

**Title:** *Mechanical Properties of Materials*  
**Course:** 14:635-407 **Section:** 02 Fall 2016  
**Time:** Tue & Thu 17:00-18:20 SoE-B120  
**Location:** Busch Campus SoE-B120  
**Instructor:** Prof. Tsakalakos  
**Office Hours:** Tue & Thu 14:00-15:30  
**Office Location:** SoE Building A100  
**Contact Information:** Tel: 732-445-2888  
**E-mail:** [tsakalak@rci.rutgers.edu](mailto:tsakalak@rci.rutgers.edu)

**TA:** Sol Torrel  
**Office Hours:** Tues 13:30 – 15:30  
**Office Location:** FO 207  
**E-mail:** [sol.torrel@rutgers.edu](mailto:sol.torrel@rutgers.edu)

**Computer Requirement:** Some classes *may* require the use of the Design, Simulation and Visualization (DSV) Computer Lab in SoE B-127. All students are required to set up an account prior to the first computer session. Advanced notice will be given to the student by the instructor as needed.

**Textbook:** The required text is: “Materials Science and Engineering: An Introduction” by W.D. Callister, 9<sup>th</sup> Ed., John Wiley & Sons (2014), Book + CD. Supplementary materials will be distributed as needed.

**Course Description/Outline:** Material covered in this class will include the following:

Week/Dates	Monday	Wednesday	Reading
09/06-09/08	---	Introduction	Ch. 1
09/13-09/15	Atomic Structure & Interatomic Bonding	Atomic Structure & Interatomic Bonding	Ch. 2
09/20-09/22	The Structure of Crystalline Solids	The Structure of Crystalline Solids	Ch. 3
09/13-09/15	Crystal Defects	Crystal Defects/Dislocations	Ch.4
09/27-09/29	Diffusion	<b>Exam # 1</b>	Ch. 5
10/04-10/06	Mechanical properties	Phase Diagrams	Ch. 6/Ch. 9
10/11-10/13	Phase Transformations	Phase Transformations/Applications	Ch.10/Ch.11
10/18-10/20	Polymers	Ceramics	Ch. 14-15/Ch. 12-13
10/25-10/27	Composites	Mechanical Properties/Constitutive Laws	Ch. 16
11/01-10/03	Mechanical Properties/Stress/Strain Tensor	<b>Exam #2</b>	Special Notes
11/08-11/10	Dislocations and Strengthening Mechanisms	Fracture Mech./Failure	Ch. 7/ Ch. 8
11/15-11/17	Fatigue	Creep	Ch. 8
11/22-11/24	Thursday class is on Tuesday Corrosion	<b>No class Thanksgiving Recess</b>	Ch. 17
11/29-12/01	Stress Corrosion/Cracking	Case Studies	Ch.17/Ch. 22
12/06-12/08	Case Studies	<b>Exam#3</b>	Ch. 22
12/13	Case Studies	<b>No class-End of Semester</b>	Ch. 22



**Course Description:** The Mechanical Properties of Materials course provides an overview of deformation behavior of engineering materials by establishing the relationships between an applied load and its response. To understand such deformation behavior of materials, it is of imperative to have an in depth comprehension of the basic principles of Materials Science and Engineering (MS&E). The MS&E discipline focuses on investigating and applying the relationships that exist between the structure and properties of materials. Mechanical properties of materials is one of the engineering sciences used in the design and analysis of engineering systems. This course covers the fundamentals of materials science and engineering, and gives a comprehensive approach to mechanical behavior such as elasticity, plasticity, strength, hardness, ductility, fracture, time dependent deformation and the impact of environment environmental effects on such properties.

**Objective:** The objective of this course is to introduce the fundamental concepts of MS&E as they relate to mechanical behavior. Mechanical Properties of Materials course will expose the student to the relationships which exist between structure of materials and its mechanical deformation. Students will develop an understanding of the underlying structural concepts pertaining to the constitution of engineering materials, how the structure affects properties with emphasis mechanical behavior, and how the structure can be altered by processing to obtain desired mechanical properties. This course will also introduce the student to the use/design materials properties, with emphasis on mechanical properties, thereby enabling the student develop the proper approach to material selection for specific applications. The examples and exercises in this course do not emphasize mathematical prowess but keep the focus heavily on fundamental concepts to develop the student's intuition. Problems will be presented in a manner to provide students with their first exposure to real world challenges.

**Grading:** Weekly in-lecture 5 min quizzes. 10% of final grade. Once a week on Wednesdays based on last lecture. (Lowest two quizzes will be dropped). Approx. 12 quizzes per semester.  
Homework –15% of final grade. Approx. 7-10. No late homework accepted. Lowest HW score dropped.  
Tests -25% each. 3 Tests. No final examination.

**Homework:** a) a lot of weight is placed on homework. If you have troubles, come ask!! BUT only after the effort has been made. b) Torn out paper edges are not acceptable – use real paper. c) Use a pen. d) Use staples and paper clips when necessary. The HW's are to encourage you to learn the material and prepare you for the tests.

**Problem-solving Tips:**

- Homework – Try even if you get stuck, move on, return, etc.
- Do not wait until the night before the test.
- List quantities asked and all relevant info given to you.
- Draw a picture, schematic, etc. to help you visualize the problem.
- Consider laws, definitions, and equations.
- Ask yourself: "What are the unique conditions?"
- Ascertain that the relations you use are appropriate.
- There may be intermediate steps in the solution.
- State the steps and assumptions used.
- Make sure you answer all questions asked.
- Check the units and conversions.

**Attendance:** Attendance is mandatory! Attendance will be taken each class. A student will be allowed 2 unexcused absences, after which the student's final grade may be dropped by 2.5% for each additional class missed. Students will be excused without penalty from class because of a religious observance or matters of health. Come see me if you have missed classes so that I can help you make up what you missed.

**Policy on Calculators:** Students will only be allowed to use a simple, four function calculators on quizzes and exams. Multifunction calculators with advanced memory capabilities will not be allowed to be used on quizzes or exams. Students should see the me prior to a quiz or exam if there is any confusion with this policy.

**Policy on Other Electronic Devices:** No Electronic Devices during Exams are allowed. The use of mobile phones, pagers, digital music players, or any other electronic devices that may disrupt the class are not permitted. Students are encouraged not to bring these devices to class. If it is necessary to bring a device to class, it must be turned off or muted.

**Academic Integrity:** Students will be expected to adhere to the Policy on Academic Integrity listed within the New Brunswick Undergraduate Catalogue. Students are encouraged to review this policy.

**Contributions of Course to Meeting the Professional Component of ABET:** Mechanical Properties of Materials is one of the engineering sciences used in the design and analysis engineering components. Materials are frequently chosen for structural applications because they have desirable combinations of mechanical characteristics. A firm understanding of mechanical behavior of materials is essential for all engineering disciplines.

**Relationship of Course to Program Objectives:** Mechanical Properties of Materials develop an integrated understanding of properties, processing and the structure of materials used in materials applications. Students will learn how materials affect the performance of engineering components in a variety of applications, forging the importance of proper materials design and selection thereby.

## Academic Policies and Student Support

### Academic

### Integrity

115 College Avenue, New Brunswick | (848) 932-9414 | [academicintegrity.rutgers.edu](http://academicintegrity.rutgers.edu)

Academic integrity is essential to the success of the University's educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community. The principles of academic integrity require that a student:

- Properly acknowledge and cite all use of the ideas, results, or words of others.
- Properly acknowledge all contributors to a given piece of work.
- Make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- Obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- Uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Rutgers University is committed to fostering an intellectual and ethical environment based on the principles of academic integrity. Every member of the University community bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

### Student Advising

**General Advising: Office of Academic Services**  
**Engineering B100, Busch Campus | (848) 445-2212 | [soe.rutgers.edu/oas](http://soe.rutgers.edu/oas)**

Undergraduate advisors and deans are available to you at the School of Engineering to assist you with inquiries related to course planning, academic policies, professional development, scholastic standing, degree progress, withdrawal options, and more. Please visit [soe.rutgers.edu/oas/advising](http://soe.rutgers.edu/oas/advising) for work-in and advising hours,

**Advising in Major: Engineering Departments**  
**Busch Campus | [soe.rutgers.edu/deptadvising](http://soe.rutgers.edu/deptadvising)**

The Undergraduate Directors in the engineering, math, and science departments are available to assist students in the areas of scheduling of major courses, special permission numbers, BS/MS advising, and other areas related to the engineering major course requirements. See the webpage above for more locations and more information.

**Absences****Verification**

**Dean of Students office | Hours & Locations:** [deanofstudents.rutgers.edu](http://deanofstudents.rutgers.edu)

Any student who needs verification of an absence (illness, conference, corporate or graduate school interview, etc.) should contact the Dean of Students office. The Dean of Students will need documentation in order to verify your absence and will then email your professor that your absence has been substantiated. If you know in advance that you will be absent from a class, it is also a good idea to submit the Self-Reporting Absence Application ([sims.rutgers.edu/ssra](http://sims.rutgers.edu/ssra)). In both situations this does not necessarily imply that a student will be excused from the class, any assignments that were due or attendance that may be required.

**Course** or **Semester** **Withdrawal**  
**Online or Visit Engineering B100 |** [soe.rutgers.edu/add-drop](http://soe.rutgers.edu/add-drop)

- The last day to drop a course without a “W” via WEBREG is within the **1<sup>st</sup> week** of classes.
- The last day to drop a class via WebReg with a 'W' grade is the **8<sup>th</sup> week**.
- With Dean’s permission from Engineering B100, students may drop SoE courses (14:xxx:xxx) before the **10<sup>th</sup> week** with a ‘W’ grade.
- Students are not allowed to drop individual class after the **10<sup>th</sup> week**.
- The last day to withdraw from ALL classes with all ‘W’ grades (semester withdrawal) is the end of the **12<sup>th</sup> week**.

**University Policy on Exam Scheduling and Conflicts**

**Office of Registrar |** [nregistrar.rutgers.edu/facstaff/examrules.htm](http://nregistrar.rutgers.edu/facstaff/examrules.htm)

The University has a strict policy on not allowing final exams to be scheduled during the last two weeks of the class period. There are also similar policies regarding the reading days and a detailed guideline on how to handle exam conflicts. For more information, please visit the Registrar's page on exam policy above.

**Academic Coaching, Tutoring, Learning Support**

**Rutgers Learning Centers | (848) 445-0986 |** [lrc.rutgers.edu](http://lrc.rutgers.edu)

Academic coaching is a comprehensive service for students who want to improve their academic and self-management skills, such as time management, organization and study skills. The Rutgers Learning Centers offer this support to help students achieve their academic goals along with self-advocacy and independent, life-long learning. To schedule an appointment, you may visit their website or call.

**Student-Wellness Services  
Counseling, ADAP & Psychiatric Services (CAPS)  
17 Senior Street, New Brunswick | (848) 932-7884 | [rhscaps.rutgers.edu](http://rhscaps.rutgers.edu)**

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

**Violence Prevention & Victim Assistance (VPVA)  
3 Bartlett Street, New Brunswick | (848) 932-1181 | [www.vpva.rutgers.edu](http://www.vpva.rutgers.edu)**

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To speak with someone immediately, call 848-932-1181.

**Disability Services  
Lucy Stone Hall, Suite A145, Livingston Campus | (848) 445-6800 | [ods.rutgers.edu](http://ods.rutgers.edu)**

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: [ods.rutgers.edu/students/documentation-guidelines](http://ods.rutgers.edu/students/documentation-guidelines). If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: [ods.rutgers.edu/students/registration-form](http://ods.rutgers.edu/students/registration-form).

**Scarlet Listeners  
(732) 247-5555 | [scarletlisteners.com](http://scarletlisteners.com)**

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.

**Download the Just-In-Case App: <http://codu.co/cee05e>**

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.