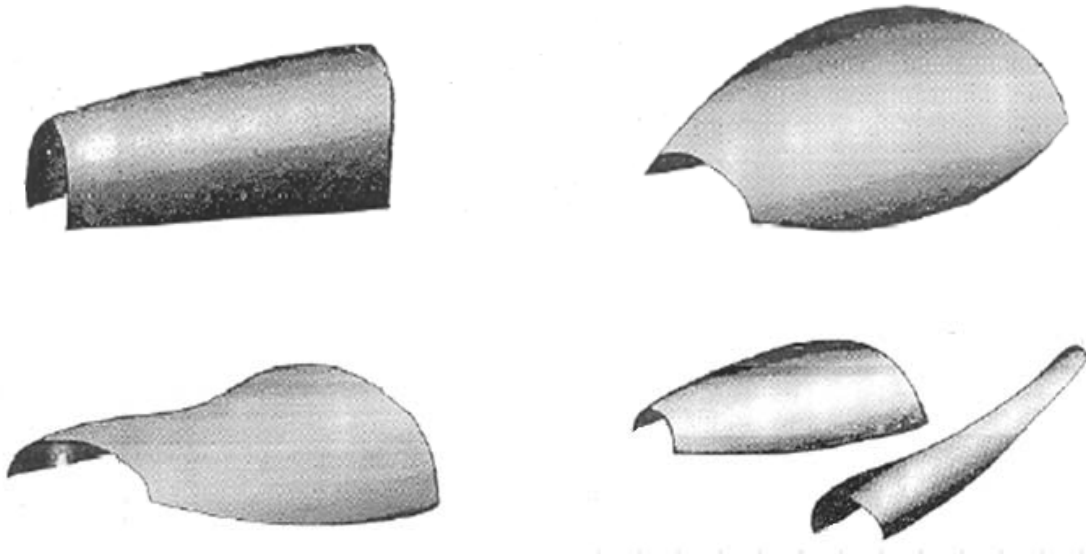
Question 4

Figure 4 - Sheetmetal Industry Product

(a)   Sheetmetal industry has undergone a tremendous evolution; **Figure 4** 'Sheetmetal Industry Product' shows one of the latest concepts in the industry. Write a short essay describing the concept, usage and applications.

(20 marks)

END OF QUESTIONS