Name:_____Student ID No:_____

Faculty of Engineering
Prince of Songkla University

การสอบปลายภาคการศึกษาที่ 1 ปีการศึกษา 255)

วัน พฤหัสบดี ที่ 4 ต.ค. 2560 เวลา 13:30 – 16:30 น.

วิชา 237-322 Metallic Materials ห้อง A20 I

คำสั่ง

(1) เขียนคำตอบให้สมบูรณ์ทุกข้อเพื่อให้ได้คะแนนเต็ม

(2) ไม่อนุญาตให้นำเอกสารทุกชนิดเข้าสอบ

(3) ให้เอา Calculator และ Dictionary เข้าห้องสอบได้

(4) ข้อสอบมี 12 ข้อ ทั้งหมด 9 หน้า ให้ตรวจสอบให้เรียบร้อยก่อนสอบ

(5) อ่านคำสั่งให้ละเอียด และตอบทุกคำถาม

ทุจริตในการสอบโทษขั้นต่ำคือปรับตกในรายวิชาที่ทุจริตและพักการศึกษา 1 ภาคการศึกษา

Question No.	Point	Result
1	20	
2	10	
3	10	
4	15	
5	8	
6	8	
7	5	
8	5	
9	5	
10	10	
11	2	
12	2	
Total	100	

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Part I of Dr. Jessada (40 points)

1. Describe the following terms (20 points).

1.1 Basic Oxygen Furnace

1.2 Spheroidize (heat treatment)

1.3 Nitriding

1.4 CCT

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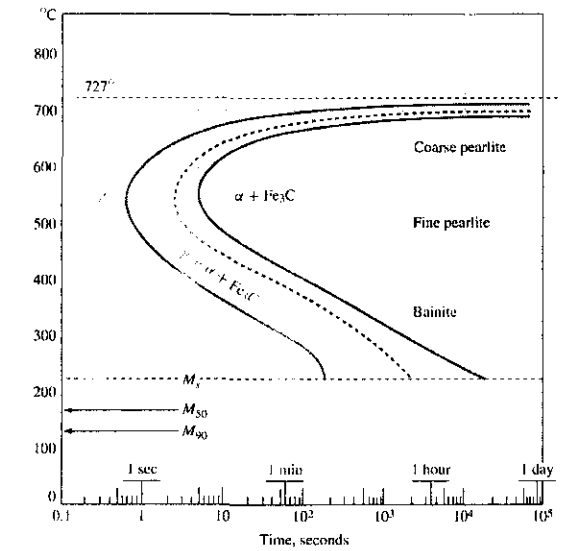
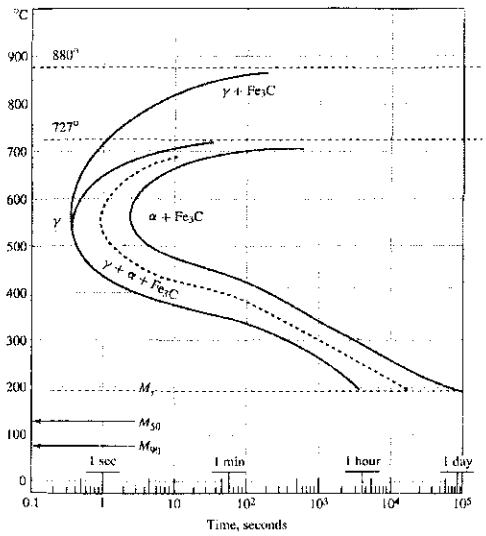
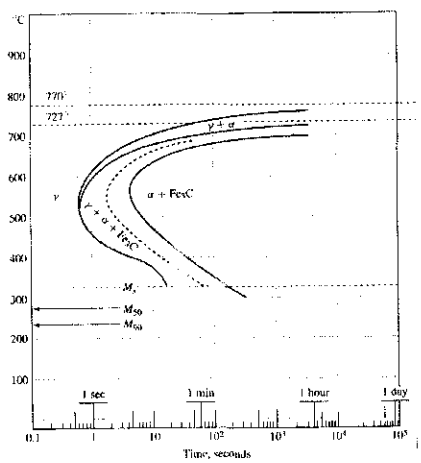
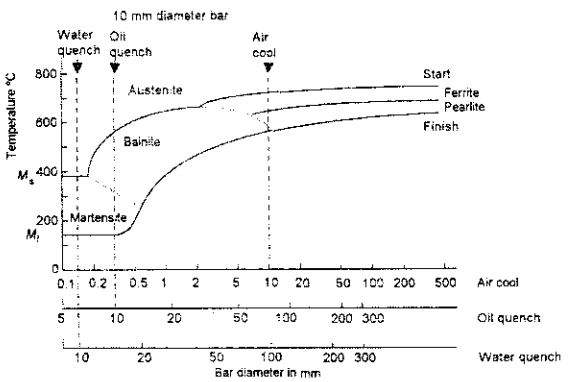
2. a) Your manager wants you to heat treat a 0.38% plain carbon steel bar with 18 mm diameter to have fully the Bainite structure. **Describe the heat treatment procedure** clearly by selecting the right diagram given below (10 points). Draw the lines also!









Continuous cooling transformations as a function of bar diameter of a 0.38% plain carbon steel

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3. Strengthening Mechanisms (10 points)

a. Gold alone is very soft, but if we add some copper to gold the strength will be increased. Explain clearly how the copper atoms help improve the strength. (5 points)

b. For high temperature applications, if aluminum alloys have dispersed particles in the microstructure, the strength will be improved. Which type of particles would give better strength at high temperatures: Cu_2Al or SiC? Explain clearly why. (5 points)

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Part II of Dr. Weerawan (60 points)

4. Fill in the following table to describe and compare main characteristics of three main classes of stainless steels (ferritic, austenitic and martensitic) including their major composition, their advantages and limitations, also give an example of common AISI gra le and their applications. (15 marks)

Type of SS	Ferritic	Austenitic	Martensitic
Major compositions			
Hardenability (How can it be hardened?)			
Magnetic property (Is it magnetic?)			
Advantages			
Limitations			
Example of common AISI grade and their applications			

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5. What are roles/purposes of these alloying elements in stainless steels? (8 marks)
- Cr

- Mo

- N

- Ti and Nb

6. Briefly describe the following types of corrosion that may occur in stainless steels:
- Stress corrosion cracking (SCC). (2 marks)

- Crevice and briefly discuss the environment/condition that would promote amoun of crevice. (3 marks)

- Intergranular corrosion and briefly discuss how you would prevent or reduce it. (3 marks)

7. What are ordered intermetallics? Describe their main characteristics/important proper ies, advantages and limitations and potential applications. (5 marks)

8. What are "Duplex stainless steels"? Describe their main characteristics/important properties, advantages compared to austenitic and ferritic stainless steels and common applications. (5 marks)

10. Describe the following terms including main compositions, their characteristics/ important properties, advantages and applications (10 marks)

- Precipitation hardenable (PH) stainless steel

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9. What are shape memory alloys? Briefly describe the term "Nitinol" including main characteristics/important properties and give three examples of application.
(5 marks)

10. Describe the following terms including main compositions, their characteristics/ important properties, advantages and applications (10 marks)

- Precipitation hardenable (PH) stainless steel

- Ni-based Superalloys

11. What are the structure and the role of γ' in the Ni-based superalloys? (2 marks)

12. What are advantages of Co-based superalloys over Ni-based superalloys? (2 marks)