

**North Dakota State University**  
**ABEN 255 Computer Aided Analysis and Design**

**Course Description:**

ABEN 255. Computer-Aided Analysis and Design. 3 credits. Application and use of software for engineering design, analysis, and graphical communication. 2 lectures. Fall.

**Meeting Times:**

9:30 to 10:45 a.m. on Tuesdays and Thursdays. A tentative class schedule will be provided in a separate document.

**Location:**

NDSU Ladd Hall, Room 201.

**Class Number:**

4841.

**Instructor:**

Dean Steele  
 701-231-7268  
[Dean.Steele@ndsu.edu](mailto:Dean.Steele@ndsu.edu)  
 101D Ladd Hall  
[https://www.ndsu.edu/aben/faculty\\_and\\_staff/personnel/steele/](https://www.ndsu.edu/aben/faculty_and_staff/personnel/steele/)

**Office Hours:**

Tuesdays and Thursdays, 2:30 – 3:30 p.m. and by appointment. Changes or variations in this schedule will be announced in class, via Blackboard, and/or via e-mail.

**Prerequisites:**

None.

**Evaluation Methods:**

Details on grading, homework, etc. are provide in the Grading section on page 3 and Table 1 on page 3.

**Important NDSU Dates:**

See <https://www.ndsu.edu/onestop/academic-calendar> or Table 2 on page 6.

**Objectives:**

Following is a list of course objectives and a student outcome for the course. The Accreditation Board for Engineering and Technology (ABET) requires that accredited engineering programs publish their program educational objectives (PEOs) and student outcomes (SOs). A goal of this course is to meet ABET requirements. Additional details on the ABEN program's PEOs and SOs are provided in the appendix, Table 3, page 7, of this document.

After completing this course, students should be able to:

1. Analyze and interpret data using techniques such as descriptive statistics, histograms, and regression analysis (ABET-6).
2. Communicate effectively using appropriate graphs, tables, drawings, letters, memos, and e-mail.
3. Use spreadsheet and computer-aided design (CAD) software to develop and document engineering designs and solutions.

**Topics:**

Use of spreadsheets for engineering design, problem solving, and documentation; technical correspondence; and computer-aided design software (AutoCAD).

**Texts and Software:**

Steele, D.D. 2021. *Engineering Problem Solving with Excel*. Fargo: N. Dak. St. Univ. (This text is required and consists of course notes, software instructions, problem sets, etc. related to engineering problem solving with Microsoft Excel. We will use this text for approximately the first half of the semester and you should bring it to class. The text is sold at roughly its cost for printing and Bookstore markup and the instructor receives no profit on its sale.)

Autodesk. 2023. *Autodesk Education Community*. Available at <http://www.autodesk.com/education/home>. See *Autodesk for Students* at <https://www.autodesk.com/education/students>. Accessed 18 Aug 2023. Please note that the NDSU and the ABEN Department computer clusters have copies of AutoCAD software available for your use.

**Required Student Resources:**

In addition to the textbook, students will need a scientific or engineering calculator with its manual, a folder or binder for notes and handouts, and note-taking materials. Students will also need data storage devices (USB flash drives, online storage, or equivalent) to keep duplicate copies of their files.

**Modality:**

On Campus Face to Face

Video and audio recordings of lecture segments using a video capture system will be attempted this semester. The recordings will serve as supplementary material to help you review concepts, complete homework, etc. Video recordings should not be expected to replace class attendance. Technical difficulties or other obstacles may prevent recordings on a given day, or the recordings may be incomplete. Transcripts of recordings are expected to contain errors.

**Computer Usage:**

Students will use computers for most or all of the homework assignments. At least one test will be conducted on the computer to test students' AutoCAD software proficiency. Excel and/or AutoCAD usage may not be allowed for some or all of the remaining tests and/or quizzes; details will be provided for each situation. The reason for this approach is to test your understanding of concepts and your ability to perform calculations related to the subject matter. You are expected to bring a handheld calculator to class for tests and quizzes, but if your calculator fails or you forget it, you may use the Microsoft Calculator available through Windows on the computers.

### **Laboratory Projects:**

All of the class periods will be held in a computer cluster for hands-on instruction, exercises, assignments, and/or projects. A limited amount of class time may occasionally be allocated to homework assignments, but please plan to complete your homework outside of regular class hours.

### **Attendance Statement**

According to NDSU Policy 333 ([www.ndsu.edu/fileadmin/policy/333.pdf](http://www.ndsu.edu/fileadmin/policy/333.pdf)), attendance in classes is expected.

Attendance is not required for this class but you are responsible for all materials, discussion, and other items presented in class as well as all scheduling changes discussed in class. If you miss class, the instructor will provide handouts upon your return if asked; you are responsible for obtaining notes from a classmate.

If you are sick or not feeling well, please stay home. If possible, contact the instructor before class if you will miss class that day. See the "Grading" section of the syllabus for additional details regarding missed tests, exams, and quizzes.

### **Veterans and Military Personnel**

Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

The instructor thanks veterans and active-duty military personnel for their service to the country and for their efforts to preserve the freedoms we enjoy.

### **Family Educational Rights and Privacy Act**

Your personally identifiable information and educational records as they relate to this course are subject to the Family Educational Rights and Privacy Act (<https://www.ndsu.edu/onestop/student-privacy-policy-ferpa>).

**Students with Special Requirements:** Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor and contact the Center for Accessibility and Disability Resources as soon as possible. The instructor may ask for verification and that, plus other assistance, can be requested from the Center for Accessibility and Disability Resources in the Lower Level of the NDSU Library (231-8463).  
<http://www.ndsu.edu/disabilityservices/>.

### **Academic Honesty**

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](#) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the [Office of Registration and Records](#). Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty).

**Policy for Individual Work:** In this class, you may consult with a classmate on procedures for homework and computer assignments designated as requiring individual work, but the final product must be your original work. Sharing of paper-based work, computer files, spreadsheets, or drawings in electronic, paper, or other formats in such situations is not acceptable. For example, it is not acceptable to obtain another person's or team's paper-based or electronic solution, spreadsheet or drawing file, change the name(s) or other items, and present the work as your own or as that of your team.

**Policy for Group Work:** Homework, computer-based assignments, or other work which involves team effort, will be designated as such and the following policies apply. The team will typically submit one set of papers or a single computer file for grading. Sharing of the workload, computer time, calculations, reporting, electronic files, etc. is acceptable and expected. It is expected that all participants will have access to copies of the material and that all participants will contribute toward completion of the final product. Sharing of material between teams is not acceptable; the policy above for individual work also applies to interactions between teams.

Quizzes, tests, and the final exam will require

individual work with no help from anyone in any form or by any means.

#### **Use of Cell Phones and Other Electronic Devices:**

All participants in this class are subject to NDSU University Senate Policy 158: Acceptable use of Electronic Communications Devices (<https://www.ndsu.edu/fileadmin/policy/158.pdf>).

As a courtesy to other students and the instructor, all cell phones, tablets, and other electronic devices except handheld calculators should be turned off or placed in a vibrate-only mode during class time. Initiating phone calls, text message, or other types of messages during class time—including those to friends, family, classmates, coworkers, or supervisors—is unacceptable unless there is a genuine emergency. Examples of emergencies include weather-related school closing announcements; fire, bomb, or other threats to public safety and well-being; and other incidents in which the NDSU NotiFind system is or could be activated to provide broadcast messages to the NDSU community.

Use of cell phones or other portable electronic devices for communication, transmission, retrieval, or storage of information during the administration of a test or quiz may be considered an incident of academic dishonesty. One exception to this policy is the use of handheld calculators for computational purposes. Use of cell phones or similar devices as a calculator during tests and quizzes will not be allowed because it is difficult to distinguish such activity from sending and receiving text messages, taking pictures, etc., which could be interpreted as a form of academic dishonesty.

#### **Dead Week Policy:**

The NDSU Dead Week policy is available at <https://www.ndsu.edu/onestop/dead-week-policy>.

#### **Homework, File Management, and Backups:**

Most homework in this course will require the use of a spreadsheet, word processor, computer-aided design, or other software. Some homework assignments may build upon previous assignments, so it is to your advantage to maintain backup copies of your work. Students are responsible for backing up their data and ensuring that electronic file submissions, if required, are received by the instructor. Please do not restrict yourself to only one device or location for data storage. Students often want to save time by storing documents, spreadsheets, and drawings on only one flash drive. You are encouraged to use multiple tools for backing up your documents, such as one of the following approaches: 1) use two flash drives rather than one; 2) use one flash drive and the "Files" tab on Blackboard; 3) use one flash drive and your e-mail account (you can send yourself an e-

mail with an attached file to store important documents); or 4) use a laptop and an external hard disk drive.

#### **Grading:**

You will have the following four categories of work in the course: homework, quizzes, tests, and the comprehensive final examination. Your lowest quiz score will be dropped. The relative weighting of these work categories is shown in Table 1. Your final grade in the course will be determined by a grade percentage ranging from 0 to 100%. The weighted grade percentage will be computed as follows: 1) divide the total points earned in each work category by the total points possible for that work category, 2) multiply the numbers from step (1) by the weight percentages for each respective work category, and 3) add the results. The weighted grade percentage will be converted to a letter grade using the following grading scale:  $90\% \leq A \leq 100\%$ ,  $80\% \leq B < 90\%$ ,  $70\% \leq C < 80\%$ ,  $60\% \leq D < 70\%$ , and  $0\% \leq F < 60\%$ . The scale may be lower, but will not be higher.

Table 1. Grade components for ABEN 255.

Work Category	Weighted Percentage of Total Grade
Homework	30%
Quizzes (short tests)	20%
Tests (full-period tests)	30%
Final Exam (comprehensive)	20%
Total	100%

The instructor realizes that most syllabi will provide grade components in terms of points per category (400 points for homework, 100 points for quizzes, etc., and a total of 1000 points for the whole semester). However, there are pedagogical and practical reasons for not listing the total point values for each grade category in this class. On the pedagogical side, approximately half of this class covers spreadsheet topics. One typical homework problem is to convert the above grading algorithm into a spreadsheet that calculates the weighted grade percentage and returns the appropriate letter grade. On the practical side, the "percentage per category" approach will give the instructor the flexibility to adjust the number of assignments or points in the homework category, for example, depending on the progress of the class.

Homework will be submitted via paper copies, via e-mail, and/or via Blackboard. If any homework, quizzes, tests, etc. are submitted electronically and require

printing by the instructor, please note that points will be deducted if the instructor cannot open your file and print your work "as is," i.e., no adjustments for print areas, scaling, etc. should be needed. If you are sick or should limit your contact with others, do not come to class or campus to turn in work. Instead notify the course instructor as soon as practical, so that accommodations can be made.

Missed tests, exams, and quizzes will receive zero points unless missed for an acceptable reason and with advance notification where possible. This policy is intended to improve exam security and to improve the fairness of the course for all students. Acceptable reasons for missing tests, exams, and quizzes include a medical or family emergency (please notify the instructor as soon as practical), or a co-curricular activity with advance notice from the student and approval by the instructor. Co-curricular activities include unusually-scheduled field trips for another NDSU or Tri-College class, a one-time requirement for a major, varsity athletic or team events, or other similar events. Unacceptable reasons for missing homework, tests, exams, and quizzes include non-curricular activities, work schedules, etc. Special circumstances may warrant make-up opportunities and these will be considered on a case-by-case basis; such situations may incur a point deduction at the discretion of the instructor. If you are sick on the day of a quiz or test, please call or e-mail the instructor before class so arrangements can be made for a make-up session and/or replacement work. Make-up work, where allowed, may be the same as or different from that given to the rest of the class.

Homework due dates will be given with the assignments. Scores on homework items involving teams may be increased or decreased when graded or at the end of the semester based on participation and contributions to team efforts. Late homework will be accepted up to 10 NDSU class days after it is due with a 10% penalty per NDSU class day. Homework must be received by the instructor before 5 p.m. to be credited to the day it is received. The 10%/day homework point deduction policy will terminate on the last regular day of this class, at which time zero points will be available for late homework or assignments. Extenuating circumstances, such as situations described above for missed tests, exams, and quizzes, may warrant changes in homework and/or homework due dates for individuals and these will be decided on a case-by-case basis.

Handwritten work in this class must be legible to receive full credit. Illegible and/or hard-to-follow solutions will not receive full credit.

The instructor will provide grade estimates only for third-party requests such as midterm progress reports for student-athletes, fraternity and sorority members, military personnel, etc., and midterm grades as required by NDSU policy. Homework, quiz, and test scores will be posted on Blackboard for informational purposes only. The "Total" and "Weighted Total" columns on Blackboard should not be relied upon to give an accurate picture of your overall grade. This is because point totals may vary from one homework assignment to the next and because at the end of the semester there may be adjustments in individual scores based on your teammates' perceptions of your contributions to team-based work. You are encouraged to develop your own spreadsheet to estimate your course grade based on your homework, quiz, and test scores.

**Instructor's Tips:**

The purpose of this section is to give you an outline of my teaching philosophy, teaching methods, and evaluation methods. It also presents some ideas about the level of effort I expect from students and myself.

*Teaching Philosophy*

Following are the major goals of my approach to teaching this course:

1. Students deserve to be respected, treated kindly, and graded consistently on their performance.
2. A hands-on approach to computer instruction will be used for most of the course. Students learn best when they can solve the problems themselves rather than watching someone else solve a problem.
3. It should be noted that commodity prices, equipment resale values, fuel costs, and other variables fluctuate greatly and therefore simplifications will be made to promote a clear and quick understanding of concepts. Students will need to do their own research to supply pricing and other information suitable for their individual situations.
4. Theory and mathematics will not be diminished or compromised for the sake of covering more material.
5. Current software will be used whenever possible and appropriate.

*Teaching Methods*

1. Experience has shown me that in computer courses, students prefer and learn best from a hands-on teaching environment. This is why class is held in a computer cluster.
2. The vocabulary of any subject is important to a good understanding of that subject. Therefore, key terms and concepts are introduced for each topic.

*Evaluation Methods*

1. The tests, quizzes, and assignments in the course are intended to test the students' understanding of the underlying concepts as well as their ability to use software. Therefore, not everything is assigned or tested using Excel or AutoCAD software. There will be quizzes and/or tests involving calculations and problems which must be solved without the use of Excel and/or AutoCAD. Furthermore, the tests, quizzes, and the final exam will include questions to assess your understanding of terms and concepts.
2. The grade in the course will be split among homework assignments, quizzes, tests, and the final exam. Extra credit is not normally given in this course.

*Student Effort*

1. Self-motivation is essential to success in the course. Because of time constraints, the instructor will not be able to assign and grade every question, exercise, or problem that is suggested for your review. Like the

situation for a math class, it is anticipated that students who do extra problems will learn the material better and achieve higher test and quiz scores compared with students who complete only the required homework.

2. The best way to learn the material covered in the textbooks is to try it for yourself. For example, the Excel text is written so you can follow the examples at your own pace using a computer outside of the classroom meeting times. A few handwritten examples are included so you can better understand what the software is doing. You should be able to do the calculations (e.g., troubleshoot spreadsheet formulas, compute statistics, develop regression parameters, etc.) by hand or with a calculator so you know how the software solves similar problems.
3. Students are expected to learn the key terms and concepts for each topic covered, just as they would learn the key terms and concepts in any other academic subject.

*Instructor Effort*

1. I will attempt to grade and return homework, quizzes, and tests in a timely manner, but items submitted for grading may not be returned at the next class period. It may take a week or so to return larger exams and sometimes other job responsibilities such as research obligations, travel, etc. may cause delays.
2. I will try to answer e-mail and phone calls by the end of the next business day unless travel, field work, or other situations prevent this from happening.

Your learning and success are my goals in this course. If you have questions or if you are having difficulty with a topic, stop by my office or contact me at [Dean.Steele@ndsu.edu](mailto:Dean.Steele@ndsu.edu) or 701-231-7268.

**Metadata**

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File: Syllabus ABEN 255 Fall 2024 v01.docx

Author: Dean Steele

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## Appendix

Table 2. Important dates for fall 2023.

Date	Day	Description
Aug 21	Mon	Classes begin at 4:00 p.m.
Aug 22	Tue	First full day of classes
Aug 28	Mon	Last day to be added to Campus Connection <a href="#">Wait Lists</a>
Aug 30	Wed	Last day to <a href="#">Add</a> classes via <a href="#">Campus Connection</a> * Permit needed after this date.
Aug 30	Wed	Last day for no-record <a href="#">Drop</a> of classes @ 100% refund*(full semester classes only)
Aug 30	Wed	Last day to <a href="#">Withdraw to Zero Credits</a> @ 100% refund*(full semester classes only)
Aug 30	Wed	Attempted credits calculated for financial aid <a href="#">SAP</a> (11:59 p.m.)
Aug 30	Wed	Eligible Pell/TEACH/ND Grants/Scholarships based on enrollment at 11:59 p.m.
Sep 4	Mon	<b>HOLIDAY</b> — Labor Day (no classes, offices closed)
Sep 5	Tue	Financial aid applied to NDSU account balances
Sep 6	Wed	Payments due for NDSU account balances
Sep 8	Fri	Last day to submit ND Resident Student Status Application for Fall 2023
Sep 11	Mon	Last day to submit requests to Audit, <a href="#">Pass/Fail</a>
Sep 18	Mon	Enrollment Census
Sep 29	Fri	Last day to <a href="#">Withdraw to Zero Credits</a> @ 75% refund*(full semester classes only).
Oct (First Week)		Spring/Summer registration schedule available
Oct (Second Week)		Spring/Summer <a href="#">registration appointment times</a> available
Oct 13	Fri	Grades of 'Incomplete' convert to 'F'
Oct 15	Sun	Late fees applied to unpaid account balances (11:59 p.m.)
Oct 16	Mon	Undergraduate/Professional Fall <a href="#">Graduation Applications</a> due
Oct 16	Mon	Graduate student <a href="#">Intent to Graduate</a> survey
Oct 16	Mon	2nd half (8-week session) of Fall semester begins
Oct 26	Thu	Spring/Summer registration begins online based on total credits completed
Oct 29	Sun	Last day to <a href="#">Withdraw to Zero Credits</a> @ 50% refund*(full semester classes only). <b>No refunds issued for withdraw to zero credits after this date.</b>
Nov 9	Thu	Last day to <a href="#">Drop</a> classes with 'W' record
Nov 9	Thu	Last day to <a href="#">Withdraw to Zero Credits</a> for Fall
Nov 10	Fri	<b>HOLIDAY</b> — Veterans Day Observed (no classes, offices closed)
Nov 15	Wed	Late fees applied to unpaid account balances

Date	Day	Description
		(11:59 p.m.)
Nov 15	Wed	Graduate student <a href="#">Oral Defense Deadline</a>
Nov 17	Fri	Fall Commencement Participation deadline
Nov 17	Fri	Graduate student <a href="#">Post-Defense Submission for Format Review</a>
Nov 20	Mon	Registration Appointment times no longer needed for spring
Nov 22-24	Wed-Fri	<b>HOLIDAY</b> — Thanksgiving (no classes; offices closed Thursday, offices open Wednesday & Friday)
Dec 4-8	Mon-Fri	<a href="#">Dead Week</a>
Dec 5	Tue	Grade entry begins
Dec 8	Fri	Last day of Fall classes
Dec 11-15	Mon-Fri	<a href="#">Final Examinations</a>
Dec 15	Fri	Late fees applied to unpaid account balances (11:59 p.m.)
Dec 15	Fri	Graduate student <a href="#">Final Degree Clearance Deadline</a>
Dec 15	Fri	<a href="#">Graduation Application</a> and <a href="#">fee</a> (Certificate and Plan C Students).
Dec 15	Fri	<a href="#">Commencement</a> ceremony (2:00 p.m. and 5:00 p.m. in Sanford Health Athletic Complex)
Dec 19	Tue	Grades due (12:00 p.m.)
Dec 19	Tue	Fall grade access begins online (late evening)
Dec 25	Mon	<b>HOLIDAY</b> — Christmas Day (offices closed)

Available at <https://www.ndsu.edu/onestop/academic-calendar>

## ABEN Program Educational Objectives and Student Outcomes

Table 3. ABEN program educational objectives and supporting student outcomes<sup>(1)</sup>.

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Graduates are expected to have established themselves as practicing engineers who, within a few years of graduation:

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- A Successfully address emerging engineering challenges in the design or evaluation of machine, processing, environmental, and natural resources systems that affect the production of food, feed, fuel, and other biobased products.

Technical learning outcomes include student outcomes (1), (2), and (6):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

- B Effectively use professional communication, critical thinking, and interpersonal skills as team leaders and team members.

Communicational learning outcomes include student outcomes (3) and (5):

3. an ability to communicate effectively with a range of audiences
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

- C Responsibly serve the public and their employers by participating in professional development and by maintaining the highest standard of professional engineering ethics.

Contextual learning outcomes include student outcomes (4) and (7):

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
  7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
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<sup>(1)</sup> See [https://www.ndsu.edu/aben/about/abet\\_accredited/](https://www.ndsu.edu/aben/about/abet_accredited/) for the current ABEN program educational objectives. See <https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2023-2024/> for information on ABET student outcomes 1-7, effective as part of the "Criteria for Accrediting Engineering Programs, 2023-2024.