

ABE 227 Computer-Aided Problem-Solving for ABE I

Fall 2026

Course website:	https://canvas.illinois.edu/courses/73534
Meeting time:	Lectures: Monday/Wednesday • 9:00 a.m. – 9:50 a.m. CT (GMT -5) Labs: Thursdays • 8:00 a.m. – 9:50 a.m. • 10:00 a.m. – 11:50 a.m. • 1:00 p.m. – 2:50 p.m.
Meeting locations:	Lecture in AESB 272, Labs in AESB 220, unless specified otherwise.
Credit hours:	3 (undergraduate)
Instructor:	Sunoj Shajahan, PhD (coordinator), sunoj@illinois.edu
Teaching assistant:	Yujin Choi, yujinc5@illinois.edu
Office hours:	Per request via email, open door policy.
Prerequisites:	One of MATH 220, MATH 221, MATH 234

Learning objectives:

Upon completion of the course, students will be able to:

- **Explain** the importance of computing in ABE
- **Understand** the application of engineering and science in ABE
- **Understand** the safety risks associated with agricultural equipment
- **Apply** mathematical concepts to solve problems in ABE
- **Apply** basic programming skills to solve problems in ABE
- **Understand** the ethical responsibility of the ABE profession and implications of engineering solutions
- **Work** and communicate effectively in a team environment
- **Create** computer programs in various languages to solve problems in ABE
- **Solve** ABE problems using problem using engineering and scientific principles

ABET Student Outcomes

The course will address, document, and assess the following Student Outcomes as defined by ABET:

- Outcome 1: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- Outcome 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
- Outcome 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
- Outcome 6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Course Description

Approaches to computer-aided problem solving in ABE. Case studies will consider traditional and new domains in ABE such as off-highway vehicle engineering, natural resources and environmental systems, control of indoor air environments, bioprocessing of food and agricultural products, digital agriculture, urban agriculture, renewable energy and sustainability.

Course Format

One hour twice per week for lecture, two hours for labs, 6 outside of class hours for homework, 2 hours per week estimated for self-study, including watching educational videos.

Learning Resources

- Required Text, Readings, and/or Materials: Course materials will be provided for free.
- Required Software: (if applicable) All required software will be provided for free.

Overview Course Requirements & Assessment

All assignments are submitted through Canvas.

Attendance (10%): Students are required to attend all classes and should not be late coming to class. Attendance will be monitored. Students must contact the instructor as soon as possible if they anticipate missing classes due to events such as chronic illnesses, travel related to team sports, or other university activities. Email the instructor for that specific week and cc the coordinator and the teaching assistant.

Late policy: Arriving more than 5 minutes late to class will be considered unacceptable and may result in being marked absent for the session.

Homework and Quizzes (35%): Six to eight homework or machine problems will be assigned throughout the semester. The homework is to be submitted via Canvas within a week from being assigned. Homework should be done neatly with the problem defined and solution clearly outlined. Final answers should have appropriate units and should be circled or underlined. The more clearly a problem is presented and solved, the more likely you will receive partial credit. Late homework will not be accepted and will get a grade of zero. Executable codes, spreadsheets, data visualizations, and solid models will represent your effort on machine problems, which will be evaluated for precision, accuracy, and efficiency.

Laboratory Reports (55%): Laboratory work can be carried out during field trips or laboratory exercises. An assignment following the report template should be uploaded on Canvas within a week of being assigned. Labs are due within a week after the activity and should be submitted through either a written report, a video that shows the working of apps, or data analysis in either MATLAB or Excel. There will be field trips to the Agricultural Engineering farm, as well as the IBRL facility. Late laboratory reports will be deducted 10 points for each day of being late and will not be accepted after 1 week from the date it was assigned.

Course schedule:

ABE 227 - Computer-Aided Problem-Solving for ABE I (3 credits) - Fall 2026

Week #	Lecture #	Day	Date	Room # (AESB)	Time	Topic	Instructor	Concentration
1	Lec 1	Mon	24-Aug	272	9:00 - 9:50 AM	Course Introduction & Computational Thinking 1	Dr. Sunoj Shajahan	General
1	Lec 2	Wed	26-Aug	272	9:00 - 9:50 AM	Computations in agriculture	Dr. Sunoj Shajahan	General
1		Thu	27-Aug	220	8:00 - 11:50 AM	Lab 1: GDD calculation and visualization	Dr. Sunoj Shajahan	General
2	Lec 3	Mon	31-Aug	272	9:00 - 9:50 AM	Computational Thinking 2 - AI in agriculture	Dr. Sunoj Shajahan	General
2	Lec 4	Wed	2-Sep	272	9:00 - 9:50 AM	Simplified understanding of AI	Dr. Sunoj Shajahan	General
2		Thu	3-Sep	220	8:00 - 11:50 AM	Lab 2: Hands-on with AI in Excel	Dr. Sunoj Shajahan	General
3	—	Mon	7-Sep	—	—	HOLIDAY: Labor Day (No Class)	—	—
3	Lec 5	Wed	9-Sep	272	9:00 - 9:50 AM	Psychrometrics & Moist Air Properties	Dr. Yuanhui Zhang	SEESE
3		Thu	10-Sep	220	8:00 - 11:50 AM	Lab 3: Psychrometric Chart Analysis Lab	Dr. Yuanhui Zhang	SEESE
4	Lec 6	Mon	14-Sep	272	9:00 - 9:50 AM	HVAC Processes & Air Conditioning Systems	Dr. Yuanhui Zhang	SEESE
4	Lec 7	Wed	16-Sep	272	9:00 - 9:50 AM	Heat Transfer I: Conduction & Fundamentals	Dr. Angela Green-Miller	SEESE
4		Thu	17-Sep	220	8:00 - 11:50 AM	Lab 4: Heat Transfer Problem Solving Lab	Dr. Angela Green-Miller	SEESE
5	Lec 8	Mon	21-Sep	272	9:00 - 9:50 AM	Heat Transfer II: Convection & Thermal Applications	Dr. Angela Green-Miller	SEESE
5	Lec 9	Wed	23-Sep	272	9:00 - 9:50 AM	Case Study Thermal Modeling	Dr. Angela Green-Miller	SEESE
5		Thu	24-Sep	220	8:00 - 11:50 AM	Lab 5: Thermal Modeling & Case Study Lab	Dr. Angela Green-Miller	SEESE
6	Lec 10	Mon	28-Sep	272	9:00 - 9:50 AM	Building Energy Use & Thermal Loads	Dr. Yuanhui Zhang	SEESE
6	Lec 11	Wed	30-Sep	272	9:00 - 9:50 AM	Building Energy Audit & Efficiency	Dr. Yuanhui Zhang	SEESE
6		Thu	1-Oct	220	8:00 - 11:50 AM	Lab 6: AESB Building HVAC & Energy Tour	Dr. Yuanhui Zhang	SEESE
7	Lec 12	Mon	5-Oct	272	9:00 - 9:50 AM	Precision agriculture fundamentals	Dr. Sunoj Shajahan	OHVEE
7	Lec 13	Wed	7-Oct	272	9:00 - 9:50 AM	GPS working and calculations	Dr. Sunoj Shajahan	OHVEE
7		Thu	8-Oct	220	8:00 - 11:50 AM	Lab 7: Hands-on GPS and accuracy calculation	Dr. Sunoj Shajahan	OHVEE
8	Lec 14	Mon	12-Oct	272	9:00 - 9:50 AM	Combine harvester working	Dr. Sunoj Shajahan	OHVEE
8	Lec 15	Wed	14-Oct	272	9:00 - 9:50 AM	Yield monitors and data applications	Dr. Sunoj Shajahan	OHVEE
8		Thu	15-Oct	220	8:00 - 11:50 AM	Lab 8: Yield calculation and mapping	Dr. Sunoj Shajahan	OHVEE
9	Lec 16	Mon	19-Oct	272	9:00 - 9:50 AM	Intro to Optimization	Dr. Luis Rodriguez	General
9	Lec 17	Wed	21-Oct	272	9:00 - 9:50 AM	Optimization Principles & Modeling	Dr. Luis Rodriguez	General
9		Thu	22-Oct	220	8:00 - 11:50 AM	Lab 9: Computational Optimization Lab	Dr. Luis Rodriguez	General
10	Lec 18	Mon	26-Oct	272	9:00 - 9:50 AM	Hydrologic Cycle & Watershed Fundamentals	Dr. Rabin Bhattarai	SWRE
10	Lec 19	Wed	28-Oct	272	9:00 - 9:50 AM	Precipitation Analysis & Runoff Processes	Dr. Rabin Bhattarai	SWRE
10		Thu	29-Oct	220	8:00 - 11:50 AM	Lab 10: Precipitation & Runoff Analysis	Dr. Rabin Bhattarai	SWRE
11	Lec 20	Mon	2-Nov	272	9:00 - 9:50 AM	Evaporation & Transpiration Principles	Dr. Rabin Bhattarai	SWRE
11	Lec 21	Wed	4-Nov	272	9:00 - 9:50 AM	Estimating Evapotranspiration (ET)	Dr. Rabin Bhattarai	SWRE
11		Thu	5-Nov	220	8:00 - 11:50 AM	Lab 11: Evapotranspiration Modeling Lab	Dr. Rabin Bhattarai	SWRE
12	Lec 22	Mon	9-Nov	272	9:00 - 9:50 AM	Surface Topography & Elevation Modeling	Dr. Rabin Bhattarai	SWRE
12	Lec 23	Wed	11-Nov	272	9:00 - 9:50 AM	Soil Erosion Mechanics & Watershed Management	Dr. Rabin Bhattarai	SWRE
12		Thu	12-Nov	220	8:00 - 11:50 AM	Lab 12: Topography & Erosion Mapping	Dr. Rabin Bhattarai	SWRE
13	Lec 24	Mon	16-Nov	272	9:00 - 9:50 AM	Worker Health, Ergonomics & Injury Prevention	Dr. Josie Rudolphi	Safety
13	Lec 25	Wed	18-Nov	272	9:00 - 9:50 AM	Mental Health & Agricultural Community Safety	Dr. Josie Rudolphi	Safety
13		Thu	19-Nov	220	8:00 - 11:50 AM	Lab 13: Agricultural Safety Case Studies	Dr. Josie Rudolphi	Safety
14	—	Mon	23-Nov	—	—	HOLIDAY: Thanksgiving Break (No Class)	—	—
14	—	Wed	25-Nov	—	—	HOLIDAY: Thanksgiving Break (No Class)	—	—
14	—	Thu	26-Nov	—	—	HOLIDAY: Thanksgiving Break (No Class)	—	—
15	Lec 26	Mon	30-Nov	272	9:00 - 9:50 AM	Agricultural Hazards & Risk Mitigation	Dr. Salah Issa	Safety
15	Lec 27	Wed	2-Dec	272	9:00 - 9:50 AM	Safety Technology, AI & Machinery Safety	Dr. Salah Issa	Safety
15		Thu	3-Dec	220	8:00 - 11:50 AM	Lab 14: Risk Assessment & Hazard Mitigation	Dr. Salah Issa	Safety
16	Lec 28	Mon	7-Dec	272	9:00 - 9:50 AM	Career Services: Networking & Info Gathering	John Mahlmeister	General
16	Lec 29	Wed	9-Dec	272	9:00 - 9:50 AM	Course Synthesis & Wrap-Up (Last Day of Class)	Dr. Sunoj Shajahan	General

Grading

The final grade will be computed based on the following components:

Attendance	10%
Homework and Quizzes	35%
Lab completion	55%
TOTAL	100%

Grades will not be curved. Letter grades will be assigned as follows:

Grade	A+	A	A-	B+	B	B-	
Range	97-100	93-96.99	90-92.99	86-89.99	83-85.99	80-82.99	
Grade	C+	C	C-	D+	D	D-	F
Range	76-79.99	73-75.99	70-72.99	67-69.99	63-66.99	60-62.99	0-59.99

Additional Resources

Academic Integrity. The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <https://studentcode.illinois.edu/article1/part4/1-401/>.

Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Generative AI usage: Tools such as ChatGPT, Microsoft Copilot, and Gemini, can answer questions and generate text, images, and other media. The appropriate use of generative AI varies from course to course. In ABE 227, generative AI may be useful at times. If you choose to use generative AI as permitted below, you must document and attribute all AI contributions to your coursework and take full responsibility for the contributions including the accuracy of the information and reliability of sources. When using generative AI, keep a journal documenting prompts, AI responses, and your usage. Your instructor may ask you to provide this documentation. If you have a question about the use of Generative AI, please reach out to your instructors. Failure to abide by these guidelines is a violation of academic integrity. We will investigate suspected uses of generative AI that do not follow these guidelines and apply sanctions as outlined in the University of Illinois Student Code.

Mental Health. Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)
- If you are in immediate danger, call 911.

Community of Care. As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regard to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or <http://odos.illinois.edu/community-of-care/referral/>). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

As a Community of Care, we want to support your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources.

Students with Disabilities. To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible and provide the instructor with a Letter of Academic Accommodations from Disability Resources and Educational Services (DRES). To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should apply for services with DRES and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours. DRES provides students with academic accommodations, access, and support services.

To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-1970, e-mail disability@illinois.edu or visit the DRES website at <http://www.disability.illinois.edu/>. Here is the direct link to apply for services at DRES, <https://www.disability.illinois.edu/applying-services>.

Disruptive Behavior. Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution (<https://conflictresolution.illinois.edu>; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Emergency Response Recommendations. Emergency response recommendations and campus building floor plans can be found at the following website: <https://police.illinois.edu/em/run-hide-fight/>. I encourage you to review this website within the first 10 days of class.

Religious Observances. Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance,

and the scheduling of examinations and work requirements. Students should complete the [Request for Accommodation for Religious Observances](#) form should any instructors require an absence letter in order to manage the absence. In order to best facilitate planning and communication between students and faculty, students should make requests for absence letters as early as possible in the semester in which the request applies.

Sexual Misconduct Reporting Obligation. The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality can be found here: wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: wecare.illinois.edu.