

## ARC 5513 – 901: Advanced Building Technology and Structures Spring 2010

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*NOTE: This Syllabus is provided for informational purposes regarding the anticipated course content and schedule. It is based on the most recent information available as of the date of its issuance. It is as accurate and complete as is possible at this time. The instructors reserve the right to make any changes deemed necessary and/or appropriate. An effort will be made to communicate any syllabus changes in a timely manner. Students are responsible for being aware of these changes.*

Class hours: TE 2:00 – 3:15 pm

Location: TBA

Contact information:

**Dr. Rashed-Ali:**

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### CATALOGUE DESCRIPTION

(3-0) 3 hours credit. Prerequisite: Graduate standing or consent of instructor.

An advanced study of building technology and structures. Includes consideration of sustainable techniques, technologies, building enclosure, structural behavior and systems, the integration of heating, cooling and ventilating systems, lighting, acoustics, electrical, plumbing and water, security, vertical circulation, and site and transportation for new and existing buildings.

### COURSE CONTENT

This course will include a survey and analysis of recent advances in the areas of building systems and technologies with the aim of introducing the student to current state-of-the-art technologies and their implications on building design. The course will address the *qualitative patterns, quantitative performance parameters, and analysis methodologies and techniques* for these technologies and systems. The systems and technologies covered in the course will be introduced from the point of view of their relationship to issues of architectural design with the intention of assisting students in gaining an understanding of how to integrate these systems into the design process and in its different stages (conceptual, schematic, design development, etc.), as well as to be aware of the different interactions in-between these systems and between them and other systems within the building.

The course will consist of two major sections; the first will focus on advanced building technologies, while the second will address advanced structural systems. The building technologies section will focus primarily on issues related to sustainable design, and sustainable building technologies, with an emphasis of high performance buildings. Topics covered in this section will include, but are not limited to:

- Advanced building materials.
- Advanced fabrication techniques.
- High-performance facades.
- Contemporary applications of passive climatic design strategies.
- Building-integrated renewable energy systems.
- Advanced mechanical and electrical building systems.
- Building performance analysis techniques.
- Building performance simulation tools.
- Integrated design methods
- High-performance, zero-energy, and carbon neutral buildings.
- Building performance metrics and rating frameworks.

The structures section will cover the historic development of structural systems with the outcomes involving the innovative building materials and construction techniques. The structural systems will be explored in detail with the strong and weak points including the effectiveness in terms of materials. The course includes seminars and discussions about the potential of innovative structural systems for different building types with different functions. Topics covered in this section will include, but are not limited to:

- *Horizontal Systems:*
  - Bending Resistant Systems: Bending Concepts; Optimization for Beams; Joists and Girders; Trusses; Folded Plates; Cylindrical Shells
  - Axial Resistant Systems: Trusses; Space Trusses; Tree Structures
  - Form-Resistant: Funicular Concepts; Arches; Vaults; Domes; Shells
  - Tensile Resistant: Tension Members; Pre-stressed Structures; Suspended Structures; Cables; Pneumatic Structures
- *Vertical Systems:*
  - Shear Resistant Systems: Walls; Shear Walls; Wood Shear Walls
  - Bending Resistant: Cantilevers; Moment Frames; Tubes
  - Axial resistant: Braced Frames

Students enrolled in the course should have a basic understanding of the underlying issues and basic principles of the topics covered in the course, typically covered in undergraduate environmental systems and structures courses. These topics include principles of sustainable design, climate analysis and climatic design strategies, basic typologies of building environmental systems, principles of structural analysis, etc.). Students without this necessary background are encouraged to use the suggested textbook list to gain the necessary background.

#### GUEST LECTURERS AND FIELDTRIPS

Class activities may also include presentation by guest lecturers in relevant topics. Fieldtrips to interesting projects may also be arranged during the semester.

#### PROJECTS AND ASSIGNMENTS

One semester project will be assigned for each of the two components of the course. The projects will represent the vehicle for documenting, applying, and evaluating the knowledge gained by the students during the course of the semester. Other assignments and applied exercises may also be assigned as needed. Relevant readings will also be assigned for some topics.

#### STUDENT EVALUATION & GRADING POLICY

Student evaluation in this course will involve a number of components including the previously mentioned projects and assignments/exercises, as well as a midterm and a final exam:

The exam may include true-false questions, multiple-choice questions, and calculations and analysis. Both the exam and the assignments will be based on both the assigned readings as well as all class presentations.

Grading of the semester projects will be based on the following criteria:

- Depth of research,
- Completeness and thoroughness in responding to project statement,
- Clarity of observation and analysis,
- Accuracy of the outcomes,
- Quality and craftsmanship of graphic design.

Projects must be submitted in a format reflective of your status as a graduate student in a professional program and submission guidelines must be followed. Poorly-organized work, torn sheets of paper, unintelligible writing, handwriting, and indecipherable spelling will not be accepted.

#### GRADING POLICY

The general meaning of the letter grades is presented below:

- A (90-100) *Excellent:*** Exceeds minimum requirements and reaches a state of exceptional work produced. Strong initiative, attendance, participation, research and reading. Complete comprehension of course/project goals. Adds positively to the educational experience for the rest of the class. Tests and projects are well beyond the minimum requirements to expand the questions or problems assigned. Work is delivered by the due date and is of exceptional graphic quality.
- B (80-89) *Good:*** Often exceeds minimum requirements for work produced – for quality and quantity, attendance, research and reading. Participates regularly in class discussions. Solid comprehension and above average demonstration of course/ project goals. Tests and projects are well composed, and make thoughtful original contributions to the questions or problems assigned. Work is delivered by the due date and is of good graphic quality.
- C (70-70) *Average:*** Meets minimum requirements for work produced – for quality and quantity, attendance, research and reading. Little or no participation in class discussions. Tests answer the question as given and projects provide the required information. Work is delivered by due date and is of average or acceptable informational and graphic quality.
- D (60-69) *Not a passing grade:*** Work produced is consistently weak with poor craft, absences, insufficient or no research, little or no reading, little or no participation. Demonstrates a weak comprehension of course/ project goals. Tests provide only partial answers to the questions given and projects may also be partially complete. Work, if delivered by the due date, is of poor informational and graphic quality.
- F (below 60) *Not a passing grade:*** Work, if any, produced is very weak with poor craft, seven or more absences, little or no research, reading, and participation. Demonstrates that course/ project goals or test questions were misunderstood or ignored. Tests provide irrelevant answers to the questions given and projects may also be substantially incomplete. Work, if delivered by the due date, is of unacceptably sloppy graphic quality.

#### COURSE REQUIREMENTS AND CLASSROOM POLICIES

##### ATTENDANCE:

*Course attendance is mandatory* and is considered an integral component of the learning experience. Attendance will be regularly recorded. Punctuality is required and considered an indication of professionalism and responsibility. Arriving more than 10 minutes late or leaving more than 10 minutes early from the class room will count as ½ day of unexcused absence. Missing one of the two class period in one day will also count as ½ day of unexcused absence. A maximum of “4” unexcused absences are allowed during the semester without affecting the final course grade. The final grade will be reduced by a full letter grade for each additional day of unexcused absence. Seven or more unexcused absences will automatically result in a grade

of “F”. Students should refer to university guidelines for a list of excused absences, however, these excused absences must be arranged for and documented in writing BEFOREHAND with the instructor, and otherwise they will count as unexcused absences. Absence for medical reasons must be supported by the appropriate documentation as soon as possible. Students with 6 or more “excused absences” must consult with the instructor as this excessive absence can impact their performance in the course. This policy will be strictly enforced.

LATE SUBMISSION:

Late submission of semester project is not allowed. Students with excused absences, who will not be present to meet the submission deadline, MUST CONSULT with the instructor BEFOREHAND to make alternative arrangements for submitting their work on time. No exceptions will be made. THERE IS NO MAKE-UP FOR QUIZZES AND EXAMS. Late submittals of projects or assignments will result in a reduction in the grade of the assignment in question by 10 POINTS for each CALENDAR DAY. No excuses will be accepted for late projects. All submissions are due at the BEGINNING of class at the due date unless otherwise announced.

BLACKBOARD:

All course material, including syllabus, class presentations, projects and assignments, and other resources, will be made available on Blackboard. Blackboard mail will also be used by the instructor to communicate important information to students. Students are responsible to check their Blackboard mail account regularly or forward it to their main e-mail account (that they do check regularly). Student grades will also be posted on Blackboard as they become available.

#### RECOMMENDED READINGS

- Stein, B.; Reynolds, J.; et al. 2006. *Mechanical and Electrical Equipment for Buildings*, 10<sup>th</sup> edition. Hoboken, NJ: John Wiley and Sons.
- Kwak, A. and Grondzik, W. 2006. *The Green Studio Handbook*. London, UK: Architectural Press.
- Keeler, M. & Burke, B. 2009. *Fundamentals of Integrated Design for Sustainable Buildings*. Hoboken, NJ: John Wiley and Sons.
- Brown, G. Z. and Dekay, M. 2000. *Sun, Wind & Light: Architectural Design Strategies*, 2nd Edition. New York, NY: John Wiley & Sons.
- Moore, F. 1992. *Environmental Control Systems: Heating, Cooling, Lighting*. New York, NY: McGraw-Hill Science/Engineering/Math.
- Grumman, D. 2003. *ASHRAE Green Guide*. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

#### RELEVANT WEBSITES

- Center for Maximum Potential Building Systems <http://www.cmpbs.org/>
- Vital signs: <http://arch.ced.berkeley.edu/vitalsigns/>
- Agents of Change: <http://aoc.uoregon.edu/>

#### SCHOLASTIC DISHONESTY

Scholastic dishonesty, including any instances of plagiarism and/or cheating *WILL NOT BE TOLERATED* in this class. Any such incident will result in automatic failure in the project, assignment, or exam involved. Plagiarism consists of passing off as one’s own ideas, words, writings, etc. which belongs to another. You are committing plagiarism if you are copying another person’s work and submitting it as your own, even if you have that person’s permission. Signing the attendance sheet for another student or leaving class immediately after signing the attendance sheet are also examples of serious dishonesty. Any and all incidents of plagiarism and academic dishonesty will be reported to the Office of Student Life. For more details, please refer to the Scholastic Dishonesty Policy as stated in the current University Catalogue.

## STUDENTS WITH DISABILITIES

The Americans with Disabilities Act (ADA) is a federal anti-discrimination status that provides comprehensive protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you need accommodation related to a disability, please make an appointment to discuss your needs.