

Prince of Songkla University
Faculty of Engineering

Midterm Examination: Semester I

Academic Year: 2011

Date: July 31, 2011

Time: 9:00-12:00

Subject: 226-304 Heat Treatment Technology

Room: A200

ทูลจรตในการสอบ โทษชนตำปรบตกรในรายวชานันและพัทการเรยน 1 ภาคการศกษา

Name..... SurnameStudent ID.....

Instruction:

- 1) There are 22 questions, 10 pages; 130 points
2) Attempt all questions.
3) Only a hand-written note on two-sided A4, a calculator and a dictionary are allowed.
4) Borrowing things from other students is prohibited.

Napisorn Memongkol
Instructor

1. (4 points) Differentiate between crystalline and amorphous

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2. (2 points) The smallest possible part of crystal lattice, determining the structure, is called

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3. (4 points) Differentiate between **Tin Bronzes** and **Aluminum Bronzes**

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4. (4 points) How many types of **cast iron**? What are they?

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5. (4 points) Differentiate between **carbon steel** and **alloy steel**

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6. (9 points) Explain the term **solid solution**, **eutectic**, and **eutectoid** system.

7. (3 points) When alloys (two metals) are cooled from liquid to solid state there are **three possibilities**. What are they?

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8. (5 points) what are the **solidus line, liquidus line, and solvus line**? (พร้อมวาดรูปประกอบ)

Solidus line is.....

Liquidus line is

Solvus line is

9. (5 points) Define the **allotropic properties of iron** and draw the diagram showing all the phases and temperatures involved in these properties including **curic point**. (ต้องวาดรูปประกอบด้วย)

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10. (4 points) **Copper** can dissolve any amount of **Nickel** in solid state and vice-versa. Justify the above statement with the help of **Hume Rothery Rules** for the information of solid solution.

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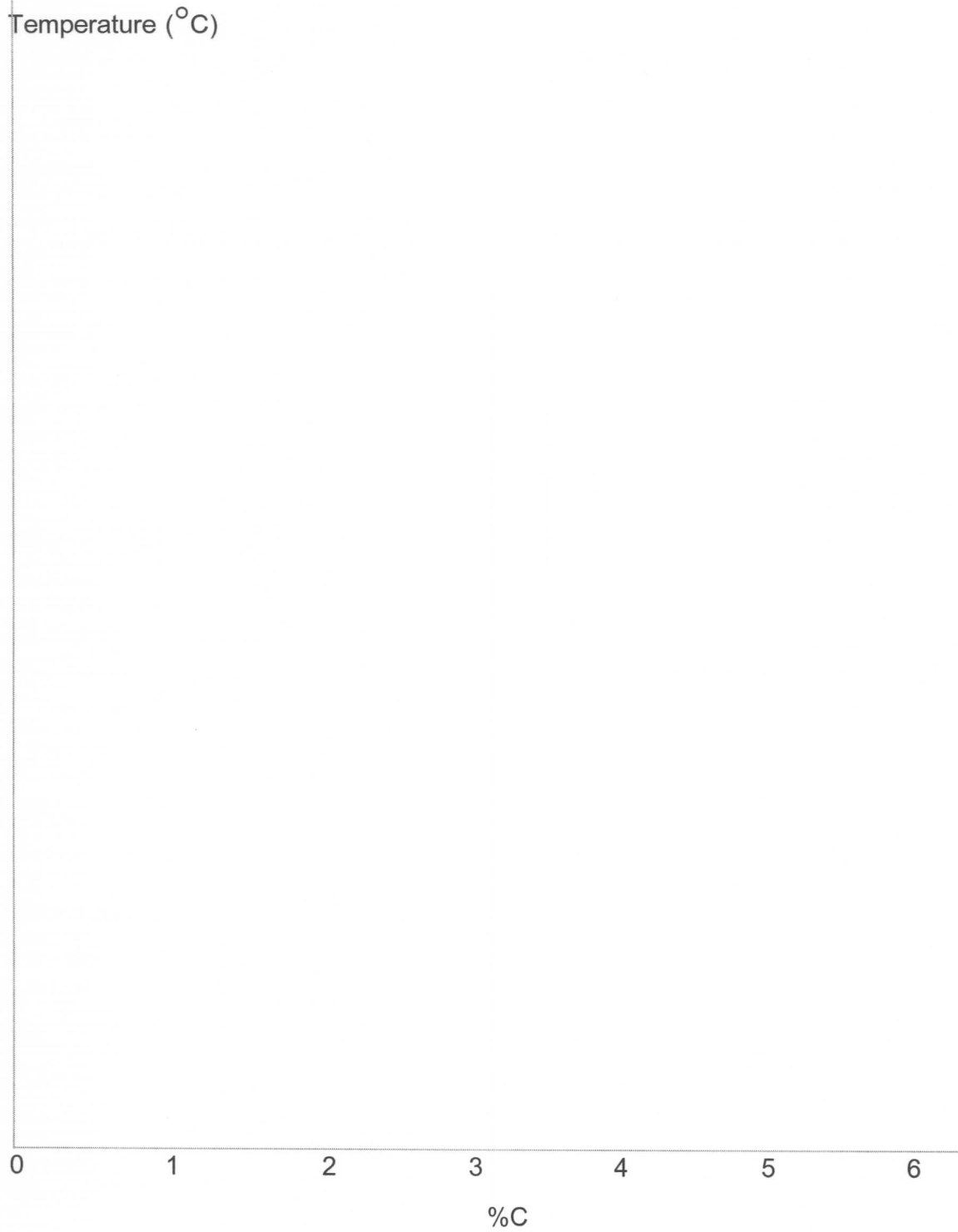
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11. (6 points) Explain the term **Heat Treatment**.
How does heat treatment alter the mechanical properties of an alloy?

12. (12 points) Draw **Fe-Fe₃C phase diagram** and **label the phase fields**. Discuss in brief the different reactions that take place in this system. (give details as much as you can)



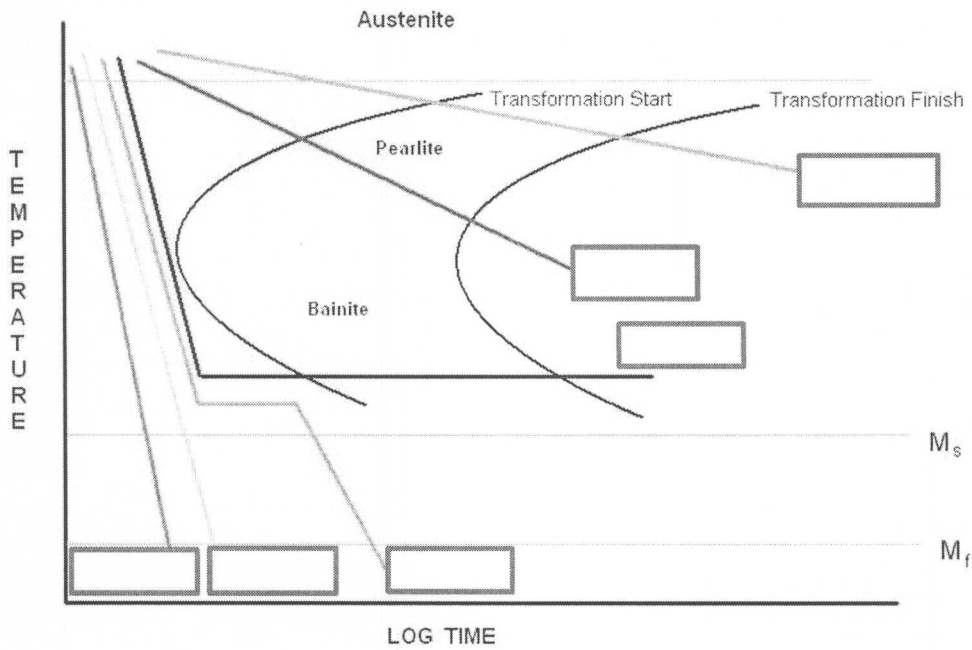
13. (8 points) Explain the cooling sequence of **hypoeutectoid steel** (0.6%C) and **hypereutectoid steel** (1.2%C) from liquid state to room temperature in detail.
(อธิบาย พร้อมวาดรูปประกอบทั้ง 2 กรณี)

14. (8 points) Compute the following:

- a) Percent pearlite and cementite in steel containing 1.2% carbon
- b) Percent pearlite and cementite in steel containing 0.8% carbon

15. (6 points) Explain why **martensite** is hard. (2 points)
 What is the **crystal structure** of martensite? (2 points)
 Show the **position of carbons** in unit cell of martensite. (2 points)

16. (6 points) From TTT diagram below, complete the diagram using the cooling condition below. (ใส่เฉพาะตัวอักษรลงในช่องสี่เหลี่ยม)



- a) Martempering b) Austempering c) Air cool
 d) Water Quench e) Furnace cool f) Oil Quench

17. (10 points) Differentiate between:

a) **Normalizing** and **Annealing**

b) **Process annealing** and **Spheroidising**

You have to give all details such as types of iron, methods, temperature range, phases involved, output properties. Also show the area of these heat treatment processes in Fe-Fe₃C phase diagram

18. (4 points) Describe the characteristics of **quenching media**

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19. (3 points) The **hardness** of hardened steel depends on **three factors**. What are they?

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20. (10 points) Explain the process of **martempering** by using the suitable diagram. What is the final structure which we get from this process? How does the **martempering** process differ from the process of **austempering**? Explain in detail.

21. (8 points) Differentiate between **TTT diagram** and **CCT diagram**

You have to give all details such as the meaning of these two diagrams, and how to use these diagrams.

22. (5 points) Graphical summary of the process heat treatments for steels on an equilibrium diagram (ให้วาดภาพ diagram คร่าวๆ แสดงให้เห็นบริเวณการทำ Heat treatment ทั้งหมดโดยการแรเงา)

Good luck!!! to (your name) from Aj. Napis

