Department of Civil Engineering, McMaster University, Hamilton, Ontario, CANADA
Term I  -  (September - December, 2018)

CIV ENG 3P04 - CIVIL ENGINEERING MATERIALS AND DESIGN
(Course Website: Follow the links from http://avenue.mcmaster.ca)

Course Instructor:  Prof. K.S. Sivakumaran  (email: civ3p4@mcmaster.ca), Office JHE 229.

Teaching Assistants:  (See course web-site for information on teaching assistants for the course)

Activities:  A total of about 36 lectures, and about 12 hours of labs related to the concrete mix-design project.

Reference Text Books:
[1]  *Design and Control of Concrete Mixtures*, by S.Kosmatka et.al, Published by Cement association of Canada.  [*Please order online from Cement association to get student discount*]

Partial class notes and concrete mix-design project descriptions will be posted in the course web-site.
Due to safety hazards in the laboratory (ADL), each student must wear safety boots, safety glasses and hard hat at all times. You must bring your own safety boots, and the other items will be supplied by ADL.

COURSE CONTENT:

<table>
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<tr>
<th>TOPICS</th>
<th>Approximate Number of Lectures</th>
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<tr>
<td>Concrete: Concrete composition; Properties of aggregates and cement; Concrete mix-design; Control of concrete mix; Fresh concrete properties; Hardened concrete properties; Response to environmental changes and chemical attack.  (<em>Useful references [1] and [3]</em>)</td>
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<td>Mechanical Properties of Materials: Homogeneity, isotropy, stress-strain relations, Hooke’s Law; Atomic and molecular basis of some mechanical and physical properties. Fatigue, fracture and long-term response to sustained stresses  (<em>Useful reference [2]</em>)</td>
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<tr>
<td>Steel and other Ferrous Metals : Steel composition, production and products; Metal forming; Factors affecting the mechanical properties of steel; Strengthening mechanisms; Other ferrous metals: wrought iron, cast iron, stainless steel; Structural steel products and their properties; Steel reinforcement for concrete and their properties; Steel corrosion  (<em>Useful references [2] and [3]</em>)</td>
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<tr>
<td>Concepts of Structural Design: Material and load uncertainty; Types and basis of design principles- Allowable (working) Stress Design, Limits States Design; Introduction to the National Building Code of Canada and Structural Design Standards; Estimation of dead load, live loads- use and occupancy, snow loads, wind loads, earthquake loads, loads due to temperature change.</td>
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<td>Wood: Constituents and classification; Properties of wood; Wood defects and their effect on strength and stiffness; Wood seasoning; Wood deterioration and its remedy; Grading of wood products.  (<em>Useful reference [3]</em>)</td>
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<tr>
<td>Plastics and composites: Chemistry of polymers; Types of plastics and their general properties; Fibre reinforced polymer (FRP) composites; Types of fibres and matrices; Properties of FRP composites; Applications of FRP in construction.  (<em>Useful reference [2]</em>)</td>
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Total: 36
**Learning Outcomes:**
1. Knowledge of most common construction materials, including concrete, structural steel and wood.
2. Understanding their important properties relevant to the design, construction and performance of structures made of these materials, and understanding the key factors that affect the various engineering properties of these materials.
3. Ability to characterize aggregates used in concrete, calculate the proportion a concrete mix for target strength and durability, blend the ingredients and produce the actual mix.
4. Perform the key laboratory tests to assess the strength and some other mechanical and physical properties of the concrete.
5. Analyse systematically the test data, discuss the findings and report the results in a coherent form.
6. Understanding the composition and relevant properties of reinforcing and structural steels as well some other ferrous alloys, and the Canadian CSA standards specifications for meeting specified requirements.
7. Understanding the composition, key properties and advantages and disadvantages of fibre reinforced polymers (FRP) in construction.
8. Understanding the structure, properties and use of wood in construction and its limitations; the factors which influence the mechanical properties and durability of wood.
9. Understanding the structural design process and the concepts of load and resistance
10. Understanding the concepts of uncertainty in design and its effect on the safety and serviceability of structures, with particular focus on the National Building Code of Canada.

**Relevant Attributes**
1. Competence in natural sciences
2. The ability to manage time and processes effectively, prioritizing competing demands to achieve personal and team goals and objectives
3. Ability to address uncertainties in the prediction of interactions on society and the environment in a structured and transparent manner
4. Ability to assess possible options and design configurations from a sustainability engineering perspective, which emphasizes environmental stewardship, life cycle analysis and long-term decision making
5. Ability to identify, characterize, assess, and manage risks to project success

**Distribution of Marks:**
- Assignments: 15%  
  [There will be 5 assignments]
- Concrete Mix-Design Project: 25%  
  [To pass the course, one must complete the full project.]
- Term Test (Closed Books): 20%
- Final Examination (Closed Books): 40%

The percentage marks will be converted to final letter grade using the standard conversion scale shown in the McMaster Undergraduate Calendar.

**[See course web-site for further information on the concrete mix-design project (Group Activity & partial Individual Activity) and the assignments (Individual Activity)]**

- Do not miss even one lab-session, since, obviously, it will not be possible to make alternate arrangements.
- Work on assignments as soon as they are posted. Submit assignments on the due date and time, even it is not complete, as no alternate arrangements will be made for missed assignment submission. Late assignment submission attracts 0 marks.

**Term Test (Closed Books):** There will be a term test for the course to be conducted on Friday, October 26, 2018 – 1.30pm - 3.30pm. This is a closed book test, and as such, books and notes are NOT permitted during the term test (as well as during the Final Examination).

- Any conflict between the term test and any other courses must be brought to the attention of the instructor immediately, so that alternate arrangements may be made.
- Marked term test will be returned to students during lecture period, and left-over books may be picked up during tutorial times only.

**Missed Term Test:** Please see McMaster Undergraduate Calendar for the relevant policy. Accordingly, please contact the associate dean of engineering in order to obtain permission for relief. If such a relief is granted, a makeup test may be arranged. **Such a makeup test will include course materials covered in the lectures up to two days prior to such a makeup test.**

- If a makeup test is not arranged, then the marks associated with the missed term test will be re-allocated to the final examination.
DISPUTE RESOLUTION PROCEDURES FOR ASSIGNMENTS & TERM TESTS

- It is possible that some students may have disputes related to the marking of their assignments and/or term tests.
- Students have **ONE (1) week** to lodge their objections [One week after returning the marked papers].
- Assignments and term tests written in pen ONLY will be considered for dispute resolutions.
  
  [Hint! Use pen to write the assignments and term tests]

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Step: 1</strong></td>
<td>If available, download or view the corresponding official solutions posted in the course web-site. Compare your solutions to official solutions and the marking scheme (if available).</td>
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<tr>
<td><strong>Step: 2</strong></td>
<td>If there are any complaints, all complaints MUST be submitted in writing. Take another clean sheet of paper and write the complaints. [Do NOT write the complaints on the assignment submissions or term test submissions, and in fact do NOT write anything on the marked documents].</td>
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| **Step: 3** | Each complaint must indicate the following THREE items.  
  - [A] Which problem(s) number(s) are you complaining about?  
  - [B] What is the nature of the complaint (as detailed as possible)  
  - [C] In your view, how much do you think you should receive for each problem? Tell us, your thoughts. |
| **Step: 4** | Staple the complaints sheet to the original of your marked assignments and/or term test answer book(s), and **HAND DELIVER it to the instructor** either during the class or during instructor’s office hours.  
  - Do NOT bring it to TA, because the re-marker may be different from the original marker.  
  - Do NOT submit to office assistants or anyone else other than the instructor, since it may be easily misplaced and may not reach the instructor.  
  - Do NOT leave it in any mail box.  
  - We strongly recommend that you make a photocopy of the whole document prior to such submissions.  
  - A remarking request may result in: [a] reduction in marks, [b] no change in marks, [c] an increase in marks. |
| **Step: 5** | Written responses will be given back to students, and if the student does not agree with the revised mark as well, then, the student may submit the **whole documentation**, including marker’s comments, to the instructor for arbitration.  
  - Students have ONE (1) week to lodge their arbitration request [One week after returning the re-marked papers].  
  - Add additional comments explaining why you want to appeal the re-marking  
  - Arbitration by the instructor may involve complete re-marking by the instructor, without any consideration to the previous marking and the resulting arguments.  
  - We strongly recommend that you make a photocopy of the whole document prior to such submissions.  
  - An arbitration request to the instructor may result in; [a] reduction in marks, [b] no change in marks, [c] an increase in marks. |
**POLICY REMINDERS**

Students are reminded of the following Policies, which could be relevant to activity in this course.

**CALCULATORS:** Only McMaster Standard Calculator (Casio fx-991) may be used during assignment/tutorials, term tests, and final examination.

**STUDENT'S RESPONSIBILITIES:** It is the responsibility of the student to check their McMaster email and course websites daily during the term and to note any changes.

**EXTREME CIRCUMSTANCES**
The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

**ACADEMIC INTEGRITY:** You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at www.mcmaster.ca/academicintegrity.

The following illustrates only three forms of academic dishonesty:
- Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

**REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK**

McMaster Student Absence Form (MSAF)

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

**ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University’s Academic Accommodation of Students with Disabilities policy.

**ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

**ADVERSE DISCRIMINATION:** The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.