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University of Macau
Department of Electromechanical Engineering
MECH203 - Engineering Materials
Syllabus
1st Semester 2011/2012
Part A – Course Outline

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Compulsory course in Electromechanical Engineering

Course description:
Metallic materials: Ferrous and Nonferrous alloys, Thermal Treatment and Hardening, Microstructure and Properties. Ceramics: Structures, Properties, Processing and Applications of Ceramics. Polymers: Structures, Characteristics and Applications of Polymers. Composites.

Prerequisite:
MECH103 - Structure & Properties of Materials

Textbook:
W.D. Callister, *Materials Science and Engineering: An Introduction,* 7th Edition, Addison-Wesley 2006

Reference:
William F. Smith, Javad Hashemi, *Foundations of Materials Science and Engineering*, 5th Edition, McGraw Hill, 2009

Course objectives:
1. Introduce students to understand the primary types of materials (metallic, ceramic, and polymeric and composites), as well as the relationships that exist between the structural elements of materials and their properties. [a]
2. Introduce students to use the techniques, skills, and engineering tools/equipments necessary for engineering practice. [e, k]

Topics covered:
1. **Metallic materials** - Phase diagram and Lever Rule, Iron-carbon System, Phase Transformations, TTT and CCT diagrams, Development of Microstructure and Alteration of Mechanical Properties, Heat and Surface Treatment of Steels, Hardness and Hardenability, Ferrous and Non-ferrous Alloys, Applications.
2. **Ceramic materials** - Structures and Properties of Ceramics, Crystalline & Amorphous Ceramics, Glass Transition Temperature, Imperfections, Fracture and Deformation, Devitrification, Processing and Applications.
3. **Polymeric materials** – Molecular Weight, Structures and Shape of Polymers, Thermoplastic and Thermosetting Polymers, Elastomers, Viscoelasticity, Glass transition temperature, Deformation and Fracture of Semicrystalline Polymers, Polymerization, Additives, Vulcanization, Processing and Applications.
4. **Composites** – MMC, PMC and CMC, Particle and Fiber-reinforced Composites, Structural Composites.

Class schedule and credits:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No / Duration of exam papers
Lecture	Tutorial	Practice				
2.5	0.75	0.75	14	56	4	1 / 3hrs

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 Programne 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 Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies	Total 100%
0	40	40	20	0	0	100

Persons who prepared this description:

Prof. Chi Tat Kwok

Part B General Course Information and Policies

1st Semester 2011/2012

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

Time/Venue:
Every Tuesday, 5:30 p.m. – 7:30 p.m., Room J206
Every Friday, 5:30 p.m. – 7:30 p.m., Room J206 / Corrosion Lab.

Assessment:
Final assessment will be determined on the basis of:

Homework:	15%
Lab report:	15%
Mid-term exam:	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 4 homework assignments.
2. Homework is due two weeks after assignment unless otherwise noted, for late homework submitted not later than 3 days, marks will be deducted by 30%.
3. Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework
4. The homework grade will be based on the average of the assignment 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 (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.