

Name: _____ Student ID No: _____

Faculty of Engineering Prince of Songkla University

การสอบกลางภาคการศึกษาที่ 1

ปีการศึกษา 2553

วันพุธที่ 4 สิงหาคม 2553

เวลา 13.30-16.30 น.

วิชา 237-322 Metallic Materials

ห้อง S 201

คำสั่ง

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

ทุจริตในการสอบโทษขั้นต่ำคือปรับตกในรายวิชาที่ทุจริตและพักการศึกษา 1 ภาคการศึกษา

Question No.	Point	Result
1	15	
2	35	
3	35	
4	15	
	Total	

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1. Iron and Steel Making Processes (15 points)

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

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

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

1.4 Explain the key difference between steel and iron (2 points).

1.5 Explain why silicon, aluminum, or titanium is added to steel before casting into ingots (7 points).

2. Basic Metallurgy (20 points)

2.1 Explain how these structures or phases are formed? Note. Use drawings also!

a) Pearlite (3 points).

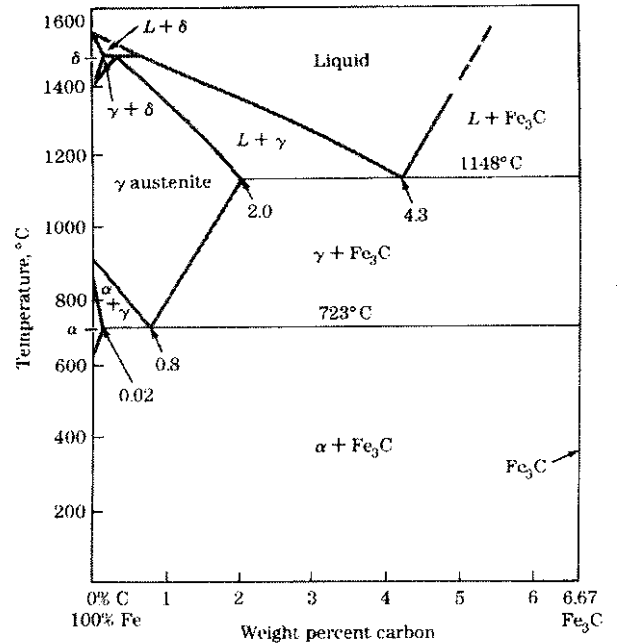
b) Bainite (3 points).

c) Martensite (3 points).

2.2 Microstructure and Phase Diagram

a) Draw the microstructure and identify all the phases of the Fe-0.8%C at room temperature (3 points).

b) Draw the microstructure and identify all the phases of the Fe-0.8%C at 800°C (3 points).



c) From the given phase diagram, draw the microstructure of a **0.5-wt% carbon steel at room temperature**. Also, answer how much of each phase in the microstructure? Show your work clearly (5 points).

3. Alloy Steels (35 points)

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

a) Manganese (5 points)

Effect (small amount):

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Effect (large amount):

b) Chromium (5 points)

Effect (small amount):

Effect (large amount):

3.2 Explain clearly (also draw microstructure) why TRIP steels are useful in automotive applications (9 points).

3.3 Tool steels are more expensive than high-carbon steels. However, they can last longer when used as drills or dies. Using the knowledge of physical metallurgy, clearly explain why tool steels are better. Note, also use drawings to explain. (8 points)

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3.4 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 (8 points).

4. Cast Iron (15 points).

4.1 Which cast iron is produced with a higher cooling rate? Make a circle (3 points).

White Cast Iron or Gray Cast Iron

4.2 Which cast iron has more silicon content? Make a circle (3 points).

White Cast Iron or Gray Cast Iron

4.3 Which cast iron has more ductility? Make a circle (3 points).

Malleable Cast Iron or Gray Cast Iron

4.4 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 (6 points).