University of Macau
Department of Electromechanical Engineering
MECH405 – Electromechanical System
Syllabus
1st Semester 2012/2013
Part A – Course Outline

Required elective course in Electromechanical Engineering

Course description:
Overview of electromechanical systems. Electrical and Mechanical system interfacing. Solenoid type devices and relay circuits. Sensors and transducers for electromechanical systems. Electric machines and power systems. Pneumatic systems and electro-pneumatic circuits. Hydraulic power and electro-hydraulic systems.

Prerequisite:
MECH205 - Electrical Engineering

Textbook:
- G. Rizzoni, ***Principles and Applications of Electrical Engineering***, Latest edition, McGraw-Hill

References:
- S.E. Lyshevski, *Electromechanical Systems, Electric Machines, and Applied Mechatronics*, Latest Edition, CRC Press.
- E. Hughes, *Electrical and Electronic Technology*, Latest Edition, Prentice Hall.

Course objectives:
1. Introduce to students some electromechanical energy conversion systems. [a, c, k]
2. Introduce to students mathematical modeling of physical systems. [a, b, e]

Topics covered:
1. **Complex power** – power factor, power triangle, power factor correction
2. **Transformers** – Ideal transformer, impedance reflection & power transfer, maximum power transfer
3. **Magnetic circuits** – magnetic materials, structure & equivalent circuit, electromagnet
4. **Electromechanical energy conversion** – Electromagnet forces, moving coil/magnet transducers
5. **Rotating electric machines** – Classification and performance characteristics
6. **DC generators and motors** – physical structure, configuration, modeling, torque/speed and dynamic characteristics
7. **Synchronous generators and motors** – Rotating magnetic field, , torque/speed and dynamic characteristics
8. **Induction motors** - Equivalent circuit, torque/speed and dynamic characteristics & control
9. **Electromechanical system models** – Dynamic modeling and analysis

Class/practice schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No / Duration of exam papers
Lecture	Tutorial	Practice				
2	0	2	14	56	3	1/2hrs

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

Relationship to EME Programme objectives and outcomes:
This course primarily contributes to Electromechanical Engineering Programme outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science, and engineering.
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

The course secondarily contributes to Electromechanical Engineering Programme outcomes that develop student abilities to:
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.
(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%
50	0	50	0	0	0	100

Persons who prepared this description:

Ir. Dr. T.W. Ching

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Part B General Course Information and Policies

1st Semester 2012/2013

Instructor:	Ir. Dr. T.W. Ching	Office:	N302
Office Hour:	By appointment	Phone:	(853) 8397-4352
Email:	twching@umac.mo		

Time/Venue:

Every Tuesday, 9:30 a.m. - 11:30 a.m., Room U107.
Every Wednesday, 9:30 a.m. - 11:30 a.m., Room N204.

Assessment:

Final assessment will be determined on the basis of:

Homework:	20%
Lab Report:	20%
Mid-term	20%
Final Exam (Comprehensive):	40%

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:

- There will be approximately 6 homework assignments.
- Homework is due one week after assignment unless otherwise noted, no late homework is accepted.
- Possible revision of homework grades may be discussed with the grader within one week from the return of the marked homework
- The homework grade will be based on the average of the assignment grades.

Quizzes/Mid-terms Exams:

Mid-term exam(s) will be held during the semester.

Note:

- Replaced by "*Electro-mechanical Energy Conversion*" in new system, i.e. last course will be offer in 1st Semester 2011/2012.
- Recitation session is important part of this course and attendance is strongly recommended.
- Check UMmoodle (webcourse.umac.mo) or email for announcement, homework and lectures.
- No make-up exam is give except for CLEAR medical proof.
- 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.
- Cheating is absolutely prohibited by the university.

Appendix - Rubric for Programme 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 (b)	5 (Excellent)	3 (Average)	1 (Poor)
Conduct experiments	Student successfully completes the experiment, records the data, analyzes the experiment's main topics, and explains the experiment concisely and well.	Student successfully completes the experiment, records the data, and analyzes the experiment's main topics.	Student either does not complete the experiment successfully, or completes it successfully but does not record the correct data.
Design experiments	Student understands what needs to be tested and designs an appropriate experiment that takes into account the limitations of the equipment and measurement accuracy.	Student understands what needs to be tested and designs an appropriate experiment, but may not fully understand the limitations of the measurements.	Student does not understand what needs to be tested and/or does not design an appropriate experiment.

Rubric for (c)	5 (Excellent)	3 (Average)	1 (Poor)
Design capability and design constraints	Student understands very clearly what needs to be designed and the realistic design constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.	Student understands what needs to be designed and the design constraints, but may not fully understand the limitations of the design constraints.	Student does not understand what needs to be designed and the design constraints.
Process to meet desired needs	Student understands very clearly the process of the design.	Student understands what the needs of the process design, but may not fully understand the limitations of the design constraints.	Student does not understand the process.

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.