University of Macau
Department of Electromechanical Engineering
EMEB351 – Advanced Materials for Engineering
Syllabus
1st Semester 2014/2015
Part A – Course Outline

Required elective course in Electromechanical Engineering

Course description:
3 credits. Specialisation of materials used in industry such as corrosion and thermal resistance materials, shape memory alloys, conductors, semiconductors and dielectric, magnetic materials, nuclear and energy materials, superconductors, biomaterials, and nano-materials. Electrical, thermal, magnetic, optical and corrosion properties

Prerequisite:
Engineering Materials

Textbook:
William D. Callister, Jr & David G. Rethwisch, ***Materials Science and Engineering: An Introduction,*** 8th Edition, John Wiley & Sons, Inc. 2012.

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]

Topics covered:
1. Electrical Properties - conductors, semiconductors and dielectric, superconductors
2. Magnetic Properties - magnetic materials
3. Thermal Properties - thermal resistance materials
4. Optical Properties - optical fibers
5. Nuclear and energy materials
6. Biomaterials - shape memory alloys, corrosion resistance materials
7. Nanomaterials

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.

Course content:

Maths	Basic Sciences	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total 100%
0	30	50	20	0	0	100

Persons who prepared this description:

Prof. Chi Tat Kwok

Part B General Course Information and Policies

2nd Semester 2013/2014

Instructor: Prof. Chi Tat Kwok
Office: E11-4069
Office Hour: By appointment
Phone: (853) 8397-4459
Email: fstctk@umac.mo

TA: Mr. Chan Weng Kin
Office: Laser Processing Lab (E11-G031)
Email: yb17414@umac.mo

Time/Venue:

Every Monday, 4:00 p.m. - 6:15 a.m. (Lecture) / E12-G020
Every Friday, 9:00 a.m. – 10:00 a.m. (Tutorial / practice) / E11-1021
Every Friday, 16:00 a.m. – 10:45 a.m. (Lecture) / E11-1021

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

Homework Policy:

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

1 There will be approximately 5 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. 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.

Student disabilities support service:

The University of Macau is committed to providing an equal opportunity in education to persons with disabilities. If you are a student with a physical, visual, hearing, speech, learning or psychological impairment(s) which substantially limit your learning and/or activities of daily living, you are encouraged to communicate with me about your impairment(s) and the accommodations you need in your studies. You are also encouraged to contact the Student Disability Support Service of the Student Counselling and Development Section (SCD) in Student Affairs Office, which provides appropriate resources and accommodations to allow each student with a disability to have an equal opportunity in education, university life activities and services at the University of Macau. To learn more about the service, please contact SCD at scd.disability@umac.mo, or 8822 4901 or visit the following website: http://www.umac.mo/sao/scd/sds/aboutus/en/scd_mission.php.

Appendix - Rubric for Programme Outcomes

(a) An ability to apply knowledge of mathematics, science, and engineering appropriate to the degree discipline

Measurement Dimension	Excellent (80-100%)	Average (60-79%)	Poor (<60%)
1. An ability to apply knowledge of mathematics to the solution of complex engineering problems.	Students understand mathematical principles (e.g. calculus, differential equations, linear algebra, probability and statistics) relevant to electromechanical engineering and their limitations in the respective application. Use mathematical principles to formulate for an engineering problem.	Students understand the theoretical background and choose mathematical principles relevant to electromechanical engineering, but have trouble in model development.	Students do not understand the background completely. Use wrong models, or do not know how to model.
2. An ability to apply knowledge of science to the solution of complex engineering problems.	Students understand the theories and principles of basic sciences (e.g. physics, chemistry, etc.). Use these principles to formulate models of physical processes and systems relevant to electromechanical engineering.	Students understand the theoretical background and choose scientific principles relevant to electromechanical engineering, but have trouble in model development.	Students do not understand the background completely. Use wrong scientific principles, or do not know how to model.
3. An ability to apply knowledge of engineering fundamentals to the solution of complex engineering problems.	Students combine mathematical and/or scientific principles to formulate for a problem relevant to electromechanical engineering. Understand limitations of these formulations in the respective application.	Students understand engineering concepts and principles, but have trouble in the development of formulation.	Students do not understand engineering concepts and principles completely. Use wrong models, or do not know how to model.
4. An ability to apply knowledge of engineering specialization to the solution of complex engineering problems.	Students understand the theoretical framework and body of knowledge for an electromechanical engineering specific area (e.g. thermal / fluid / materials / manufacturing / mechatronic / electrical / electronic engineering, etc.). Use the related knowledge to analyze an engineering problem correctly.	Students understand the theoretical framework of a specific area, but cannot analyze engineering problems relevant to this specific area correctly.	Students do not understand the theoretical framework of a specific area completely. Use wrong approaches, or do not know how to analyze problems.

(e) An ability to identify, formulate and solve engineering problems

Measurement Dimension	Excellent (80-100%)	Average (60-79%)	Poor (<60%)
1. An ability to identify complex engineering problems	Students can identify how various pieces are related to a complex engineering problem. Understand the relation between theories and practical problems.	Students can identify most but miss some pieces of the whole problem and do not fully understand the relation between theories and practical problems.	Students cannot identify the major components of the whole problem and do not understand the relation between theories and practical problems.
2. An ability to solve and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences	Students can apply theories to formulate strategies for solving complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	Students apply theories to formulate strategies to solve engineering problems of moderate difficulty reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.	Students have no coherent strategies for problem solving and use no resources to reach substantiated conclusions.

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline

Measurement Dimension	Excellent (80-100%)	Average (60-79%)	Poor (<60%)
1. An ability to use appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.	Students build engineering systems/designs correctly, and understand the limitations of the hardware for building the engineering systems/designs.	Students incompletely build engineering systems/designs.	Students are unable to build the engineering systems/designs correctly.