

Name: _____ Student ID No: _____

Faculty of Engineering Prince of Songkla University

การสอบกลางภาคการศึกษาที่ 1

ปีการศึกษา 2550

วัน พุธ ที่ 1 ส.ค. 2550

เวลา 13:30 – 16:30 น.

วิชา 237-322 Metallic Materials

ห้อง A203

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 | 20 | |
| 2 | 10 | |
| 3 | 10 | |
| 4 | 30 | |
| 5 | 20 | |
| 6 | 10 | |
| | Total | |

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1. Describe the following terms (20 points).

1.1 Blast Furnace

1.2 Normalize (heat treatment)

1.3 Electroslag Refining

1.4 H13

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2. **Explain how to change Ferritic Stainless Steel to Martensitic Stainless Steel.**
(10 points)

3. **Roles of Alloying Elements (10 points)**

*(**Don't give more than 2 elements. You will get deductions if put more than 2**)*

- a. Give two alloying elements that break cementite to form graphite
- b. Give two alloying elements that stabilize ferrite
- c. Give two alloying elements that stabilize austenite
- d. Give two alloying elements that improve machinability

4. **Cast Irons (30 points)**

- a. Explain how to produce "Blackheart Malleable Cast Iron" (5 points).

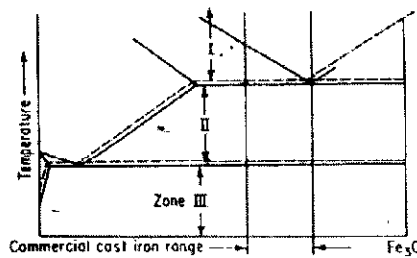
b. Ductile cast iron:

i. In making ductile cast iron, what element do we usually add? (5 points)

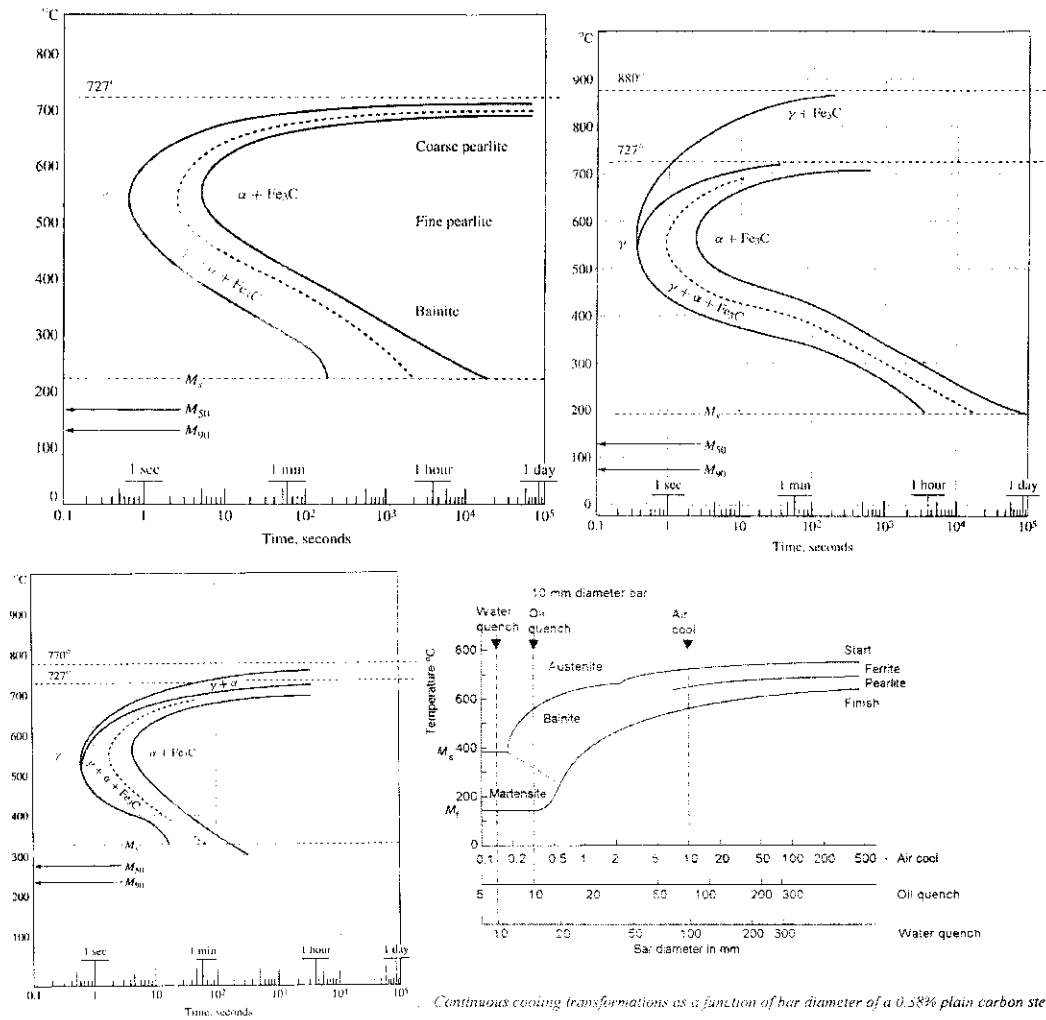
ii. What are the two elements that we need to control to very low levels? (5 points)

c. A cast iron contains 2.5% C and 2.7% Si, what is the carbon equivalent of this cast iron? (5 points)

d. If this cast iron is solidified from liquid with very slow cooling rate (through Zone I and Zone II) and also cooled down with very slow cooling rate during the eutectoid temperature range (Zone II to Zone III). What is the final microstructure? Explain and draw the microstructure. (10 points)



5. Your manager wants you to heat treat a **0.8% carbon steel** to have the microstructure consisting of **25% fine pearlite, 25% bainite and 50% tempered martensite**. Describe the heat treatment procedure clearly by selecting the right diagram given below. Draw the lines also! (20 points)



Continuous cooling transformations as a function of bar diameter of a 0.8% plain carbon steel

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6. During quenching a steel part, the cooling rates of the surface and the core are different leading to distortion or cracking. Explain the two (2) heat treatment procedures to avoid cracking or distortion during quenching. (10 points)