

Fall 2019

ME 215-003: Engineering Materials and Processes

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MECHANICAL ENGINEERING
NEW JERSEY INSTITUTE OF TECHNOLOGY

ME215 Engineering Materials and Processes
Course Syllabus and Guidelines Fall 2019

(Updated: August 29, 2019)

It is the responsibility of the student to read and understand this course syllabus. This syllabus is subject to change and may be updated throughout the semester.

Course Description

This course introduces the student to a combined lecture and laboratory related to engineering materials and processes. Engineering materials considered include, but are not limited to, metals, ceramics, and polymers. Processes, and how they affect properties, include but are not limited to, the formation of a part from a molten/particle state, forming, material removal, heat treatment, and additive manufacturing. Laboratory exercises involve, but are not limited to, basic machine tools, measurements, microstructure identification, and computer controlled equipment.

Credits and Contact Hours

This course is 3 credits, with 2 lecture contact hours and 2 laboratory contact hours.

Class Times

Section	Lecture	Lab
001 & HM1	Mon. 8:30-10:35 CKB222	Fri. 1:45-3:50 MEC232
003	Mon. 11:30-1:35 CULM LECT 3	Tue. 1:00-3:05 MEC232
005	Mon. 1:00-3:05 FMH106	Wed. 12:15-2:20 MEC232
007	Mon. 1:00-3:05 MEC221	Thu. 1:45-3:50 MEC232
009 & HM3	Mon. 8:30-10:35 CKB220	Thu. 10:00-12:15 MEC232
011	Mon. 10:00 - 12:05 CKB341	Tue. 10:00-12:05 MEC232
101	Mon. 5:45-7:40 MEC224	Mon. 7:50-9:45 MEC232
103	Wed. 5:45-7:40 CULM LECT 3	Wed. 7:50-9:45 MEC232

Instructors

Section(s)	Instructor	Office	Email
001 & HM1 & 003	Prof. Veljko Samardzic	MEC325	samardzi@njit.edu
005 & 011	Prof. Conrad Koenke	MEC324	cjk24@njit.edu
007	Prof. Nikola Bosnjak	MEC324	nsb35@njit.edu
009 & HM3	Prof. Shawn Chester	MEC305	shawn.a.chester@njit.edu
101 & 103	Prof. Naruemon Suwattananont	MEC324	ns48@njit.edu

Teaching Assistants

Abhishek Mukherjee (am2455@njit.edu) Keven Alkhoury (ka989@njit.edu)
Patrick Thompson (pbt6@njit.edu) Yassine Tissaoui (yt277@njit.edu)

Office Hours

Instructors will inform their section(s) of their office hours in the class. Also, office hours for individual instructors are posted in the department office.

Prerequisites

CHEM 126 or CHEM 122.

Text

(Required text) J.T. Black, R.A. Kohser. DeGarmo's Materials and Processes in Manufacturing, 13th Ed., John Wiley & Sons Inc., 2019.

(Lab manual) ME 215A: R. Dubrovsky: Engineering Materials and Processes. (Available on Canvas.)

Communication

This course will make use of Canvas for dissemination and collection of various materials. Also, you will be regularly contacted via email at your NJIT email address.

Repeat Students

Students repeating the course are required to repeat the entire course. Assignments, laboratory practices, exams, and laboratory reports cannot be transferred from previous semesters.

Honors Students

For those registered for an honors section of this course, an extra laboratory and corresponding report will be assigned to earn honors credit. The specific date of the honors lab will be determined in the later half of the course.

Course Learning Objectives and Performance Criteria

Students are expected to gain a basic working knowledge of engineering materials and manufacturing processes, through combined lecture and laboratory exercises. The specific objectives and performance criteria are:

1. Design new alloys, or select an alloy for a required application. Evaluated on exams and reports: 80% of the students will earn a grade of 75% or better.
2. Select a desired material based on the design. Evaluated on exams and reports: 80% of the students will earn a grade 75% or better.
3. Describe the mechanical properties of different engineering materials. Evaluated on reports and the library research assignment: 80% of the students will earn a grade of 75% or better.

4. Select a material and sequence of manufacturing processes for a desired application. Evaluated on reports: 80% of the students will earn a grade 75% or better.
5. Plan the sequence of operations in order to achieve final part configuration. Evaluated on reports: 80% of the students will earn a grade 75% or better.
6. Explain the manufacturing process required for achieving desired part configuration. Evaluated on exams: 80% of the students will earn a grade of 75% or better.
7. Define tolerances, allowance, and the difference between clearance and allowance. Evaluated on exams and reports: 80% of the students will earn a grade 75% or better.
8. Select the required tolerance using tables in the system of limits and fits. Evaluated on exams and reports: 80% of the students will earn a grade 75% or better.
9. Use different measuring tools and equipment to take readings from them with required accuracy. Evaluated on lab exercises and reports: 80% of the students will earn a grade 75% or better.

Exams

For all day sections Exams 1 and 2 will be common exams that take place on Monday 4:15-5:45pm, *Exam 1 will be on 9/30, and Exam 2 will be on 11/4*, and the room assignments will be announced in class. For evening sections exams will be held at the regular time and regular room following the syllabus weekly schedule. The final exam will also be a common exam, the time and place announced by the registrars office. For conflicts, we follow the NJIT policy for final exams provided online. The policy generally indicates that the course with the higher numerical value takes place during the regularly scheduled period.¹

The NJIT honor code will be upheld and any violations will be brought to the attention of the dean of students. Only non-programmable calculators are allowed during exams. *Mobile phones, smart watches, programmable calculators, and similar electronic devices are expected to remain out of sight — the sight of a mobile phone, smart watch, or programmable calculator during an exam results in a grade of F for the class.* The exam materials consist of two documents, a question booklet, and an answer sheet. Please note the answer sheet is the only thing that will determine the grade, not what is in the exam booklet. Also, failure to show for an exam results in a grade of zero, unless the dean of students contacts the instructor, and a decision is made otherwise. Employment is not considered a valid reason for missing an exam, and no makeup exams will be given.

In the case that a student is absent (or expects to be absent) for an exam, the following actions are required in order for that exam grade to be non-zero:

1. The student should write an email to the professor indicating that he/she is going to contact the dean of students office about their absence from the exam. Those expecting official travel (i.e., athletes, academic conferences, etc.) must notify the professor and the dean of students office at least 2 weeks prior to the exam. In extreme cases (i.e., unforeseen sickness, death, etc.) the student must notify the professor and dean of students office within 48 hours after the originally scheduled exam time. In the email sent to the dean of students office, students should at a minimum include the following: (i) name; (ii) ID number; (iii) course and section; (iv) professor's name and email; (v) regularly scheduled exam time; (vi) evidence for absence.

¹This paragraph does not apply to summer courses, where exam details are handled in each class.

2. Upon receiving notice from the dean of students office, the professor will contact the course coordinator and provide the relevant information.
3. Since it is likely that multiple students across different sections are in a similar situation, the course coordinator will make a decision that is equitable to everyone involved.

Laboratory and Laboratory Reports

Safety in the laboratory is a high priority – students are required to wear safety glasses at all times in the laboratory an experiment is being performed.

Laboratory attendance is mandatory, students are required to complete all laboratory practices and submit all corresponding laboratory reports to pass the course. Further, if more than 15 minutes late, credit will not be given for that laboratory practice and a makeup must be taken (*more details below*). *Pre-lab quizzes are given in the first 15 minutes, these simple quizzes serve to take attendance, as well as ensure that students have read the manual prior to the lab.* Students that miss a laboratory practice are required to makeup that experiment by going to another section that semester (*see the details below*). Employment is not considered a valid reason for missing lab.

Laboratory reports are due one week (specifically five working days, e.g., a lab experiment completed on a Monday, is typically due the following Monday) after the experiment is finished. Lab reports are to be *submitted electronically via Canvas as a single PDF file. Any other method is not an appropriate method to submit, and therefore not graded.* Each day a laboratory report is late 10% is taken off the maximum allowable grade. Therefore a perfect lab report will get 50% credit if it is submitted 5 days late. After 10 days the report will have zero value, however will show on the record as being submitted. Keep in mind that holidays and weekends are not ignored in the late policy, they count as days.

For lab reports, lateness is defined through the following example:

Suppose a report is due at 11:30am on Wednesday, if submitted anytime prior to 11:30am Wednesday full credit is given for what the student earns, so an 80/100 remains 80/100. If submitted 2:00pm on Wednesday, it is late within the span of one day and therefore 10% is subtracted based on what the student earns, so an 80/100 becomes 70/100. If submitted at 9:12am on Thursday, it is late within the span of one day and therefore 10% will be subtracted based on what the student earns, so an 80/100 becomes 70/100. If submitted at 2pm on Monday, it is late within 3 working days and therefore 30% is subtracted based on what the student earns, so an 80/100 becomes 50/100. If submitted at 2pm on Wednesday the following week, it is late within the span of 5 days and therefore 50% will be subtracted based on what the student earns, so an 80/100 becomes 30/100.

Lastly, past experience has shown a few students will knowingly submit an entirely incorrect document in an attempt to circumvent the policy that the lack of a submission leads to a failure. The course coordinator is the only person responsible to determine if a report was submitted in good faith or not. A report that has been deemed submitted not in good faith will be marked as if it were never submitted.

Makeup labs: For a makeup, the makeup lab needs to be reserved online, and the provided makeup form must be attached to the submitted lab report so proper attendance may be kept. The makeup reservation is a google form that is only available with your NJIT UCID. The link may be found on Canvas, and it asks for details about what was missed and when you intend to make it up.

After submission, your reservation is saved to a spreadsheet and an email sent to the instructors. The makeup form must be completed in full prior to the student leaving the makeup lab. A makeup lab report is due one week (again, specifically five working days) after the makeup lab is completed.

Here are a few example cases to ensure clarity of the policy, in cases 1 and 2 everything goes as scheduled, however in cases 3 - 5, a lab is missed.

1. A student goes to a lab on 10/1, and the lab is finished. The report is then due one week later at the start of lab on 10/8.
2. A student goes to a lab on 10/1, and it is part 1 of a two part experiment. The student returns on 10/8 and part 2 of the lab is finished. The report is then due one week later at the start of lab on 10/15.
3. A student misses a lab on 10/1. That student then goes to a makeup lab on 10/21 in a different section. The report is due one week later on 10/28 with the makeup form attached.
4. A student goes to lab on 10/1, and it is part 1 of a two part experiment. That student misses part 2 of a lab on 10/8. That student then goes to a makeup lab on 10/21 for part 2 in a different section. The report is due one week later on 10/28 with the makeup form attached.
5. A student misses lab on 10/1, and it is part 1 of a two part experiment. The student goes to part 2 of a lab on 10/8 as scheduled. That student then goes to a makeup lab on 10/21 for part 1 with a different section. The report is due one week later on 10/28 with the makeup form attached.

Makeup labs can be attended throughout the semester, as the previous examples showed. Typically a student needs to refer to the lab schedule and find another section that will perform that laboratory at a time in the future. However, if the last laboratory was missed, or no other time exists, then there is no other section to attend. Accordingly, there will be two days set aside at the end of the semester for makeup labs, with a set of labs running in the day and that same set in the night. To ensure that we have adequate resources in place (instructors, TA's, supplies, etc.) we will only run a particular lab, at a particular time if it has been reserved. Details will be worked out after the second exam of the semester.

HW assignments

Homework is regularly assigned and the questions for the entire semester are posted at the end of this syllabus. Assignments will be collected via Canvas only, and a random sample of assignments will be graded at various times throughout the semester. The solutions to these assignments will not be posted, they will only be discussed in the class.

Grading

Note that *late assignments, reports, etc., will not be accepted after the last day of class for the semester (i.e., the university wide last day of class, not the last day of lecture for your section).* The weights shown in the table will be used in determination of the final course grade. Alongside are the letter grades and their corresponding description as written in the university undergraduate academic policy.

Exam 1:	20%	A	Superior
Exam 2:	20%	B+	Excellent
Final Exam:	25%	B	Very Good
Reports	} Laboratory:	C+	Good
Pre-lab quiz		C	Acceptable
HW/Library/Participation/etc.:	5%	D	Minimum
		F	Inadequate

In addition, an inability to meet 40% of the course objectives described previously will result in a grade of F regardless of performance. For example, any student that is unable to meet 4 out of the 9 listed performance criteria will be considered to have inadequate understanding of the course material — and therefore will earn a grade of F. Also, as mentioned previously an inability to submit or attend all labs will result in a failure regardless of performance. And note that external factors (such as level of effort, ability in other courses, time management, etc.) are typically not considered in the computation of grades.

In semesters where multiple sections of the course are running, for fairness and consistency, the final assigned grades will be determined among all sections at once. That implies that any curve will be computed among all sections, not just a single section. Any disagreement over grades must be brought to the attention of the instructor no later than the first two weeks of the following semester, grades will not be altered after that. Further, final grades are typically not discussed via email, an appointment should be made.

Academic integrity

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found [here](#).

Please note that it is the professional obligation and responsibility of faculty to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing, using any online software inappropriately, or other forms of dishonesty in academics will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu.

Requirements

In order to ensure fairness and consistency among all sections of ME215, the following requirements and expectations are meant to ensure that all sections are equivalent, and everyone is treated equally and fair.

Requirements for Instructors Instructors will not fall behind the schedule posted on the syllabus for lecture, as well as the lab schedule (with the exception of officially cancelled days). Exam question booklets will be held for one year, while answer sheets are returned to the student immediately. It is the instructors responsibility to take and maintain attendance for all laboratory periods. Instructors are expected to remain in the laboratory for the entire laboratory period, *the instructor is the responsible person* for the people and equipment. If an instructor is sick or otherwise unavailable for a lab, then arrangements should be made to have someone cover since

the schedule shouldn't be changed unless due to official school closures. When a student from section "A" is doing a makeup lab in section "B" that student will have a pre-lab quiz and makeup form. The instructor should place the completed pre-lab quiz in the mailbox of the professor for the student's regular section. This allows the instructor of the regular section to confirm the new report deadline to account for the makeup. The course coordinator will arrange for two laptops for use with all lab class periods with media services. All instructors (and TA's) should meet at the start of the semester to coordinate.

Requirements for TA's The TA's will input the due dates for lab reports on Canvas, including those for makeup labs. Have lab reports graded and returned one week after receipt of student submission. Do not override the prescribed late policy for reports described here previously. Reports with incomplete cover pages should not be accepted for submission. Obtain the laptops from media services before the lab period starts, and return them when the lab period is finished (before 9pm for night classes). The most senior TA and the course coordinator will determine the specific lab schedule every semester. For new TA's, they should attend to prior classes for practical experience. All TA's should meet with the instructors at the start of the semester to coordinate.

Requirements for students Prior to the start of the lab class period, print a hard copy of the lab manual, read it, and bring it to the lab class period. Ensure that you have taken the pre-lab quiz for attendance. The student is responsible to attend all labs, and complete all reports since they are mandatory. As soon as possible after missing a lab, it is the responsibility of the student to fill out the online makeup lab reservation form to arrange for a makeup lab, and also to bring a hardcopy of the makeup form for signatures, so that proper credit can be received. It is the responsibility of the student to inform the dean of students of any missed exam or other mandatory materials. Employment is not considered a valid reason for missing an exam, class, lab, or any portion of the class. If you feel you are not going to pass this course, please reach out to your instructor with adequate time before the drop date.

Tentative Lecture Schedule

Section schedules are color coded as follows: 001 & HM1; 003; 005; 007; 009 & HM3; 011; 101; 103; and labelled by “section number”-“lecture number” in the calendar below. Note that the schedule may be changed due to unforeseen circumstances such as weather closings.

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9/2/19 Labor Day	9/3/19	9/4/19 103-1	9/5/19	9/6/19
9/9/19 001-1 003-1 005-1 007-1 009-1 011-1 101-1	9/10/19	9/11/19 103-2	9/12/19	9/13/19
9/16/19 001-2 003-2 005-2 007-2 009-2 011-2 101-2	9/17/19	9/18/19 103-3	9/19/19	9/20/19
9/23/19 001-3 003-3 005-3 007-3 009-3 011-3 101-3	9/24/19	9/25/19 103-4	9/26/19	9/27/19
9/30/19 Common Exam 1 Exam 1	10/1/19	10/2/19 Exam 1	10/3/19	10/4/19
10/7/19 001-4 003-4 005-4 007-4 009-4 011-4 101-4	10/8/19	10/9/19 103-5	10/10/19	10/11/19
10/14/19 001-5 003-5 005-5 007-5 009-5 011-5 101-5	10/15/19	10/16/19 103-6	10/17/19	10/18/19
10/21/19 001-6 003-6 005-6 007-6 009-6 011-6 101-6	10/22/19	10/23/19 103-7	10/24/19	10/25/19
10/28/19 001-7 003-7 005-7 007-7 009-7 011-7 101-7	10/29/19	10/30/19 103-8	10/31/19	11/1/19
11/4/19 Common Exam 2 Exam 2	11/5/19	11/6/19 Exam 2	11/7/19	11/8/19
11/11/19 001-8 003-8 005-8 007-8 009-8 011-8 101-8 Drop day	11/12/19	11/13/19 103-9	11/14/19	11/15/19
11/18/19 001-9 003-9 005-9 007-9 009-9 011-9 101-9	11/19/19	11/20/19 103-10	11/21/19	11/22/19
11/25/19 001-10 003-10 005-10 007-10 009-10 011-10 101-10	11/26/19 Thu. Classes Meet	11/27/19 Fri. Classes Meet	11/28/19 Thanksgiving	11/29/19
12/2/19 001-11 003-11 005-11 007-11 009-11 011-11 101-11	12/3/19	12/4/19 103-11	12/5/19	12/6/19
12/9/19 001-12 003-12 005-12 007-12 009-12 011-12 101-12	12/10/19	12/11/19 103-12	12/12/19 Reading Day	12/13/19 Reading Day

Lecture Topics and Assignments

Lecture	Topic	Pages	Review Questions
1	Introduction, and manufacturing systems design	1-22	Ch.1: 1, 3, 6, 17, 26, 31, 32
2	Nature of materials	45-56	Ch.3: 1, 2, 6, 16, 17, 21, 22, 23, 29, 30, 34, 37
3	Properties of materials. Fundamentals of metal alloys. Equilibrium diagrams. Iron - Iron carbide equilibrium diagram, steels and cast Irons.	23-44, 57-66	Ch.2: 3, 6, 10, 11, 15, 16, 21, 24, 42, 43. Ch.4: 2, 4, 12, 13-18, 22, 28-30, 32-35, 37, 39
4	Heat treatment of metals	67-86	Ch.5: 1, 5-7, 11, 12, 23, 25, 32, 59
5	Ferrous metals and alloys, cast irons and steels, and non-ferrous alloys. Non-metallic materials. Materials selection.	87-105, 106-124, 125-152, 153-162	Ch.6: 2, 11, 17, 19, 23, 47, 54; Ch.7: 4, 5, 7; Ch.8: 3, 5, 46; Ch.9: 4
6	Fundamentals of metal forming, bulk forming, hot and cold working, and sheet forming	292-303, 304-330, 331-358	Ch.17: 3, 24, 37, 47; Ch.18: 5, 48, Ch.19: 1, 20, 35, 46
7	Casting, powder metallurgy, joining process, and their influence on design aspects.	221-235, 236-259, 260-274, 275-291, 680-689, 690-711, 712-725, 726-745	Ch.13: 2, 8, 10; Ch.14: 1, 50; Ch.15: 1, 3, 4, 28; Ch.16: 1, 2, 5, 11, 15; Ch.35: 3, 7; Ch.36: 2, 9, 11; Ch.37: 7; Ch.38: 6, 14, 18, 33, 40
8	Measurement and inspection.	163-185, 186-196	Ch.10: 1, 10, 11, 21, 23; Ch.11: 5, 8, 9, 10
9	Fundamentals of machining and tool geometry.	381-404, 405-427	Ch.21: 3, 4, 6, 15; Ch.22: 1, 6, 8, 13, 17
10	Turning, boring, and drilling	428-446, 462-481	Ch.23: 2, 4, 8, 21; Ch.25: 8, 21, 23;
11	Milling, sawing, broaching, other machining. CNC.	447-461, 502-522, 482-501	Ch.24: 1, 12; Ch.27: 34; Ch.26: 1, 23
12	Additive processes	637-655	Ch.33: 2, 10, 12, 13, 70

Exam coverage

- Exam 1 covers all material covered in lectures 1 through 3.
- Exam 2 covers all material covered in lectures 3 through 7. (There is indeed some overlap.)
- The final exam covers all lecture and lab material.