**CIVL427 – Steel Structures**
**Syllabus**
**1st Semester 2012/2013**

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| Coordinating Unit: | Department of Civil and Environmental Engineering,<br>Faculty of Science and Technology | | |
| Supporting Unit(s): | Nil | | |
| Course Code: | CIVL427 | Year of Study: | 4 |
| Course Title: | Steel Structures | | |
| Compulsory/Elective: | Elective | | |
| Course Prerequisites: | CIVL314 Structure I | | |
| Prerequisite Knowledge: | Load estimation skills and structural analysis capability, particularly shear and moment diagrams obtained from static analysis under the appropriate loads. | | |
| Duration: | One semester | Credit Units: | 3 |
| Class/Laboratory Schedule: | Three hours of lecture per week. | | |
| Laboratory/Software Usage: | The design software SAP2000 is adopted. | | |
| Course Description: | This course covers the following topics: This course is designed to introduce the behaviour and design of steel structural members according to the limit states design concept. The behaviour and design of tension members, compression members, laterally restrained and unrestrained beams, beam-columns and design of connections will be discussed. Students are expected to obtain basic knowledge about the design and failure mode of steel structural members after finished this course. | | |
| Course Objectives: | 1. To introduce to students the theory and application of analysis and design of steel structures.<br>2. To develop students with an understanding of the behavior and design of steel members and systems.<br>3. To prepare students for the effective use of the latest industry standard formulas, tables, design aids and computer software in the design of steel members. | | |
| Learning Outcomes (LO): | Upon completion of this course, students should be able to:<br>1. recognize the manufacturing process and the material properties of steel products [POs: e]<br>2. recognize the design philosophy of steel structures and have concept on limit state design [POs: e]<br>3. understand the behaviour of steel structures, in particular the various forms of failure for members and connections under tension, compression, bending and combined actions [POs: a,e]<br>4. apply the principles, procedures and current code requirements to the analysis and design of steel tension members, beams, columns, beam-columns and connections [POs: a,c,d,e]<br>5. ability to follow different structural design specifications and apply computer software to analyze steel structural systems under gravity and lateral loads [POs: a,c,e,l] | | |
| References: | 1. Lam, D., Ang, T-C. and Chiew, S-P, Structural Steelwork: Design to Limit State Theory, 3rd Edition, Butterworth-Heinemann Ltd.<br>2. Morris, L. J. & Plum, D. R., Structural Steelwork Design to BS 5950, 2nd Edition, Prentice Hall.<br>3. Nethercot, D. A., Limit States Design of Structural Steelwork, 3rd Edition, Spon Press.<br>4. Gardner, L. and Nethercot, D. A., Designer's guide to Eurocode 3: Design of steel structures, Thomas Telford Limited, 2005<br>5. Eurcode 3: Design of steel structures general rules and rules for buildings | | |

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| Student Assessment: | • Group project 30 %<br>• Two Mid-term Examines 40 %<br>• Final Examine 30 % |
| Learning Outcome Assessment: | • Tests, final examination and project.<br>• Course evaluation |
| Pedagogical Methods: | ☑ Lecture ☐ Service learning<br>☐ Guest speakers ☐ Internship<br>☐ Case study ☐ Field study<br>☐ Role playing ☐ Company visits<br>☑ Student presentation ☐ e-learning<br>☑ Project ☑ Independent study<br>☐ Simulation game ☑ Others: Computer software<br>☑ Exercises and problems |

| Major Assessment Methods: | Case Study | Role Playing | Student Presentation | Individual assessment | Group project/paper | Simulation Game | Exercises & problems | Service learning | Internship | Field Study | Company visits | Written examination | Oral examination | Others (Computer software) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Class Participation/ Discussion (0%) | | | | | | | | | | | | | | |
| Group project (30%) | | | ✓ | ✓ | ✓ | | | | | | | | | |
| Test(s) (40%) | | | | | | | | | | | | ✓ | | |
| Examination (30%) | | | | | | | | | | | | ✓ | | |
| Others *(please specify)* _____ (0 %) | | | | | | | | | | | | | | |
| Course Web: (if any) | http://webcourse.umac.mo/ | | | | | | | | | | | | | |

Course Content: (topic outline)

| Week no. | Topics | LO no. |
|---|---|---|
| 1 | Concepts of structural steel design and material properties of structural steel and discussion of types of loads and load combination. | 1 |
| 2 | Concepts of Limit States Design – Ultimate limit states and Serviceability limit states, Partial safety factors and plastic analysis of beam member and frame structure. | 2 |
| 3 | Tension members – Behavior and design of tension members. Eccentrically loaded tension members. Combined tension and moment. | 3,4 |
| 4 | Beam Design – Beam classifications. Bending moment capacity. Lateral torsional buckling. Shear in beams. Beams deflection. Web buckling and bearing resistance. | 3,4 |
| 5,6 | Compression members – Classification of cross-section. Euler column buckling. Column design: effects of residual stresses and initial imperfections, effective lengths of columns and slenderness, design compression resistance. | 3,4 |
| 7 | Mid-term Examination 1 | -- |
| 8,9 | Beam-Column Design – Interaction equations. Effects of moment gradient loading. Design resistance of beam-column members. | 3,4 |
| 10 | Concept of welding process. Type of welded connections and failure mode. Design of welded connections. | 3,4 |
| 11 | Type of bolted connections and failure mode. Design of bolted connections. | 3,4 |
| 12 | Mid-term Examination 2 | -- |
| 13 | Discussion of different design codes and analysis of steel structural system by using computer software | 5 |
| 14 | Group project presentation | -- |
| TBA | Final Examination | |

Percentage Content of:

| Math | Engineering Science | Engineering Design and Synthesis | Complementary Studies | Computer Studies | Total |
|---|---|---|---|---|---|
| 0 | 15 | 80 | 0 | 5 | 100 |

Timetabled work in hours per week:

| Lecture | Tutorial | Laboratory | Other | Total |
|---|---|---|---|---|
| 3 | --- | --- | --- | 3 |

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| Contribution to Program Outcomes: | |

| Program Outcomes | Contribution to POs[#] 5 ----------> 1 Significant Least | | | | |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |
| (a) Apply knowledge of mathematics, science, and engineering | ✓ | | | | |
| (b) Design and conduct experiments, and analyze data | | | | | |
| (c) Design components, systems or processes in presence of constraints | ✓ | | | | |
| (d) Function in a multi-disciplinary team | | | ✓ | | |
| (e) Engineering problem solving | ✓ | | | | |
| (f) Understand professional and ethical responsibility | | | | | |
| (g) Communicate effectively | | | | | |
| (h) Understand the impact of engineering solutions to the society | | | | | |
| (i) Recognize the need and have the ability for lifelong learning | | | | | |
| (j) Have knowledge of contemporary issues | | | | | |
| (k) Apply the skills, techniques, modern engineering tools | | | | | |
| (l) Use the computer/IT tools relevant to the discipline | | | | ✓ | |
| *# Note* 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support | | | | | |

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| Course Instructor(s): | Dr. Chi Chiu Lam |