

University of Macau
Department of Electromechanical Engineering
MECH406 – Production System, Planning & Control
Syllabus
1st Semester 2010/2011
Part A – Course Outline

Required elective course in Electromechanical Engineering

Course description:

This course introduces the following concept:

- Elements of the production systems and interfaces between these elements;
- Different types of production systems;
- Principles and concepts in the design and control of production systems, including organization, production, and advanced quality control, work methods and measurement;
- Mathematical and computer models for planning and control of facilities, human resources, projects, materials, and information in production systems through the forecasting techniques.

Prerequisite:

None

Textbook:

- Daniel Sipper; Robert L. Bulfin, JR., *Production: Planning, Control and Integration*, McGraw-Hill, 1998.

References:

- Stephen J. Guastello, *Human Factors Engineering and Ergonomics: A Systems Approach*. Lawrence Erlbaum Associates, 2006.
- Mark S. Sanders, and Ernest J. McCormick, *Human Factors in Engineering and Design*, McGraw-Hill, 1993.
- Douglas C. Montgomery, *Introduction to Statistical Quality Control*, 6th edition, Wiley, 2008
- Chase, Aquilano, Jacobs, *Production and Operations Management - Manufacturing and Services*, 8th Edition, McGraw-Hill, 2001.
- William J. Stevenson, *Operations Management*, 10th Edition, McGraw-Hill/Irwin, 2008.

Course objectives:

1. Introduce to students to organize the production process improvement project. [c, d, g, h]
2. Introduce to students mathematical modeling of production quality control and forecasting. [a, e, l]
3. Introduce to students different measurement method for advanced production system. [k]

Topics covered:

1. Job Design
 - Development and Improvement of Work Methods
 - Therblig Analysis
 - Motion Economy and Work Efficiency
 - Human Factors and Ergonomics
 - Physical Measurements
 - Cognitive Measurements
 - Mechanical Aids
2. Advanced Quality Control
 - Quality assurance, Quality management
 - Control Chart
 - Sampling Plan
 - Reliability
 - Acceptance Sampling

- Decision Making for Data Analysis of Quality Control
3. Forecasting
 - Forecasting System
 - Exponential Smoothing
 - Trend-Adjusted Smoothing
 - Decomposition Approach
 - Seasonal Variation
 - Centered Moving Average
 4. Measurement Method
 - Traditional
 - Nontraditional

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 | | | | |
| 3 | 0 | 1 | 14 | 56 | 3 | 1 / 3 hours |

Contribution of course to meet the professional component:

This course prepares students to work professionally in the area of **engineering management**.

Relationship to EME program 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;
- (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.
- (d) an ability to function on multidisciplinary teams;
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline.

The course secondarily contributes to Electromechanical Engineering program outcomes that develop student abilities to:

- (e) an ability to identify, formulate, and solve engineering problems;
- (g) an ability to communicate effectively;
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context;
- (l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations.

Course content:

| Maths | Engineering Science | Engineering Design and Synthesis | Complementary Studies | Computer Studies | Total 100% |
|-------|---------------------|----------------------------------|-----------------------|------------------|------------|
| 20 | 20 | 25 | 20 | 15 | 100 |

Course modulator:

Dr. Zhixin Yang

Persons who prepared this description:

Dr. Seng Fat Wong, Dr. Zhixin Yang, Dr. Seng Fat Wong

Part B – General Course Information and Policies

1st Semester 2010/2011

Instructor: Dr. Seng Fat Wong
Office Hour: by appointment
Email: fstsfw@umac.mo

Office: N403
Phone: (853) 8397-4453

Time/Venue:

Every Monday, 4:30 p.m. - 6:30 p.m., Room N203
Every Thursday, 4:30 p.m. - 6:30 p.m., Room N203

Assessment:

Final assessment will be determined on the basis of:

| | |
|--------------------------------------|-----|
| Attendance and in-class Performance: | 5% |
| Homework: | 10% |
| In-class Quizzes: | 15% |
| Course Project: | 30% |
| 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 textbook (chapter related) prior to the lecture, should work all homework and in-class quizzes and should made use of the material provided at UMMoodle such as examples and extra material. You are encouraged to look at other sources (such as other textbooks, websites, 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 7 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 course grade will be based on the average of the homework grades.

Quizzes/Mid-terms Exams:

Approximately 4 quizzes and one final exam will be held during the semester.

Note:

- Check UMMoodle (ummoodle.umac.mo) for announcement, e-quizzes and lectures. Report any mistake on your grades within one week after posting.
- Attendance is strongly recommended.
- No make-up exam is give except for CLEAR medical proof.
- No exam is given if you are 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 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 (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 (d) | 5 (Excellent) | 3 (Average) | 1 (Poor) |
|---------------------------------|---|---|--|
| Ability to work in teams | Performance on teams is excellent with clear evidence of equal distribution of tasks and effort as well as frequent meetings of the team members. | Performance on teams is acceptable with one or more members carrying a larger amount of the effort as well as infrequent meetings of the members or one or more members being absent from several meetings. | Performance on teams is poor to unacceptable with one or two members clearly carrying the majority of the effort as well as inadequate team meeting or one or more members missing the majority of the meetings. |
| Multi-disciplinary teams | Team consists of members from two or more different engineering/science/business fields (this could contain some members not actually enrolled in the course but interacting as part of a competition, collaboration, etc.) | Team consists of members from two or more concentrations within the Department of Electromechanical Engineering | Team consists of members from the same concentration within the Department of Electromechanical Engineering |

| 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, or cannot understand problem | 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 (g) | 5 (Excellent) | 3 (Average) | 1 (Poor) |
|----------------------------|--|---|---|
| Professional Impact | Student's/Team's/Group's document(s)/presentation(s) is/are considered to be of professional quality | Student's/Team's/Group's document(s)/presentation(s) is/are considered acceptable for college level work | Student's/Team's/Group's document(s)/presentation(s) is/are considered unacceptable for college level work |
| Written Component | Document is nearly error free with sophisticated use of vocabulary, formatted properly, with well developed concise sentences and paragraphs | Document contains some errors with a somewhat colloquial vocabulary, minor formatting issues, with some organizational issues that do not interfere with communication | Document contains many errors, very colloquial vocabulary, with severe organizational issues that interfere with communication. Document would be considered unacceptable. |
| Oral Component | Presentation is consistent, uniform, clear, direct, complete and captivating with very clear fonts and graphics with an excellent layout that clearly presents the technical content | Presentation is somewhat inconsistent between speakers, occasionally difficult to hear, with an acceptable layout containing acceptable fonts and graphics that adequately presents the technical content | Presentation is very inconsistent between speakers, difficult to hear with a poor layout containing illegible fonts and graphics that poorly presents the technical content. Would be considered unacceptable |

| 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. |

| Rubric for (l) | 5 (Excellent) | 3 (Average) | 1 (Poor) |
|---|--|---|---|
| Use modern computer and software tools in engineering practice | Student uses the computer and software to correctly analyze engineering problems and/or create engineering designs, and understands the limitations of the software. | Student uses the computer and software to correctly analyze engineering problems and/or create engineering designs. | Student does not use the computer and software to correctly create engineering designs and/or does not correctly interpret the results. |