Prince of Songkla University

Faculty of Engineering

Midterm Examination: Semester I **Academic Year: 2010**

Date: August 1, 2010 **Time: 9:00-12:00**

Subject: 226-304 Heat Treatment Technology **Room: A201**

ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้นและพักการเรียน 1 ภาคการศึกษา

Name..... Surname .....Student ID.....

Instruction:

1. ***There are 29 questions, 12 pages; 160 points***
2. ***Attempt all questions.***
3. ***Only a hand-written note on two-sided A4 and a dictionary are allowed.***
4. ***Borrowing things form other students is prohibited.***

Napisporn Memongkol

Instructor

1. (2 points) What are the two basics properties of metals?

   First property is .....

   Second property is .....

2. (4 points) Differentiate between **metals** and **non-metals**.

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3. (2 points) Define an **alloy** and give some examples of engineering alloys?

   Alloy is .....

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   Examples of engineering alloys are ..... and .....

4. (4 points) Differentiate between **crystalline** and **amorphous**.

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5. (2 points) The smallest possible part of crystal lattice, determining the structure, is called .....

6. (3 points) When alloys (two metals) are cooled from liquid to solid state there are three possibilities. What are they?

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7. (5 points) Crystals are grouped into **seven systems**. What are they? Also show the sketch of two systems

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8. (6 points) Explain the term **FCC, BCC,** and **HCP** structure. (give details in structure, characteristics (such as ductile or brittle), number of atoms per unit cell, sketch the structure and give examples of metals that have those structures)

	FCC	BCC	HCP
Structure (sketch)			
Characteristics			
No. of atoms/unit cell			
Examples			

9. (5 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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10. (4 points) What is **metallography**? Discuss the importance of **metallography** with special reference to heat treatment.

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11. (2 points) What is a **solid solution**? Give examples of solid solutions.

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12. (2 points) What information do you get from the study of **phase diagrams**?

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13. (2 points) what is unary diagram and what are the important factors in this system?

Unary diagram is .....

important factors are .....

14. (2 points) what is binary diagram and what are the important factors in this system?

Binary diagram is .....

important factors are .....

15. (3 points) what are the solidus line, liquidus line, and solvus line?

Solidus line is.....

Liquidus line is .....

Solvus line is .....

16. (4 points) What is the role of **imperfections** in heat treatment?

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17. (6 points) Define the **allotropic properties of iron** and draw the diagram show all the phases and temperatures involve in these properties include **curic point**.

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18. (8 points) Explain the term **Heat Treatment**.

How does heat treatment alter the mechanical properties of an alloy?

19. (3 points) Differentiate between **cast irons** and **steels.**

20. (15 points) Draw **Fe-Fe_3C 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)

21. (10 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.

22. (10 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.

23. (9 points) Explain why **martensite** is hard.

    What is the **crystal structure** of martensite?

    Show the **position of carbons** in unit cell of martensite.

24. (5 points) Explain why hardening by quenching is followed by tempering treatment.

25. (15 points) Differentiate between:

a) **Normalizing** and **annealing**

b) **Process annealing** and **spheroidising**

You have to give all details such as types of iron, using methods, temperature range, phases involve, output properties. Also show the area of these heat treatment processes in Fe-Fe_3C phase diagram

26. (6 points) Give the details of the three reactions in Fe-Fe_3C diagram; **peritectic** reaction, **eutectic** reaction, and **eutectoid** reaction. (such as phases, %carbon, temperature)

27. (5 points) Describe the characteristics of **quenching media**?

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28. (3 points) The hardness of hardened steel depends on three factors. What are they?

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29. (13 points) Explain the process of **martempering** by using the suitable diagram. What is the final structure do we get from this process? How does the martempering process differ from the process of **austempering**? Explain in detail.

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