University of Macau
Department of Electromechanical Engineering
MECH442 – Advanced Materials for Engineer
Syllabus
1st Semester 2012/2013
Part A – Course Outline

Required elective course in Electromechanical Engineering

Course description:
3 credits. Specialisation of materials used in industry such as lightweight materials, corrosion, wear and thermal resistance materials, conductors, semiconductors and dielectric, magnetic materials, superconductors, optical fibers, biomaterials, nano-materials, smart materials and environmental-friendly materials. Electrical, thermal, magnetic, optical and corrosion properties, and case studies

Prerequisite:
Engineering Materials

Textbook:
W.D. Callister, ***Materials Science and Engineering: An Introduction,*** 8th Edition, Addison-Wesley 2010

References:
1. William F. Smith, Javad Hashemi, *Foundations of Materials Science and Engineering*, 5th Edition. McGraw Hill, 2009
2. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, *Biomaterials Science : An Introduction to Materials in Medicine*, 2nd Edition, Academic Press, 2004
3. Daniel L. Schodek, Paulo Ferreira, Michael F. Ashby, *Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers and Architects*, Butterworth-Heinemann, 2009

Course objectives:
1. Introduce students to comprehensive knowledge of advanced and novel materials and their applications. [a]
2. Introduce students to use the techniques, skills, and engineering tools necessary for engineering practice [e, k]
3. Introduce students to the impact of engineering solutions in a global, economic, environmental and societal context [h].

Topics covered:
1. Electrical Properties - conductors, semiconductors, dielectric, transducers
2. Magnetic Properties - magnetic materials, superconductors
3. Thermal Properties - thermal resistance materials
4. Optical Properties - optical fibers, lasers, LED
5. Corrosion and wear resistance materials
6. Biomaterials
7. Nanomaterials
8. Smart materials - shape memory alloys
9. Lightweight materials for automotive and aircraft
10. Environmental-friendly materials

Class/practice schedule:
Four weekly lecture hours (14 weeks)

Contribution of course to meet the professional component:
This course prepares students to work professionally in the area of **materials science and engineering**.

Relationship to EME programme objectives and outcomes:

This course primarily contributes to Electromechanical Engineering Program outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science, and engineering.

The course secondarily contributes to Electromechanical Engineering program outcomes that develop student abilities to:
(e) an ability to identify, formulate, and solve engineering problems.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public.

Course content:

Maths	Basic Sciences	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total 100%
0	0	80	20	0	0	100

Persons who prepared this description:

Prof. Chi Tat Kwok

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Part B General Course Information and Policies

1st Semester 2013/2014

Instructor: Prof. Chi Tat Kwok
Office: N409
Office Hour: By appointment
Phone: (853) 8397-4459
Email: fstctk@umac.mo

Time/Venue:

TBA

Assessment:

Final assessment will be determined on the basis of:

Homework:	20 %
Lab report:	10%
Mid-term:	20%
Final Exam (Comprehensive):	50%

Grading System:

The credit is earned by the achievement of a grade from 'A' to 'D'; 'F' carries zero credit.

Grades are awarded according to the following system:

Letter Grades	Grade Points	Percentage
A	4.0 (Excellent)	93-100
A-	3.7 (Very good)	88-92
B+	3.3	83-87
B	3.0 (Good)	78-82
B-	2.7	73-77
C+	2.3	68-72
C	2.0 (Average)	63-67
C-	1.7	58-62
D+	1.3	53-57
D	1.0 (Pass)	50-52
F	0 (Fail)	Below 50

Comment:

The objectives of the lectures are to explain and to supplement the text material. Students are responsible for the assigned material whether or not it is covered in the lecture. Students who wish to succeed in this course should read the assignments prior to the lecture and should work all homework and lab assignments. You are encouraged to look at other sources (other texts, etc.) to complement the lectures and text.

Homework Policy:

The completion and correction of homework is a powerful learning experience; therefore:

1 There will be approximately 7 homework assignments.
2 Homework is due one week after assignment unless otherwise noted, no late homework is accepted.
3 Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework
4 The course grade will be based on the average of the homework grades.

Quizzes/Mid-terms Exams:

One mid-term exam will be held during the semester.

Note:

1 Recitation session is important part of this course and attendance is strongly recommended.

2 No make-up exam is give except for CLEAR medical proof.
3 No exam is given if you are 15 minutes late in the midterm exams and 30 minutes late in the final exam. Even if you are late in the exam, you must turn in at the due time.
4 Cheating is absolutely prohibited by the university.

Appendix - Rubric for Program Outcomes

Rubric for (a)	5 (Excellent)	3 (Average)	1 (Poor)
Understand the theoretic background	Students understand theoretic background and the limitations of the respective applications.	Students have some confusion on some background or do not understand theoretic background completely	Students do not understand the background or do not study at all
Use a correct model and formulation correctly	Students choose a model correctly and properly apply correct techniques	Students choose a wrong model sometime, use a wrong formula, or a different technique	Students use a wrong model and wrong formula, or do not know how to model
Compute the problem correctly	Students use correct techniques, analyze the problems, and compute them correctly	Students sometime solve problem mistakenly using wrong techniques	Students do not know how to solve problems or use wrong techniques completely

Rubric for (e)	5 (Excellent)	3 (Average)	1 (Poor)
Identify applications in engineering systems	Students understand problem and can identify fundamental formulation	Students understand problem but cannot apply formulation.	Students cannot identify correct terms for engineering applications
Modeling, problem formulation and problem solving	Students choose and properly apply the correct techniques	Students model correctly but cannot select proper technique or model incorrectly but solve correctly accordingly	Students at loss as to how to solve a problem

Rubric for (h)	5 (Excellent)	3 (Average)	1 (Poor)
Scope of Content	Students will demonstrate material, items, or topics characterized by a sophisticated array of information, insight, and understanding.	Students demonstrate significance reflecting an acceptable degree of perception and thoughts.	Students have limited abilities to relate, incorporate, or demonstrate knowledge of subject with a dynamic breadth.
Impact of Process	Students will employ techniques, designs, ideas, and knowledge demonstrating a profound ability to improve and possess broad applications with a keen a series of actions, changes, or functions	Techniques, designs, ideas, and knowledge present some understanding and ability to demonstrate progression, significance, and influence.	Techniques, designs, ideas, and knowledge present limited progression, significance, and influence

Rubric for (k)	5 (Excellent)	3 (Average)	1 (Poor)
Use modern hardware tools in engineering practice	Student uses the hardware to measure and/or build engineering systems/designs correctly, and understands the limitations of the hardware.	Student uses the hardware to measure and/or build engineering systems/designs correctly.	Student does not use the hardware correctly.