

Name: _____ Student ID No: _____

Faculty of Engineering Prince of Songkla University

การสอบกลางภาคการศึกษาที่ 1

ปีการศึกษา 2554

วันพุธที่ 3 สิงหาคม 2554

เวลา 13.30-16:30

วิชา 237-322 Metallic Materials

ห้อง หัวหุ่นยนต์

คำสั่ง

- (1) เขียนคำตอบให้สมบูรณ์ทุกข้อเพื่อให้ได้คะแนนเต็ม
- (2) ให้เอา Note ขนาด A4 ที่เขียนด้วยลายมือเข้าได้ (ห้ามถ่ายเอกสาร)
- (3) ให้เอา Calculator และ Dictionary เข้าห้องสอบได้
- (4) อ่านคำสั่งให้ละเอียด และตอบทุกคำถาม

ทิวติในการสอบโทษันต่ำคือปรับตกรในรายวิชาที่ทิวติและพักรการศีกษา 1 ภาคการศีกษา

Question No.	Point	Result
1	10	
2	20	
3	30	
4	15	
5	25	
	Total	

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1. Iron and Steel Making Processes (10 points)

1.1 Which furnace is used to produce steel (2 points)?

1.2 Which furnace is used to produce iron (2 points)?

1.3 Which process is used to refine steel (2 points)?

1.4 Explain why titanium is added to steel before casting into ingots (4 points).

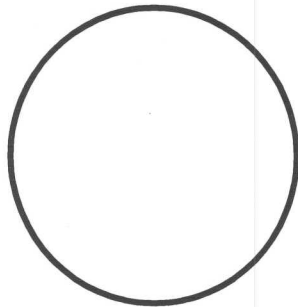
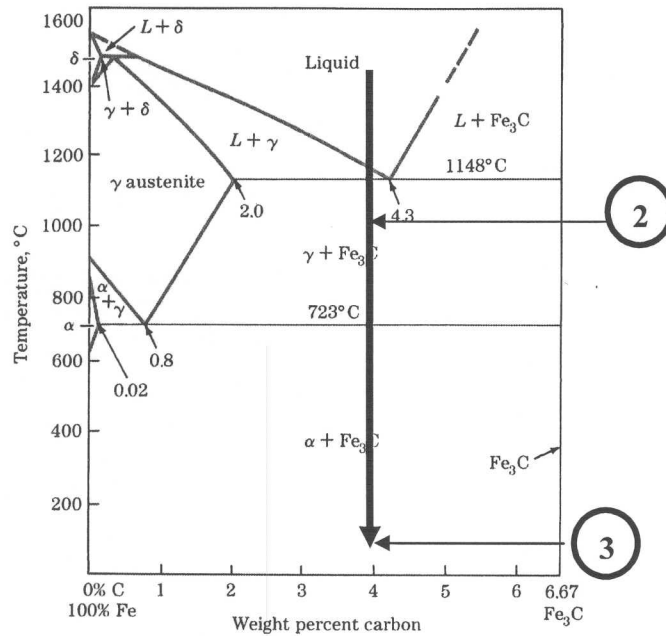
2. Basic Metallurgy and Cast Irons (20 points)

2.1 Draw the following microstructures and explain how these structures are formed?

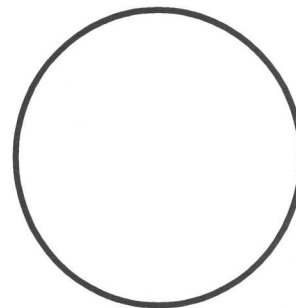
a) Pearlite (5 points).

b) Bainite (5 points).

2.2 Draw the microstructure of the metal at points **2** and **3** when the metal is cooled down with very slow cooling rates from the liquid phase to the room temperature. The metal contains some Mg and very low amount of S and P. Also identify the phases (10 points).



At Point 2



At Point 3

3. Alloy Steels (30 points)

3.1 Explain the effects of these alloys when they are added in small amounts and large amounts.

a) Manganese (5 points)

Effect (when added in a small amount):

Effect (when added in a large amount):

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b) Chromium (5 points)

Effect (when added in a small amount):

Effect (when added in a large amount):

3.2 Some stainless steels are used as acid tanks. However, they may have problems of acid leaking out. It has been shown that the acid can leak from the grain boundary of the stainless steel microstructure. Clearly explain with drawings how the leakage can occur (10 points).

3.3 Alloy steels do not need to be quenched in water to get martensite. Explain clearly why? (10 points)

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4. Cast Iron (15 points).

4.1 Explain the effects of cooling rates on forming different types of cast irons. (5 points)

4.2 Explain the effects of adding more silicon on forming different types of cast irons. (5 points)

4.3 Ductile cast iron is commonly used as safety components because they have good ductility property. Explain clearly with drawings why ductile cast iron has high ductility (5 points).

5. High Alloy Steels (25 points)

5.1 A ferritic stainless steel containing 16% Cr and 0.05% C will give ferrite phase at room temperature. Assuming that you are an engineer working in a casting company.

- a) Your manager orders you to make this ferritic stainless steel into a martensitic stainless steel, explain how to do it. (10 points)

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- b) Your manager also orders you to make this ferritic stainless steel into an austenitic stainless steel, explain how to do it. (10 points)

5.2 Which steel is suitable to be used to cut seafood products? Explain your reasons. (5 points)

♥ GOOD LUCK ♥