

**University of Texas at Arlington**  
**Department of Civil Engineering**  
**CE 4347: Reinforced Concrete Design**  
**Spring, 2015**

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| <b>Catalog Data</b>                    | CE 4347: Reinforced Concrete Design   |
| <b>Credits</b>                         | 3   |
| <b>Catalog Description (2008-2009)</b> | An analysis, design-synthesis course for concrete structures, emphasizing elastic analysis and ultimate strength design. Topics include strength and serviceability requirements, design of slabs, beams, columns and foundations for strength for flexure, shear, and bearing.   |
| <b>Prerequisites</b>                   | Passing grades in CE 3341 Structural Analysis.<br>Admission to CE Professional Program.<br><i>The prerequisites will not be waived.</i>   |
| <b>Class Schedule</b>                  | <b>Lecture:</b> T Th: 11:00 AM – 12:20 PM, Room 308 WH<br><b>Tutorial:</b> MW: 2:00 – 4:00 PM; (Room 265 ELB)   |
| <b>Instructor</b>                      | Nur Yazdani, Ph.D., P.E., CE Professor<br>Office: 430 NH<br>Office hours: M W: 2 PM – 4 PM<br>I am also usually available in my office at other times, except before Class periods. Alternately, you may schedule an appointment by phone or e-mail.<br><br>Phone: (817) 272-0676 (Office)<br>FAX: (817) 272-0371<br>E-mail: <a href="mailto:Yazdani@uta.edu">Yazdani@uta.edu</a>   |
| <b>Teaching Assistant</b>              | Md. Istiaque Hasan, Enhanced Graduate Teaching Assistant (EGTA)<br>Office: Room 265 ELB<br>Office hours: MW: 2:00 – 4:00 PM<br>Phone: 817-272-5646<br>E-mail: <a href="mailto:mdistiaque.hasan@mavs.uta.edu">mdistiaque.hasan@mavs.uta.edu</a>  |
| <b>Course Material</b>                 | <b>Required Material:</b> <ul style="list-style-type: none"> <li>• <i>Structural Concrete: Theory and Design, 5th Edition, By M. Nadim Hassoun and Akthem Al-Manaseer, John Wiley &amp; Sons, ISBN: 978-1-118-13134-3.</i></li> <li>• <i>Building Code Requirements for Structural Concrete, ACI 318-14, American Concrete Institute, Farmington Hills, MI, 2014.</i></li> <li>• Lecture notes: available on Blackboard (<a href="http://www.uta.edu/blackboard/">http://www.uta.edu/blackboard/</a>)</li> </ul> <b>Optional Reference Material:</b> <ul style="list-style-type: none"> <li>• <i>Theory and Problems of Reinforced Concrete Design</i>, by N. J. Everard, Schaum's Outline Series, McGraw-Hill Book Company.<br/>This is a classic problem solving reference with numerous detailed worked out examples.</li> </ul> |

|   | <ul style="list-style-type: none"> <li>• <i>Notes on ACI 318-14 Code for Concrete Design</i>, by the Portland Cement Association (PCA), Chicago, IL.<br/>This fine reference demonstrates many of the latest ACI 318 Code specification applications through explanations and examples. It contains many user-friendly design aids. A copy will be held as a reference in the Engineering Library.</li> </ul> <p><b>Online Resources:</b> A variety of on-line resources are available for the enhancement of your concrete design learning experience. There are many others. Please feel free to explore.</p> <p> <a href="http://www.cement.org">www.cement.org</a><br/> <a href="http://www.pci.org">www.pci.org</a><br/> <a href="http://www.concrete.org.uk">www.concrete.org.uk</a><br/> <a href="http://www.concrete.org">www.concrete.org</a><br/> <a href="http://www.crsi.org">www.crsi.org</a> </p>   |                         |                            |  |                |   |                |
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| <b>Computer Accounts</b>  | <ul style="list-style-type: none"> <li>• Class e-mail will be sent to your UT Arlington account through the Blackboard course web site and also your MyMav account. If you use another primary e-mail account, you need to regularly check your UT Arlington e-mail for important information.</li> <li>• Lecture notes, this syllabus, assignments, assignment solutions, term project details, grades, etc. will be available on Blackboard (<a href="http://www.uta.edu/blackboard/">http://www.uta.edu/blackboard/</a>)</li> </ul>  |                         |                            |  |                |   |                |
| <b>Course Rationale</b>   | <p>In your previous courses, you have acquired knowledge in various areas such as mechanics (finding reactions, centroids and moments of inertias), strength of materials (finding stresses and strains in structures), and structural analysis (finding reactions, moments, shears and deflections). The previous courses laid the groundwork for your transformation into a structural/concrete designer. This course will build upon your knowledge from the previous courses, and will provide you with the skills needed to analyze and design real life basic concrete structural elements such as slabs, beams, and columns. Reinforced Concrete is one of the most widely used materials in modern buildings, bridges, highways, tanks, walls, dams, etc. Concrete is the most consumed material in the modern society, besides water. The strength, versatility, adaptability, durability, appearance and cost of modern concrete are unparalleled. This course will enable you to become familiar with the latest specifications, methods and software for concrete design. The course instruction will be heavily practice and technology oriented, with broad emphasis on practical applications and methodology. Material you learn in this course is critical to your becoming a successful and valued concrete engineer in today's highly competitive marketplace.</p> |                         |                            |  |                |   |                |
| <b>Student Outcomes</b>   | <p>At the end of this course, you should be able to accomplish the student outcomes shown in the following (<a href="http://www.uta.edu/ce/abet-accreditation.php">http://www.uta.edu/ce/abet-accreditation.php</a>). The goal of the course is to provide graduating seniors with a thorough background in the theory and practice of basic reinforced concrete design. Towards this end, the following student outcomes will be achieved:</p> <table> <thead> <tr> <th><u>Student Outcomes</u></th><th><u>Extent of Coverage*</u></th></tr> </thead> <tbody> <tr> <td>(a) An ability to apply knowledge of mathematics, science, and engineering</td><td>C<sub>1</sub></td></tr> <tr> <td>(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</td><td>T<sub>E</sub></td></tr> </tbody> </table>   | <u>Student Outcomes</u> | <u>Extent of Coverage*</u> | (a) An ability to apply knowledge of mathematics, science, and engineering | C <sub>1</sub> | (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 | T <sub>E</sub> |
| <u>Student Outcomes</u>   | <u>Extent of Coverage*</u>  |                         |                            |  |                |   |                |
| (a) An ability to apply knowledge of mathematics, science, and engineering  | C <sub>1</sub>  |                         |                            |  |                |   |                |
| (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 | T <sub>E</sub>  |                         |                            |  |                |   |                |

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|                                   | <p>(e) An ability to identify, formulate and solve engineering problems T<sub>I</sub></p> <p>(f) An understanding of professional and ethical responsibility C<sub>I</sub></p> <p>(g) An ability to communicate effectively T<sub>I</sub></p> <p>(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context C<sub>I</sub></p> <p>(i) A recognition of the need for, and an ability to engage in life-long learning C<sub>I</sub></p> <p>(j) A knowledge of contemporary issues C<sub>I</sub></p> <p>(k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice T<sub>I</sub></p> <p><u>*Notes</u></p> <p>Covered Implicitly (C<sub>I</sub>): The outcome is implicitly covered</p> <p>Covered Explicitly (C<sub>E</sub>): The outcome is explicitly covered</p> <p>Tested Implicitly (T<sub>I</sub>): The outcome is covered and implicitly assessed for by one or more means (assignments, test questions, essay questions, presentation evaluations, lab reports, etc.)</p> <p>Tested Explicitly (T<sub>E</sub>): The outcome is explicitly assessed for by one or more means</p>   |
| <b>CE 4347, a “Design” Course</b> | <p>The Civil Engineering Department ABET procedure includes assessing the achievement of various departmental student learning outcomes. CE 4347 is designated as a “Design” course for the CE Department, through which the following outcomes will be assessed:</p> <p><i>CE Department Outcome “c”:</i> 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.</p> <p><i>ABET CE Program Outcome:</i> An ability to design a system, component or process in more than one civil engineering context.</p> <p><u>The following process will be followed in this course towards assessing the outcomes:</u></p> <ol style="list-style-type: none"> <li>1. There will be a design term project, including both analysis and synthesis requiring at least three weeks of effort.</li> <li>2. The project must have some iterative components. Students will be encouraged to define the design problem, including scope and design objectives.</li> <li>3. The course project will be open-ended, with at least a few alternate solutions.</li> <li>4. The course project or assignment should include any applicable codes and regulations, and also a minimum of two realistic design constraints from the following list: economic, environmental, social, political, ethical, health and safety, constructability, and sustainability.</li> <li>5. A design summary report must be completed by students at the semester end; it should include a documented analysis of alternatives and consideration of constraints.</li> <li>6. The minimum passing grade in the project is 70.</li> <li>7. The project grade will also count towards your overall course grade, as discussed later.</li> </ol> |

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| <p><b>Student Responsibility</b></p> | <p><b><u>Deadlines and Instructions</u></b></p> <p>Following professional conduct that you will encounter in practice, the course contains strict deadlines, instructions and professionalism. Please read instructions carefully and schedule your activities accordingly to meet schedules. You should check your e-mail and the Blackboard course web page regularly, and note other announcements, on-line and in class.</p> <p><b><u>Class Participation</u></b></p> <p>Class participation can be achieved in two ways. I shall ask your group and you questions in class on the previous lectures, and on the material currently being discussed. You should be prepared to answer these questions, and should also participate by asking questions, suggesting ideas, and performing in-class group activities that I assign. I prefer an interactive class-room where the instructor and the students freely participate in active learning. Of course, you cannot participate in class unless you attend it!</p> <p><b><u>Group Work</u></b></p> <p>You must work in groups of three for the following activities: homework, class quizzes and term project. The groups should represent diversity in terms of student background and academic performance. You should participate in all group activities and make a fair contribution to the group effort.</p> <p><b><u>Homework</u></b></p> <p>Required homework will be due at the beginning of the period on the due date - one solution set per group. Use engineering paper, one side of each paper, and box the solution. On the inside, put the name of the group leader, all other participating group members, the date, and the assignment number. If a student's name appears on a solution set, it certifies that he/she has participated in solving some of the problems and understands all the solutions. If this turns out not to be the case, both the student in question and the group leader will be considered to have cheated and will be dealt with accordingly. Please keep a copy of your homework before it is submitted in case the homework is lost or misplaced. Late homework will be accepted for up to two weeks after the due date. A penalty of 20% for each 24 hours will be assessed on late homework. However, if a group abuses this privilege on a regular basis, it will be withdrawn. One group member should be designated the leader for each homework. The leader will be responsible for coordinating the work and making sure everyone in the group understands all the problem solutions before they are handed in (Hint: Try to set up each problem individually, then get together to work out the details). After being a group leader, an individual may not be leader again until everyone else in the group has held the position.</p> <p><b><u>Tutorial Session Attendance</u></b></p> <p>Two tutorial sessions per week will be arranged outside the regularly scheduled class period. Although the tutorial class attendance is not required, it is highly recommended. The tutor will provide you with helpful hints on homework, solve additional problems, and help you with your term project and software usage.</p> <p><b><u>Term Project</u></b></p> <p>A group term project is required as a part of this class. The topic will be practice oriented, will require design code usage, latest design software and drafting applications. The instructor will supply the class with the project concept during the</p> |
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|   | <p>second week of classes. A written proposal, oral final presentation and written final report are required. The project grade will be based on the following:</p> <p>Proposal: 30%</p> <p>Oral presentation: 30%</p> <p>Final report: 40%</p> <p>You must be able to understand, explain and execute your group project work. About half of the group project grade will be based on group activities, and the other half based on your individual contribution. Therefore, when asked, you should be able to explain and clearly identify your own contribution.</p> |                            |                        |
| <b>Professional Component of the Course</b>                         | The course will teach senior level civil engineering students how to efficiently analyze and design real life buildings and bridges made of reinforced concrete, using the latest available professional codes, methods and tools. Professional level group term project is also involved.  |                            |                        |
| <b>Topics/<br/>Tentative Time<br/>Schedule/<br/>No. of Sessions</b> | <b><u>Course Topics</u></b>   | <b><u>Dates (2015)</u></b> | <b><u>Sessions</u></b> |
|   | Introduction: Reinforced concrete (RC), building and design codes, service and ultimate loads, the ACI analysis and design process, structural safety, types of RC structures, loads.   | 01/20 – 01/22              | 2                      |
|   | Materials: Mechanical properties of concrete and reinforcing steel, compression/tension/stress-strain, types of reinforcing steel.  | 01/27 – 01/29              | 2                      |
|   | Beam Design for Flexure: Service conditions, Whitney stress block, flexural strength, load and capacity factors, strength design and analysis, reinforcement limits, steel choice and placement, open ended design.   | 02/03– 02/19               | 6                      |
|   | Project proposals due   | 02/24                      | ---                    |
|   | Flanged beams: Effective flange width, steel limits, effect of moment reversal, continuous spans.   | 02/24 – 03/03              | 3                      |
|   | One-way slabs: two-way vs. one-way construction, moment coefficients, steel limits and placement, temperature and shrinkage steel.  | 03/05 – 03/17              | 2                      |
|   | <b>TEST 1</b>   | 03/19                      | 1                      |
|   | Spring Break (classes in Cancun!)   | 03/10 – 03/12              | 2                      |
|   | Serviceability: deflections, short and long term effects, equivalent Moment of Inertia, deflection limits, crack control.   | 03/24 – 03/26              | 2                      |

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|                         | Shear Design: shear failure in reinforced concrete beams, shear steel and limits, shear strength of concrete, stirrup placement.  | 03/31 – 04/02 | 2   |
|                         | Guest Lecture   | 04/07         | 1   |
|                         | Bond and Anchorage: Bond stress, development length of steel, cutoff points and anchorage.  | 04/09 – 04/14 | 2   |
|                         | Field Trip  | 04/16         | 1   |
|                         | Columns: Fundamentals of column behavior, beam-columns, short column strength, interaction diagrams.  | 04/21 – 04/30 | 4   |
|                         | <b>Test 2</b>   | 05/05         | 1   |
|                         | Term Project presentations  | 05/07         | 1   |
|                         | <b>Optional Final Test</b> (comprehensive)  | TBD           | --- |
| <b>Grading Criteria</b> | <p>The overall course grade will be based on the performance of each student in the following categories: homework, tests, term project, and class participation.</p> <p>The following is the published grade percentage distributions:</p> <p>Homework: 19%</p> <p>Two tests: 27% each</p> <p>Term project: 20%</p> <p>Class participation: 7%</p> <p>A weighted grade of 90 or above overall is guaranteed an A, 80 or above at least a B, 70 or above at least a C, and 60 or above at least a D. Exceptions from the published grade scales may be made based on the overall course grade statistics, and the following factors: (a) your participation in class, (b) your interaction with the instructor, tutor and other students in the class, (c) your leadership demonstration.</p> |               |     |
| <b>Prepared By</b>      | <i>Nur Yazdani, Ph.D., P.E.</i>   |               |     |

## **COURSE POLICIES**

**Examinations:** There will be two regular tests during the semester and one optional final examination. The instructor understands that students may have a down day once in a while, which may affect their test grades. As a compensation for extenuating circumstances affecting your test grades, you may take the optional comprehensive final examination, which will be scheduled during the final examination week. If you take this optional test, the grade from this test will substitute the grade from one of the regularly scheduled tests. If you miss any test for emergency reasons, a cumulative make-up test will be scheduled during the last week of classes. All students missing any test will be given the opportunity to take this make-up test. The student

must submit admissible evidence of emergencies that prevented them from taking the regularly scheduled examination.

**Attendance:** The universities require attendance in all classes, and it is very important to your learning. It is important that you make every effort to attend all lectures, if possible. The instructor may cover material from outside the text-book which will be useful supplementary material. The instructor will also use visual aids, practical cases, class interaction and thoroughly worked out example problems to enhance classroom learning. In the instructor's opinion, keeping attendance record is a poor and inefficient practice. However, students attending lectures will be indirectly credited through group activities (see grading policy and group activities). In emergency situations, absence may be excused with appropriate documentation. You should let me know in advance, when possible, and submit the documentation. You should make up any materials missed due to absence.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/aao/fao/>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Title IX:** The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX).

**Academic Integrity:** Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

**Student Support Services Available:** The University of Texas at Arlington supports a variety of student success programs to help you connect with the University and achieve academic success. These programs include learning assistance, developmental education, advising and mentoring, admission and transition, and federally funded programs. Students requiring assistance academically, personally, or socially should contact the Office of Student Success Programs at 817-272-6107 for more information and appropriate referrals.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more



information, visit <http://www.uta.edu/sfs>.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located on the left side of the lecture room. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

**Professional Ethics:** You will gain confidence in your ability to design and analyze concrete bridge structures only when you do the work yourself. However, you will also learn a lot through discussions with your peers. In order to balance the two goals, the following guideline is provided:

- *Things you may not do:* You should not copy work from others. This includes directly copying homework, tests, project materials, etc, and submitting it as your own work. Furthermore, you should assure that others cannot copy your work. Allowing copying of your material will only hinder the learning of the parties involved.
- *Things you may do:* You may discuss specific problems related to analysis/design steps, Code usage, efficient design, and project issues with others.

**Technology and Practice:** The course work will be heavily geared towards technology and practice. Students will be asked to contact outside sources such as design/construction industry and vendors in order to obtain information. Problems in the class and homework will be designed to utilize this information. Commercial software similar to the ones used by industry design offices will be demonstrated in the classroom. Students will be able to use the software from the college computer labs. It is expected that at least one field trip to a bridge construction site will be arranged during the semester, where you can obtain valuable practice oriented knowledge as complementary to the classroom knowledge. Guest speakers from the industry will be invited to speak to the students.

**Emergency Phone Numbers:** In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911.

**Syllabus Change Policy:** This syllabus is a guide for the course and is subject to change with advance notice.