

**TED UNIVERSITY**

**CE 221**

**Materials Science**

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**SYLLABUS - FALL 2016-2017**

## Course Information

<b>Required or Elective</b>	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective	<b>Date Prepared</b>	September 2016
<b>Semester</b>	Fall 2016	<b>Class Hours and Classrooms</b>	<u>Lectures (both sections)</u> Tue. 12:00 – 13:00 Rm. D028 Wed. 14:00 – 16:00 Rm. D030 <u>Laboratory</u> Thu. 9:00 – 11:00 (S_01) Fri. 11:00 – 13:00 (S_02) Materials Lab. (basement of Block H)
<b>Course Credit Hours/ ECTS Credits</b>	(3+0+2) 4 / 6	<b>Pre-requisite/ Co-requisite</b>	NA
<b>Level of Course</b>	Sophomore	<b>Language of Instruction</b>	<input checked="" type="checkbox"/> English <input type="checkbox"/> Turkish
<b>Instructor and Office Hours</b>	Dr. Cem Akgüner (cem.akguner@tedu.edu.tr) (Rm. D312) Office hours: Tu. 15:00 – 16:00; Th. 16:00 – 17:00 Please make an appointment through e-mail for other times		
<b>Teaching Assistant(s)</b>	Onur Doğan (onur.dogan@tedu.edu.tr) (Rm. G206) Anıl Ekici (anil.ekici@tedu.edu.tr) (Rm. GB20)		
<b>Textbook</b>	Basic Materials of Construction by S.T. Erdoğan and T.Y.Erdoğan, METUPress, 2014.		
<b>Recommended Readings</b>	1) Construction Materials: Their Nature and Behaviour by P.Domone, J.Illston, 4th Edition, CRC Press, 2010 2) Material Science and Engineering: An Introduction by W.D.Callister, D.G.Rethwisch, 9th Edition, Wiley, 2013		
<b>Course Web Pages</b>	I have already enrolled all of you to the Moodle course information system for this class and sections ( <b>2016F_CE221_SECo1</b> or <b>2016F_CE221_SECo2</b> on <b>moodle.tedu.edu.tr</b> ). Please make a habit of regularly following these pages to have access to course materials and contribute to class discussions.		

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## Course Description

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Engineering requirements of materials; the structure of matter; atomic arrangements, structural imperfections. Mechanical properties. Concepts of force, stress, deformation and strain; elasticity; elastic and plastic behavior. Creep, relaxation, brittleness, ductility, hardness, fatigue, toughness, resilience, and damping characteristics of materials. Construction materials; hydraulic cements, mineral aggregates, concrete, ferrous metals, polymers, bituminous materials, timber.

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## Course Objective

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Main objectives of this course are to introduce the students to the fundamental nature, types, production processes, microstructural and mechanical properties, and uses of engineering materials; to standard testing methods of physical and mechanical properties of engineering materials; to concepts such as strength, durability, and cost in order to promote effective material selection as part of the overall design process. This course also aims to demonstrate to the students the main differences in behavior of various engineering materials through a series of laboratory experiments.

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## Course Learning Outcomes

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On successful completion of this course, students will be able to:

1. Describe the atomic structure; describe and compare primary bonds and secondary bonds; and explain different types of materials
2. Describe cubic and hexagonal crystal structures; sketch crystal directions and planes; compute atomic packing factor, volume for different crystal structures
3. List and compare structural imperfections
4. Apply Hookes law and state its limitations
5. Compute stresses, strains, true stresses and true strains in one dimensional axially loaded structural elements
6. Estimate parameters such as modulus of elasticity, shear modulus, bulk modulus, ductility, strength, toughness by using a stress-strain diagram
7. Compare elastic and plastic material behavior
8. Explain concepts such as creep, stress relaxation, fatigue and describe corresponding testing methods
9. Describe the production processes, microstructural and mechanical properties and uses of cements, concrete, ferrous metals, polymers, bituminous materials and wood
10. Devise tests in order to measure the fresh and hardened properties of concrete
11. Devise tests in order to classify mineral aggregates and measure their physical/chemical properties
12. Perform concrete mix design
13. Prepare technical reports in English

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## Course Assignments

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- A. **Homeworks and Quizzes (20%):** Students are expected to complete seven mandatory laboratory sessions throughout the semester. Reports prepared after these sessions will contribute towards 15% of total grade. Quizzes given throughout the semester will contribute towards another 5% of total grade.
- B. **Midterm Exams (50%):** There will be two midterm exams.
- C. **Final (30%):** There will be a cumulative final.

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## Course Assessments & Learning Outcomes Matrix

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Assessment Methods	Course Learning Outcomes
Homeworks and Quizzes	all
Midterm Exam I	#1, #2, #3, #4, #5, #6, #7, #8
Midterm Exam II	#9
Final Exam	#1 - #9, #12

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## Relationship to Program Outcomes

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This course contributes to fulfillment of the following program outcomes:

- ii. Apply knowledge of mathematics, science, and engineering to design and implement original, innovative and sustainable civil engineering systems or processes to meet desired needs within a greater societal context
- v. Design and conduct experiments; analyze and interpret data
- vi. Identify, formulate, and solve engineering problems
- vii. Demonstrate effective oral and written professional skills in English
- xi. Employ state-of-the-art engineering techniques and computing tools necessary for creative engineering solutions

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## Tentative Course and Laboratory Outline

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A tentative course outline for the lectures is given below. Any changes and updates will be announced on the Moodle web page for the course.

Week	Topics
1	<ul style="list-style-type: none"><li>• Atomic structure and interatomic bonding</li></ul>
2	<ul style="list-style-type: none"><li>• Structure of crystalline solids, imperfections in solids</li></ul>
3	<ul style="list-style-type: none"><li>• Behavior of materials under loads</li></ul>
4	<ul style="list-style-type: none"><li>• Ferrous metals</li></ul>
5	<ul style="list-style-type: none"><li>• Gypsum and lime</li><li>• <b>Midterm 1</b></li></ul>
6	<ul style="list-style-type: none"><li>• Pozzolan and portland cement – manufacturing, Bogue's Equation</li></ul>
7	<ul style="list-style-type: none"><li>• Portland cement – hydration, tests on cement</li><li>• <b>Lab session 1:</b> Cement consistency, setting time and strength</li></ul>
8	<ul style="list-style-type: none"><li>• Building stones, aggregates – classification and description of some aggregate types, sampling gradation</li><li>• <b>Lab session 2:</b> Determination of strength for cement specimens</li></ul>
9	<ul style="list-style-type: none"><li>• Aggregates – moisture states, absorption capacity, specific gravity, unit weight, alkali-aggregate reactivity, abrasion resistance equation</li><li>• <b>Lab session 3:</b> Sampling aggregates and determination of bulk density and moisture content</li></ul>
10	<ul style="list-style-type: none"><li>• Concrete – introduction, properties of fresh concrete</li><li>• <b>Lab session 4:</b> Determination of specific gravity for aggregates</li></ul>
11	<ul style="list-style-type: none"><li>• Concrete – properties of hardened concrete</li><li>• <b>Lab session 5:</b> Sieve analysis and Los Angeles test</li><li>• <b>Midterm 2</b></li></ul>
12	<ul style="list-style-type: none"><li>• Concrete mix design</li><li>• <b>Lab session 6:</b> Slump test and calculation of air content of concrete</li></ul>
13	<ul style="list-style-type: none"><li>• Bricks, woods</li><li>• <b>Lab session 7:</b> Determination of compressive strength for concrete</li></ul>
14	<ul style="list-style-type: none"><li>• Plastics, bituminous materials</li></ul>

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## Course Policies and Some Remarks

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### *Instructor Absence*

I will have to miss some classes and/or laboratories during the semester for professional activities such as conferences or seminars. We will have to make-up the missed classes and/or laboratories during the semester through additional sessions as needed.

### *Attendance*

I encourage you to be a part of the lectures but I will not be collecting any attendance. I expect you to behave in a responsible and appropriate manner while you are in class. However, you are required to be present in all of the laboratory sessions without any exception. You will not be allowed to make-up any laboratory sessions unless you can provide an acceptable proof of your absence within a couple of days which should be approved by me. Anyone who fails to meet the attendance requirement for the laboratories will not be allowed to take the final exam and will be assigned a failing grade.

Classes and laboratories start on time. Please be respectful of your classmates by being on time.

Cell phones should be in quite mode/turned off and kept out of sight. Please do not undertake any unrelated activities (homework for some class, use of your computers etc.) during class time.

### *Calculator Policy*

You may use a non-programmable calculator during exams.

### *Plagiarism*

Collaboration on non-collected homework and in studying is strongly encouraged; however, the work you hand in must be solely your own. Sharing written work before it is turned in to be graded is academic dishonesty. For more information on TEDU policy on intellectual integrity, see the link: [http://student.tedu.edu.tr/sites/default/files/content\\_files/2015-2016ogrencielkitabi.pdf](http://student.tedu.edu.tr/sites/default/files/content_files/2015-2016ogrencielkitabi.pdf)

### *Disability Support*

If you have a disabling condition which may interfere with your ability to successfully complete this module, please contact the TEDU Disabled Students Committee (email: [info@tedu.edu.tr](mailto:info@tedu.edu.tr)). For further information, please see the Handbook for Registered Students above.

### *Make Up Exams*

In general, make-up exams for the first two exams during the semester will NOT be offered. If you have a legitimate reason for missing an exam, then you must arrange to make up the exam BEFORE the scheduled time of the exam. The only exceptions are illness or emergency (e.g., death in family, a traffic accident, etc.). In case of an illness or emergency you need to supply a documentation that supports your claim.

Also please read the document given in the link below for the TEDU Academic Rules and Regulations for Undergraduate Study:

[http://www.tedu.edu.tr/sites/default/files/content\\_files/docs/Yonetmelikler/TEDU\\_Academic\\_Rules\\_Regulations\\_Undergraduate\\_Study.pdf](http://www.tedu.edu.tr/sites/default/files/content_files/docs/Yonetmelikler/TEDU_Academic_Rules_Regulations_Undergraduate_Study.pdf)