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:
Quentin Burdick Building, Room 114.

Class Number:
3030.

Instructor:
Dr. Dean D. Steele
701-231-7268
Dean.Steele@ndsu.edu
113 ABEN Building
https://www.ndsu.edu/aben/fs/faculty/dr.-dean-d.-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/registrar/dates/2020/#c570510 or the appendix of this document, 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. 2019. *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.)

Hamad, M. 2013. *AutoCAD 2014 Beginning and Intermediate*. Dulles, Virginia: Mercury Learning and Information LLC. ISBN# 978-1-938549-62-5. http://www.merclearning.com/titles/AutoCAD_2014.html. Accessed 22 Aug 2019. (This text is not required but is recommended as a reference. It consists of introductory-level instruction in the use of Autodesk AutoCAD® software. AutoCAD topics will be discussed starting approximately in mid- October.)

Autodesk. 2019. *Education Community Home.* Available at http://www.autodesk.com/education/home. *Free AutoCAD Software*. Available at http://www.autodesk.com/education/free-software/autocad.
Accessed 22 Aug 2019. (Please note that student editions of AutoCAD software are optional for this course. The NDSU and the ABEN Department computer clusters have copies of AutoCAD software available for your use. If you decide to use a trial version of AutoCAD, make sure its license will be valid through the end of the semester.)

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.

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), 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.

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.

Americans with Disabilities Act for Students with Special Needs
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 Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.

Academic Honesty Statement
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.

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, tablets, 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 obviously be interpreted as a form of academic dishonesty.

Dead Week Policy:
The NDSU Dead Week policy is available at https://www.ndsu.edu/registrar/dates/deadweek/.

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 must be submitted in the format requested, that is, credit will not be given for submissions via e-mail if a paper copy was required and vice-versa (unless due to extenuating circumstances and with prior arrangements whenever possible). The reason for this policy is to minimize the logistical difficulties and time constraints with regard to file handling, printing, etc. When you submit paper copies as requested, it allows the instructor to provide feedback on your content more quickly compared with the time requirements of file management and printing. You understanding and cooperation is appreciated.

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 tests, exams, and quizzes include non-curricular activities such as sports, family and personal vacations, hunting or fishing trips, work schedules, farming operations, routine medical and dental appointments made after the semester begins, etc. Other 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.

Video and audio recordings of lecture segments using the YuJa 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. Transcripts of recordings are expected to contain errors.

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 University 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 or 701-231-7268.

Folder: C:\files\2019\Teaching 2019\ABEN 255 2019
File: Syllabus ABEN 255 Fall 2018 v03.docx
Last update: 08/23/2019

Appendix

Table 2. Important dates for fall 2019.

Date		Day	Description
Aug	26	Mon	Classes begin at 4:00 p.m.
Aug	27	Tue	First full day of classes
Sep	2	Mon	**HOLIDAY** — Labor Day *(no classes, offices closed)*
Sep	3	Tue	Last day for Campus Connection Wait Lists to run
Sep	4	Wed	Last day to Add classes via Campus Connection* Permit needed after this date.
Sep	4	Wed	Last day for no-record **Drop** of classes @ 100% refund* *(full semester classes only)*
Sep	4	Wed	Last day to Withdraw to Zero Credits @ 100% refund* *(full semester classes only)*
Sep	4	Wed	Attempted credits calculated for financial aid SAP (11:59 p.m.)**
Sep	4	Wed	Eligible Pell/TEACH/ND Grants/Scholarships based on enrollment at 11:59 p.m.
Sep	10	Tue	Financial aid applied to NDSU account balances
Sep	11	Wed	Payments due for NDSU account balances*
Sep	16	Mon	Last day to submit requests to Audit, Pass/Fail
Sep	20	Fri	Undergraduate/Professional Fall Degree Applications due
Sep	20	Fri	Graduate student Fall Graduate Degree Applications due
Sep	23	Mon	Last Day to Add Full Semester Classes. Permit & Appeal needed after this date.
Oct	4	Fri	Last day to Withdraw to Zero Credits @ 75% refund* *(full semester classes only).*
Oct	First	Week	Spring registration schedule available
Oct	15	Tue	Late fees applied to unpaid account balances (11:59 p.m.)
Oct	18	Fri	Grades of 'Incomplete' convert to 'F'
Oct	21	Mon	2nd half (8-week session) of Fall semester begins
Nov	3	Sun	Last day to Withdraw to Zero Credits @ 50% refund* *(full semester classes only).* ***No refunds issued for withdraw to zero credits after this date.***
Nov	4-24	Mon	Spring registration begins online based on total credits completed
Nov	11	Mon	**HOLIDAY** — Veterans Day *(no classes, offices closed)*
Nov	15	Fri	Last day to **Drop** classes with 'W' record*
Nov	15	Fri	Last day to Withdraw to Zero Credits for Fall
Nov	15	Fri	Late fees applied to unpaid account balances (11:59 p.m.)
Nov	15	Fri	Graduate student Initial Disquisition submission for December graduation
Nov	25	Mon	Open registration for spring
Nov	27-29	Wed-Fri	**HOLIDAY** — Thanksgiving *(no classes; offices closed Thursday, offices open Wednesday& Friday)*
Dec	2	Mon	Fall Commencement Participation deadline
Dec	9-13	Mon-Fri	Dead Week
Dec	10	Tue	Grade entry begins
Dec	13	Fri	Last day of Fall classes
Dec	15	Sun	Late fees applied to unpaid account balances (11:59 p.m.)
Dec	16-20	Mon-Fri	Final Examinations
Dec	20	Fri	Graduate student Final Disquisition copy due for December graduation
Dec	20	Fri	Commencement ceremony (2:00 p.m. in Sanford Health Athletic Complex)
Dec	24	Tue	Grades due (12:00 p.m.)
Dec	24	Tue	Fall grade access begins online (late evening)
Dec	25	Wed	**HOLIDAY** — Christmas Day Observed *(offices closed)*

https://www.ndsu.edu/registrar/dates/2020/#c570510

ABEN Program Educational Objectives and Student Outcomes

Table 3 below was developed in 2019 and is intended to be used in the 2024 ABEN ABET self-study report, Criterion 3, Student Outcomes, Section B, Relationship of Student Outcomes to Program Educational Objectives. The ABEN Program Educational Objectives are available at https://www.ndsu.edu/aben/about/abet-accredited/program-educational-objectives. Student Outcomes describe the knowledge, skills, and behaviors that ABEN students are expected to have by the time of graduation. See https://www.ndsu.edu/aben/about/abet-accredited/student-outcomes.

Table 3. Program educational objectives and supporting student outcomes.*

	Graduates are expected to have established themselves as practicing engineers who, within a few years of graduation:
A	Successfully address emerging engineering challenges in the design or evaluation of machine systems, processing systems, and natural resources and environmental systems affecting the production of food, feed, 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 (a, e)† 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 (c) 6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (b)
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 (g) 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 (d)
C	Responsibly serve the public and their employers by participating in professional development and by maintaining the highest standard of professional 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 (f, h, j) 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (i)

* See 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-2019-2020/#GC3 for information on ABET student outcomes 1-7, effective as part of the "Criteria for Accrediting Engineering Programs, 2019-2020."

† ABET student outcomes (a) – (k) from the previous review cycle are included for cross-referencing only. Former student outcome (k) is implied in (1), (2), and (6).

Approval and revision history:
8/14/2019. Approved by ABEN program committee.
8/19/2019. Approved by ABEN faculty.