



ET 405 Engineering Design, 4 Credits

UNH Credit Hour Policy: The University of New Hampshire is in compliance with the federal definition of the credit hour. For each credit hour, the university requires, at a minimum, the equivalent of three hours of student academic work each week assuming a 15-week semester (student workload for shorter length terms must be increased proportionally per week to maintain required approximately 45 hours of work per credit per term). Student work reflects intended learning outcomes and is verified through evidence of student achievement. For this 4-credit, 15-week course, students are expected to spend a minimum of 12 hours each week on their academic work.

Course Format: This course is an in-person, on-campus course. There is no remote attendance option. There are regularly scheduled class meeting times. The lecture session meets twice a week and the lab session once per week. Students are expected to attend all sessions. See course outline for topics/schedule and projected assignment due dates. Student participation is expected. All due dates apply to all students and will be strictly enforced.

COURSE DESCRIPTION: This course introduces students to the engineering design process and solid modeling software tools used to create 3D CAD models and generate professional industry standard engineering drawings. Industry codes and procedures will be practiced such as Geometric Dimensioning & Tolerancing (GD&T). Students will complete hands-on projects and activities. The engineering design process includes problem identification, brainstorming, concept creation, modeling, documentation, analysis, and manufacturability. Industry standard 3D modeling software is used along with project design methodology for graphical, written, and oral communication of mechanical design ideas.

Attributes - Discovery: Inquiry

Note: Inquiry attribute courses must contain four individually necessary and collectively sufficient features:

1. Inspire curiosity: An Inquiry student will compose open-ended questions that lead to further investigation into increasingly focused problems and issues.
The Engineering Design Process (EDP) is used to inspire curiosity by having students formulate design ideas through brainstorming activities and developing concepts using CAD software.
2. Develop understanding and perspective taking: An Inquiry student will explain a central issue or question of the course using at least two unique perspectives.
As students create concept ideas to solve a design problem, various perspectives must be considered. e.g., functionality, manufacturability, assembly, maintainability, etc.? Students present their concept ideas to the class and explain reasoning for their approach to solve the problem.



3. Clarify standards of thinking: An Inquiry student will be able to identify, compare, and evaluate different interpretations (hypotheses, explanations) of a given phenomenon.
The EDP typically generates several concepts, the student can compare and evaluate different concept ideas and then select one or two viable options for further development.
4. Create effective communicators: An Inquiry student will present in clearly organized form the results of the investigation into questions or problems they have posed.
Once a design idea is developed and formalized, appropriate documentation must be created to communicate the design to others, e.g., design engineering to manufacturing, or to marketing or customers. Presentations include written and oral forms which are required in industry. The written form includes engineering graphics – CAD models and appropriate standardized engineering drawings.

CLASS MEETING INFORMATION: Attendance is expected.

Section	Day	Start Time	End Time	Room
Lecture	Tuesday	3:10 PM	4:30 PM	P376
Lecture	Thursday	3:10 PM	4:30 PM	P376

Although this course is primarily a lecture course, there will be individual and group activity/exercise assignments conducted during class time. Activity/exercise sessions will use the EDP. (Watch for updates and revisions posted in Canvas)

The Engineering Design Process (EDP) consists of the following phases: problem identification and definition, concept creation, modeling, analysis, and documentation. The creation or design of any mechanical product begins with a problem definition and a stated need for the item. The problem to be solved is often opened ended with many broad possibilities. A brainstorming session usually follows for ideas and an initial evaluation to then create viable concepts. Usually, two or three concepts are selected for problem solutions. These concepts are developed for the analysis and/or modeling phases. The EDP requires creative thinking and is an iterative process. After the analysis there is an evaluation and sometimes an optimization phase. It is not unusual for concepts to become unusable and earlier phases may need to be repeated. Once viable concepts are developed one will be chosen for further study. After the analysis and evaluation, the final step is creation of suitable documentation, which includes graphical (CAD) drawings, written information - instructions, and often oral presentations to communicate the design idea for implementation to others such as the manufacturing department. The activities in the course will use communication skills and tools as well as develop student creative thinking throughout the various phases of the EDP.

REQUIRED TEXT:

Engineering Graphics with SOLIDWORKS 2024, David C. Planchard, SDC Publications ISBN: 978-163057-6271 (paperback - hardcopy).

I suggest the hardcopy version so that you can easily follow the tutorial exercises in the textbook



while using the SolidWorks CAD software. An electronic version could be used but you would need two monitor screens. It is much easier to follow the tutorial using a hardcopy book while working on your computer.

Note: An older version of the textbook, 2023 may work, but the ordering of the exercises and assignments in the text might be different. It becomes the responsibility of the student if using an earlier edition and the assignments do not match the current edition.

SOFTWARE:

The software is on the computer in the lab which we will be using. A student download is available so that students can work on their own computers. Typically, each year, the latest version 2023-24 and one older version, 2022-23 are available. I would suggest holding off on downloading the software until we meet in person. The 2022-23 is known to be stable and works fine. The newest version has just been purchased and there are unknowns.

INSTRUCTOR: Robert Arredondo

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Cell: 603-660-4832

OFFICE HOURS: Office hours will be posted on my office door or arranged by appointment. If you have questions during the semester, please feel free to ask. If you are having trouble understanding the material or with the course, please let the instructor know as early as possible so that resources can be utilized.

GRADING: The grading for this course will be divided among the following categories:

Homework	20%
Tests (2)	30%
Activity/exercise assignments (3)	30%
Final Project	20%

Spreading the overall course grade across different assessment methods is helpful for most students who may have difficulty with one particular method, e.g., test anxiety, time constraint, etc. It is important that the student complete assignments in each of the above categories in order to achieve a passing grade in this course.

Important Note: Program required courses require students to achieve a minimum passing grade of C- in order to graduate from the program. A minimum GPA of 2.0 is also required in all program required courses for graduation.

ASSIGNMENTS: Homework and activity/exercise assignments will be assigned throughout the semester. All assignment information will be posted on Canvas with applicable due dates. Typically, a two-week advance notice for a test will be given. All assignments must be submitted



by the due date. Late assignments will be accepted up to “ONE-WEEK” (5 weekdays) beyond the announced due date. Late assignments will be reduced by one full letter grade. Late assignments submitted after the “ONE-WEEK” period will not be accepted and a grade of “zero” will be recorded for that assignment. Tentative dates for tests are indicated on the course outline. Watch for update/revisions to course outline schedule and announcements in Canvas. The schedule will change over the course of the semester.

Tests: There will be two tests given in this course. Each test will cover general topics related to the EDP and/or may cover the CAD software topics covered in the textbook. In general, the format of the test will have a combination of true/false, multiple choice, short answer questions, and a problem or two. There may also be related short portions of the test using CAD software. Tests are typically CLOSED BOOK – NO NOTES.

ASSIGNMENT SUBMISSION REQUIREMENTS: General requirements for assignments, as well as tests, and final project:

1. Always show all your work. (Partial credit cannot be given unless steps are clearly shown.)
2. Clearly identify final answers.
3. Work should be legible and performed in a clear and organized manner.
4. Turn in homework in electronic form. Electronic form should consist of a single coherent legible document for each single assignment. Do not submit several pieces of electronic items such as phone snapshots for a given single assignment. Scanning may be done using the ET Commons copier/printer.
5. Include a cover page with assignment information on each assignment submitted. This includes the assignment number and type of assignment, e.g., Homework #1 Chapter 1, Activity 1 – Brainstorming Exercise. Be sure to include your name (and names of your group if applicable) on the cover page.
6. Some assignment formats may vary per activity/exercise.

These items facilitate fair grading of the assignment and granting of partial credit where warranted. Working on homework and activity assignments in groups is permitted but each person will submit individual assignments when required. Activity assignments may be individual or by group depending on the exercise and requested format.

ATTENDANCE: Class attendance is important for your learning. You are responsible for all course assignments and meeting all deadlines unless exceptions are agreed upon with the instructor ahead of time. Attendance in this course is expected, if excessive absences occur (more than 4) a grade of AF may be issued at the discretion of the instructor. See the [Attendance and Class Requirements](#) policy in the undergraduate catalog.

In the event that a student needs accommodation for a religious or cultural holiday/observance, that student is encouraged to make that request as early in the semester as possible.

If you are dealing with an unexpected, extenuating circumstance that will keep you out of class or affect your performance for more than a day or two (e.g. test positive for Covid19), reach out



to Lisa Enright, Assistant Dean of Student Success, at lisa.enright@unh.edu to request a letter be sent to all your faculty.

If you are required to miss significant class time, you will be provided temporary academic support so that you can continue to make satisfactory progress in this course. Please contact your course instructor to discuss the specific types of support that will be implemented during your absence.

Tests, Activity/Exercise and Final Project: Tests are given in class and take about an hour of class time. If a student cannot take the test on the assigned date, the instructor should be notified prior to the test date, to request other arrangements. In extreme circumstances and if no prior notification is possible, the student must contact the instructor within 24 hours of the missed test and submit a valid reason the test was missed. A modified test may be given on a case-by-case basis.

ACADEMIC HONESTY: In the preparation and presentation of any assigned work – including examinations, tests, quizzes, term papers, reports, papers and other written or oral exercises – every student shall conform to a strict standard of academic honesty. Any attempt to deceive a faculty member or to help another student to do so will be considered a violation of this standard. In all assignments, students must acknowledge the words and/or ideas of others taken from print or electronic media, whether a direct quotation or a paraphrase; any omission of this is dishonest. Cheating on examinations or tests consists of knowingly giving, receiving, or using – or attempting to give, receive, or use – unauthorized assistance during an examination or test. A faculty member may record a grade of “zero” for any assignment on which a student has plagiarized or cheated. For repeat offenses within a single course, the faculty member may record a grade of “F” for the course. See these various links to academic honesty, plagiarism tutorial, and academic integrity:

<https://catalog.unh.edu/srrr/academic-policies/academic-honesty/>

<https://cola.unh.edu/academics/plagiarism-tutorial>.

<https://catalog.unh.edu/srrr/university-policies-regulations/academic-integrity/>

PROFESSIONALISM: Students are expected to show proper behavior and respect in the classroom and laboratory. Each student is expected to act as a professional as would be expected in industry. This includes the use of proper language and attitude toward the instructor and other students in the classroom and lab. Students should be on time, not exit and re-enter class or lab excessively, and not leave early. Cell phones **should be turned off and put away** during lectures and laboratory sessions. Laptops are permitted for **note taking only**, NOT for accessing the internet or email services. Courtesy and respect are expected from all students. **All safety practices and policies must be adhered to at all times, especially in the lab.** Improper behavior or continued violations of any of the above rules will not be tolerated. Violation of the above rules, especially safety rules, will result in suspension from the lab and/or course with appropriate corresponding grade consequences.

STUDENTS WITH DISABILITIES: According to the Americans with Disabilities Act (as amended, 2008), each student with a disability has the right to request services from UNH to accommodate



his/her/their disability. If you are a student with a documented disability or believe you may have a disability that requires accommodation, please contact Student Accessibility Services (SAS) located on the Manchester campus in the Student Services Suite (Office 405A).

Accommodation letters are created by SAS with the student. Please follow up with your instructor as soon as possible to ensure timely implementation of the identified accommodations in the letter. Faculty have an obligation to respond once they receive official notice of accommodations from SAS but are under no obligation to provide retroactive accommodations.

For more information refer to www.unh.edu/sas or contact SAS at 603.862.2607, 711 (Relay NH) or sas.office@unh.edu.

Confidentiality and Mandatory Reporting of Sexual Violence or Harassment:

The University of New Hampshire and its faculty are committed to assuring a safe and productive educational environment for all students and for the university as a whole. To this end, the university requires faculty members to report to the university's [Title IX Coordinator](#) (Bo Zarycky, Bo.Zarycky@unh.edu, 603-862-2930/1527 TTY) or to the UNH Manchester/CPS Title IX Deputy Intake Coordinator (Lisa Enright, lisa.enright@unh.edu 603-641-4336, Room 439) any incidents of sexual violence and harassment shared by students.

If you wish to speak to a confidential support service provider who does not have this reporting responsibility because their discussions with clients are subject to legal privilege, you can contact the [SHARPP Center for Interpersonal Violence Awareness, Prevention, and Advocacy](#) at (603) 862-7233/TTY (800) 735-2964. For more information about what happens when you report, how the university treats your information once a report is made to the Title IX Coordinator, your rights and reporting options at UNH (including anonymous reporting options) please visit [student reporting options](#). [The uSafeUS app](#) is also available for students to keep reporting options and resources easily accessible on their phones.

Help us improve our campus and community climate. If you have observed or experienced an incident of bias, discrimination or harassment, please report the incident by contacting the Civil Rights & Equity Office at UNH.civilrights@unh.edu or TEL # (603) 862-2930 voice/ (603) 862-1527 TTY / 7-1-1 Relay NH, or [visit the CREO website](#). Anonymous reports may be submitted.

Confidential Support Resources for UNH Manchester:

- SHARPP Extended Services Coordinator for UNH Manchester- room 417. Available in person Mondays 9 am to 4-pm and by Zoom appointment year-round M-F.
- YWCA, NH – 603-668-2299(24hour), 72 Concord St. Manchester, NH
- The Mental Health Center of Greater Manchester: On campus mental health counselors are available by appointment during the academic year. Located in room 426.
- 24 Hour NH Sexual Violence Hotline: 1-800-277-5570
- 24 Hour NH Domestic Violence Hotline: 1-866-644-3574



UNH Statement on emotional or mental health distress: In partnership with The Mental Health Center of Greater Manchester, UNH Manchester offers consultation visits on a walk-in basis and through telehealth appointments. Services include:

- Free confidential screening & consultation with a licensed mental health therapist.
- Referrals to mental health or substance misuse treatment. And assistance in understanding how to afford additional treatment (with or without insurance!) or find free services.

You may email: unhm.wellness@unh.edu to make an appointment to meet with a counselor by clicking [here](#) or by using the QR codes below.

[For in person appointments please scan this code](#)



[For remote appointments please scan this code](#)



If you would like to connect to counseling services directly, you may do so by contacting The Greater Manchester Mental Health Center at (603) 668 - 4111.

The National Suicide Prevention Lifeline provides 24/7, free and confidential support via phone or chat for people in distress, resources for you or your loved ones, and best practices for professionals. Call (800) 273-TALK (8255).

Library Resources:

The UNH Manchester librarians are available to assist you with the research process. Visit the library's website at <https://cps.unh.edu/library> to learn about library services and to search for reliable academic sources. You can contact the library at 603-641-4173 or at unhm.library@unh.edu.

The links below guide you to useful online library resources:

- Make a **Research Appointment** with a librarian: <https://libraryguides.unh.edu/remoteaccess/researchhelp>
- Use the **Library Search Box** to find information: https://libraryguides.unh.edu/librarysearchbox_unhmanchester
- Reserve a **Study Room**: <https://cps.unh.edu/library/support-services>
- Discover resources for **Citing Sources**: <https://libraryguides.unh.edu/unhmciting-sources>
- Learn strategies for **Evaluating Sources**: <https://libraryguides.unh.edu/ENGL401UNHManchester/evaluatingsources>.



Course Specific Objectives or Outcomes:

1. Students will understand the use of the Engineering Design Process (EDP) as used in related mechanical and manufacturing engineering industry practice.
2. Students will understand how to use Standard Drawing/Drafting Practices for the mechanical engineering industry.
3. Students will be able to use an industry standard 3-Dimensional Computer Aided Drawing (CAD) software package (SolidWorks) to create electronic 3D models and assemblies, as well as animation of assembly models.
4. Students will be able to create detailing working engineering drawings using the 3D CAD software: includes part drawings and assembly drawings.
5. Students will gain a basic understanding and use of Geometric Dimensioning and Tolerancing (GD&T) practice.

The following section refers to the Engineering Technology program accreditation.

ABET/ETAC (Accreditation Board for Engineering and Technology/Engineering Technology Accreditation Commission)

I. General Criteria (2019)

Criterion 3. Student Outcomes

The program must have documented student outcomes with a documented and effective process for the periodic review and revision of these student outcomes. For purposes of this section, well-defined activities or problems are practical, narrow in scope, use conventional processes and materials in traditional ways, and require knowledge of standard operating processes. Broadly defined activities or problems are practical, broad in scope, relatively complex, and involve a variety of resources; use new processes, materials, or techniques in innovative ways; and may require extension of standard operating procedures.

B. For baccalaureate degree programs, these student outcomes must include, but are not limited to, the following:

- (1) an ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problems appropriate to the discipline;
- (2) an ability to design systems, components, or processes meeting specified needs for



broadly defined engineering problems appropriate to the discipline;

- (3) an ability to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;
- (4) an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results to improve processes; and
- (5) an ability to function effectively as a member as well as a leader on technical teams.

II. PROGRAM CRITERIA

MECHANICAL ENGINEERING TECHNOLOGY

PROGRAM CRITERIA FOR BACCALAUREATE LEVEL PROGRAMS

The curriculum must prepare baccalaureate degree graduates with the knowledge, techniques, skills, and use of modern equipment in mechanical engineering technology. Baccalaureate degree graduates build on the strengths of associate degree programs by gaining proficiency in the analysis, applied design, development, implementation or oversight of more advanced mechanical components, systems, or processes. Programs may focus on preparing graduates with in-depth but narrow expertise, while other programs may choose to prepare graduates with a broad spectrum of expertise. The depth and breadth of expertise demonstrated by baccalaureate graduates must support the program's educational objectives. The following curricular topics are required (unless the program's faculty and primary constituents approve the substitution of other specific, mechanically related technical subjects supporting attainment of program educational objectives):

- a. Application of principles of geometric dimensioning and tolerancing;
- b. Use of computer aided drafting and design software;
- c. Perform selection, set-up, and calibration of measurement tools/instrumentation;
- d. Elements of differential and integral calculus;
- e. Manufacturing processes;
- f. Material science and selection;
- g. Solid mechanics (such as statics, dynamics, strength of materials, etc.);
- h. Mechanical system design;
- i. Thermal sciences (such as thermodynamics, fluid mechanics, heat transfer, etc.);
- j. Electrical circuits (ac and dc) and electronic controls;
- k. Application of industry codes, specifications, and standards; and
- l. Technical communications are typically used in preparation of engineering proposals, reports, and specifications.

ET405: GENERAL ENGINEERING TECHNOLOGY BACCALAUREATE OUTCOMES

This course covers general topics which lead directly to achieving ABET General Criteria 3 - Section B outcomes (1), (2), (3), and (5) in varying degrees. Outcomes (2), (3), and (4) are used



with assessment tools in the General Criteria 4 Continuous Improvement Plan.

ET405: MECHANICAL ENGINEERING TECHNOLOGY PROGRAM OUTCOMES

This course covers general topics which lead directly to achieve the ABET MET Program Specific Curriculum requirements in Categories “a” (GD&T), “b” (CAD), “e” (manufacturing processes), “k” (industry codes and specifications), and “l” (technical communications). These outcomes are assessment tools in the General Criteria 4 Continuous Improvement Plan.