Perancangan Mengajar

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN MEKANIKAL

MATERIALS SCIENCE		
BMCB 2423	**SEMESTER II**	**SESSION 2009/2010**

1.0 OBJECTIVE

The objective is to give exposure to materials science, to provide students with an understanding of the underlying principles of synthesis and characterization of materials and of the interrelationships among structure, properties and processing.

2.0 LEARNING OUTCOMES

At the end of this course the students should be able to: -

a. Describe the classifications, structures and applications of metals, ceramics and polymers correctly.
b. Analyse deformations behavior and strengthening mechanisms relying to its structure and properties of materials clearly.
c. Apply Fick's Law in calculating the diffusion process and its mechanism in solids properly.
d. Demonstrate appropriate test methods in determining mechanical properties.
e. Apply the relation between composition, microstructure and properties of metallic materials by using apposite phase diagram and heat treatment process.

3.0 SYNOPSIS

This course comprises the fundamentals of Materials Science and its applications, atomic structure, crystal structure, solidification, imperfections and solid diffusion, mechanical and physical properties, phase diagrams and transformation, synthesis, types and applications of materials.

4.0 REFERENCES

a. Callister W. D., 2008, *Fundamentals of Materials Science and Engineering*, 3rd Edition, John Wiley & Sons.
b. Smith W. F., 2004, *Foundation of Materials Science and Engineering,* 4th Edition, McGraw Hill.
c. Shackleford J. F. , 2000, *Introduction to Materials Science for Engineers,* 5th Edition, Prentice Hall.
d. Budinski K. G. and Budinski M.G., 1999, *Engineering Materials: Properties and Selection*, 6th Edition, Butterworth-Heinemann UK.

e. Askeland D. R., 1994, *The Science and Engineering of Materials*, 3rd Edition, PWS Publication Co.

5.0 COURSE IMPLEMENTATIONS

Lectures will be conducted during 14 weeks of academic studies and conducted in English. Students will learn and practice themselves to solve course-related problems by attending to several tutorial sessions. There will be 7 tutorial handouts given during the session and students will be guided to solve the problems. Within the same group of the tutorial session, the laboratory sessions requires the students to perform 4 experimental works consist of the Microstructure Examination, Charpy Impact Test, Rockwell Hardness Test and Heat Treatment of Steel. Students will write 4 laboratory report, which is consist of 1 formal group report and 3 informal individual reports. 1 test will be given to the students in the middle of the semester. In between, 1 assignment consist of at least one design problem will be given and should be submitted within 4 weeks. Meanwhile, 2 quizzes will be held within the semester. Finally, students should demonstrate all their knowledge and skills in a mini project and this will be presented at the end of semester.

The detail implementation of this course as below:

a. Lecture.
   i. 2 hours per week for 14 weeks (Total = 28 hours)
b. Tutorials/Assignments.
   i. 3 hours per week for 10 weeks (Total = 30 hours)
c. Laboratory.
   i. 3 hours per week for 4 weeks (Total = 12 hours)

6.0 COURSE INSTRUCTIONS

Attendance is compulsory for lectures/tutorials and should be more than 80% of the total contact hours.

7.0 COURSE EVALUATIONS

	CRITERIA	PERCENTAGE (%)
COURSE WORK		
TEST	1 Test (1½ hour)	20
ASSIGNMENT	1 assignment (will be submitted 4 weeks after tutorial)	10
	1 group presentation	*5*
QUIZ	2 Quizzes	*5*
LABORATORY	3 Informal Group Reports (hand written) (will be submitted 3 days after laboratory session)	12
	1 Formal Individual Report (hand written) Will be submitted 1 week after laboratory session	8
FINAL EXAMINATION		
EXAM	1 Final Exam 2 ½ hours	40
TOTAL		**100**

8.0 COURSE CONTENTS

Week	Chapter/Topic	Contents	Remarks
1	CHAPTER 1 Introduction to Materials Science & Engineering	1.1 Materials Science & Engineering. 1.2 Structure, properties & processing. 1.3 Classification & characteristic of materials.	Tutorial session: Introduction to course
2	CHAPTER 2 Atomic Structure & Bonding in Solids	2.1 Fundamental concepts. 2.2 Electron principle. 2.3 The Periodic Table. 2.4 Ionic, Covalent & Metallic bonding. 2.5 Secondary bonding. 2.6 Properties from bonding.	Tutorial session: Lab. briefing
3	CHAPTER 3 Structures of Metals & Ceramics	3.1 Fundamental concepts. 3.2 Metallic crystal structures 3.3 Theoretical density. 3.4 Ceramic crystal structures. 3.5 Bond hybridization. 3.6 Single crystal & poly crystal.	Tutorial session: Tutorial 1 (Ch.2)
4	CHAPTER 3 (cont.) Structures of Metals & Ceramics	3.7 Crystal systems. 3.8 Point coordinates, crystallographic directions & planes. 3.9 Linear density & planar density. 3.10 Ceramics structure determination (X-ray diffraction).	Lab. session: Laboratory 1
5	CHAPTER 4 Structures of Polymers	4.1 Polymer molecules & structure. 4.2 Molecular configuration. 4.3 Thermosetting & thermoplastic polymers. 4.4 Polymer crystallinity & crystals.	Tutorial session: Tutorial 2 (Ch.3)
6	CHAPTER 5 Defects in Solids	5.1 Point defects. 5.2 Linear defects. 5.3 Planar defects. 5.4 Microscopic examination.	Lab. session: Laboratory 2
7	CHAPTER 6 Diffusion in solids	6.1 Diffusion process & mechanism. 6.2 Processing using diffusion. 6.3 Steady-state diffusion. 6.4 Non-steady state diffusion.	Tutorial session: Tutorial 3 (Ch.5)
8		**MID-SEMESTER BREAK**	
9	CHAPTER 7 Mechanical properties	7.1 Concepts of stress & strain. 7.2 Elastic & plastic deformation. 7.3 Elastic properties of materials. 7.4 Tensile properties. 7.5 Variability of material properties.	Tutorial session: Tutorial 4 (Ch.6) **MID YEAR TEST**

Week	Chapter/Topic	Contents	Remarks
10	CHAPTER 8 Dislocations & Strengthening Mechanisms	8.1 Dislocation & plastic deformation. 8.2 Mechanisms of strengthening. 8.3 Recovery, recrystallization & grain growth.	Lab. session: Laboratory 3 **ASSIGNMENT**
11	CHAPTER 9 Failure of materials	9.1 Fracture. 9.2 Fatigue. 9.3 Creep.	Tutorial session: Tutorial 5 (Ch.7&8)
12	CHAPTER 10 Phase Diagrams	10.1 Basic concepts of phase diagram. 10.2 Binary phase diagrams. 10.3 Interpretation of phase diagrams. 10.4 The iron-carbon system.	Lab. session: Laboratory 4
13	CHAPTER 11 Phase Transformations	11.1 Phase transformations in metals. 11.2 Microstructural & property changes in Fe-C alloys. 11.3 Precipitation hardening. 11.4 Heat treatment & hardenability.	Tutorial session: Tutorial 6 (Ch.9)
14	CHAPTER 12 Types and Applications of Materials	12.1 Classification & applications of metal alloys. 12.2 Classification & applications of ceramics. 12.3 Classification & applications of polymers.	Tutorial session: Tutorial 7 (Ch.10&11)
15	CHAPTER 13 Physical Properties	13.1 Electrical properties. 13.2 Thermal properties. 13.3 Magnetic properties. 13.4 Optical properties.	Tutorial session: **GROUP PRESENTATION**
16		**STUDY WEEK**	
17 & 18		**FINAL EXAM WEEK**	

9.0 COURSE STAFFS

a. Lectures Sessions

LECTURERS	
1BMCS2	Encik Wan Mohd Farid Bin Wan Mohamad Tel : 06-3316566 Room : Level 1, FTMK Email : farid@utem.edu.my
1BMCD2	Encik Muhd Ridzuan bin Mansor Tel: Room: Kompleks Makmal Fasa B Email:

b. Tutorial and Laboratory Sessions

GROUP	K1	K2
1BMCS2	En. Wan Mohd Farid Bin Wan Mohamad Tel : 06-3316566 Room : Level 1, FTMK Email : farid@utem.edu.my	Dr. Hady Effendy Tel : Room : Level 1, FTMK Email : @utem.edu.my
1BMCD2	Pn. Mahanum Binti Zamberi Tel : Room : Level 1, FTMK Email : @utem.edu.my	Encik Imran Syakir Mohamad Tel : 06-3316729 Room : Level 3, FTMK Email :imran@utem.edu.my

c. Technician

TECHNICIAN	
ALL GROUP	En. Mahader Bin Muhamad Tel : 06-233 2532 Room : Materials Science & Technology Laboratory (Lab. Phase B) Email : mahader@utem.edu.my

TEACHING PLAN APPROVAL (BEFORE 29 JUNE 2009)

Prepared by;

…….
Name :

Position :
Stamp :

Date : _____

Approved by;

……..
Dean/Deputy Dean (Academic)/Head of Department
Stamp :

Date : _____

TEACHING PLAN IMPLEMENTATION (MID SEMESTER BREAK, 17 – 21 AUGUST 2009)

Comment :

Checked by;

……..
Dean/Deputy Dean (Academic)/Head of Department
Stamp : Date:_____

TEACHING PLAN IMPLEMENTATION (WEEK 16, 19 – 23 OCTOBER 2009)

Comment :

Checked by;

……..
Dean/Deputy Dean (Academic)/Head of Department
Stamp : Date: _____

Matrix of Learning Outcomes:

No	Learning Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	Delivery	Assessment
1	Describe the classifications, structures and applications of metals, ceramics and polymers correctly.	3						1			Lecture & Tutorial	Assignment & Test
2	Analyse deformations behavior and strengthening mechanisms relying to its structure and properties of materials clearly.	3	2	1				1			Lecture & Tutorial	Tutorial, Quiz, Test & Exam
3	Apply Fick's Law in calculating the diffusion process and its mechanism in solids properly.	3	1	1							Lecture & Tutorial	Assignment Tutorial Quiz,Test & Exam
4	Demonstrate appropriate test methods in determining mechanical properties.	2	1								Lecture, Tutorial & Lab	Quiz,Test & Exam
5	Apply the relation between composition, microstructure and properties of metallic materials by using apposite phase diagram and heat treatment process.	3	2					1			Lecture, Tutorial & Lab	Assignment,Tutorial, Quiz,Test & Exam

1 = Light 2 = Medium 3 = Heavy