

TUSKEGEE UNIVERSITY
College of Engineering
Department of Chemical Engineering
CENG 210 – Material and Energy Balances
Fall 2026

<u>Instructor:</u>	Kyung C. Kwon
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<u>Office Hours:</u>	MW: 10:00 am– 3:00 pm
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<u>Class Room</u>	LHFH 101
<u>Class Schedule:</u>	MWF: 9:00 am -10:00 am Th: 9:00 am – 11:00 am
<u>Catalog Description:</u>	Materials and Energy balances for engineering systems subjected to chemical and physical transformations; Calculations on industrial processes.
<u>Pre-requisite:</u>	CENG 110 (Introduction to Chemical Engineering), MATH 207 (Calculus I), CHEM 231 (General Chemistry)
<u>Co-requisite:</u>	None
<u>Required Textbook:</u>	Richard M. Felder and Ronald W. Rousseau, <u>Elementary Principles of Chemical Processes</u> , 4th edition with Integrated Media and Study Tools, Wiley and Son, New York, 2016.
<u>References:</u>	David M. Himmelblau, <u>Basic Principles and Calculations in Chemical Engineering</u> , 7th edition, Prentice-Hall, Englewood Cliffs, NJ, 2004.

Chemical Engineering Program Educational Objectives:

Within a few years after graduation, our graduates will:

1. Be successful practitioners in chemical and related industries, private practice, government or academia.
2. Be engaged in graduate studies or continuing education endeavors in chemical engineering or related fields.
3. Be engaged in professional development commensurate with a career by participating in structured professional activities.

The following course objectives of this course are chosen to advance our above-mentioned chemical engineering program objectives.

Course Objective:

1. Learn fundamental chemical and physical principles of material and energy balances.
2. Apply fundamental principles of material and energy balances to solutions of realistic problems in chemical processes
3. Apply mathematical principles to solutions of balance problems
4. Learn to use computer software for solutions of material and energy balance problems

Course Outcomes

ABET Student Outcomes	1	2	3	4	5	6	7
Objective 1	X						
Objective 2	X						
Objective 3	X						
Objective 4	X						

ABET Student Outcomes

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.
3. an ability to communicate effectively with a range of audiences.
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.
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.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Student None discrimination statements

Tuskegee University as a recipient of federal funds complies Title IX of the Higher Education Amendments of 1972, 20 U.S.C. § 1681 et seq. ("Title IX") and therefore provides equal opportunity in employment and education that does not discriminate on the basis of sex, sexual orientation, gender identity, pregnancy, parental status, race, color, religion, national origin, or disability status. The Affirmative Action/EEO Coordinator is located in Kresge

Center. The exact location and phone number can be obtained from the University Office of Human Resources.

Tuskegee University, in accordance with, the Americans Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973, shall provide supportive services and reasonable accommodations for students with documented disabilities. Additional information is available in the Office of ADA Compliance which is located in the Thomkins Hall Room 404.

CLASS POLICIES & GRADING:

All students are REQUIRED to use Canvas. All communications will be through Canvas and TU email. Your Tuskegee email must be secured and use it. Syllabus, announcements, and others will be posted in Canvas. You are entirely responsible for failure to receive and read TU emails in a timely manner.

Cell phone and portable computers:

Cell phones (working or not) and portable computers **MUST** be turned off and **PUT AWAY** during quizzes, tests, and final exam; otherwise, it will be considered a form of cheating. Cell phones and portable computers **MUST** also be turned off and **PUT AWAY** during class time.

Class Participation:

Class participation includes attendance, participation in class discussions and activities, and working problems on the board. Students are required to attend all scheduled classes. The instructor will take attendance before starting each class. You are expected to stay in the classroom during one-hour and two-hour sessions.

Home work/Tests/Final exam:

Homework will be assigned in the class or Canvas and completed homework assignments will be submitted to the instructor at the beginning of the class on the due date. Students are responsible to check the Canvas regularly for any assigned homework and announcements.

All Tests/final exam will be taken with available references such as the textbook, class notes, homework assignments, and any other references.

Grading:

Homework	=	20 %
Tests	=	50 %
Final Exam	=	30 %
Total	=	100 %

A = 90-100 B = 80-89 C = 70-79 D = 60-69 F = 0 -59 (%)

Policies:

1. Lectures will be delivered in the class on MWF. Problems will be discussed during the lab (study session) period on Thursday.
2. The course outline, homework assignments, and announcements are posted in the Canvas
3. You should show your all works (solution procedures) in tests, final examination, homework problems to get partial credits on your works, even if your answers are wrong.
4. Our CENG 210 class starts on 9:00 am.
5. Cheating will not be tolerated. Any student caught cheating will get a zero for that exam. A second offense will result in an F for the course.
6. Students are not allowed to talk with each other during lecture, tests, and final exam. If there is an emergency, students need to go outside of the class to talk for maintaining a better learning environment in the classroom.
7. All **electronic devices** (i.e. cell phones, iPad, laptop etc.) must be turned off and put away during class time to avoid disruptions.
8. **Head gear and dark sun shades** are not allowed in class, unless they are of religious significance.
9. The student is expected to attend regularly all classes in attire that meets the College's Dress Code Policy of Business Casual. Students who are not attired appropriately will be asked to leave class and may return with appropriate dress. However, students who do not return will receive an absence. The instructor has the right to establish rules and regulations for the classroom. The classroom is the place for the beginning of professional training.
10. No make-up assignments (tests, homework assignments, final examinations) will be given.
Exceptions:
 - University allowed excuses with WRITTEN PROOF.
 - Medical reasons with WRITTEN PROOF.
 - In the event of a medical emergency, proof must be provided within 24 hours of the student's return to campus or release from doctor's care.
 - In the event of an excused absence, make up assignments must be done by the next class meeting following the date of the excused absence (unless scheduled with the instructor). The student is responsible for his/her own missed assignments. The student will receive a full credit for class participation for an excused absence.
11. No food, drink, candy, and chewing gum in the class
12. Answers to homework problems and tests should be hand-written on 11-inch x 8.5-inch papers.
Answers to homework problems should be well organized, paginated, and have a typed cover page indicating your name, course name, and assigned homework problems. Each student should prepare his/her own reports.
13. Other policies may be announced later if necessary

Important points to remember

1. Read ahead – make sure you have already read the chapter/section before it is being discussed.
2. Discussion – be prepared to answer questions during the lecture and ask questions on the topic that you do not understand
3. Check Canvas frequently to get information about the class.

Course Timetable/Test/Exam Schedule

Sessions	Topics	Reading Assignments, Chapters
1	<u>Chemical Engineers</u>	1
2-4	<u>Introduction to Chemical Engineering</u> Units & Dimensions, Unit Conversions Force & Weight, Dimensional Homogeneity, Dimensionless Quantities, Arithmetic Calculations, Scientific Notations Significant Figures, Precision	2
5	Test 1	
6-8	<u>Processes and Process Variables</u> Mass and Volume, Flow Rate, Chemical Composition, Pressure, Temperature	3
9	Test 2	
10-16	<u>Fundamentals of Material Balances</u> Balances on Multiple-Unit Processes, Recycle and By-pass, Chemical Reaction Stoichiometry, Balances on Reactive Systems, Combustion Reactions.	4
17	Test 3	
18-21	<u>Single-Phase Systems</u> Liquid and Solid Densities, Ideal Gases, Equations of State for Nonideal Gases	5
22	Test 4	
23-26	<u>Multiphase Systems</u> Single Component Phase Equilibrium, The Gibbs Phase Rule, Gas-Liquid Systems with One Condensable Component, Multi-component Gas-Liquid Systems, Solutions of Solids in Liquids, Solubility	6
27	Test 5	

Sessions	Topics	Reading Assignments, Chapters
28-32	<u>Energy and Energy Balances</u> Forms of Energy with The First Law of Thermodynamics, Kinetic and Potential Energy, Energy Balances on Closed Systems and Open Steady-State Systems, Tables of Thermodynamics Data, Energy Balance Procedures, Mechanical Energy Balances	7
33	Test 6	
34-35	<u>Balances on Nonreactive Processes</u> State Properties, Process Paths, Changes in Pressure and Temperature, Phase Change Operations, Mixing and Solutions	8
36	Test 7	
37-40	<u>Balances on Reactive Processes</u> Heat of Reaction, Heat of Formation, Heat of Combustion, Energy Balances on Reactive Processes, Fuels and Combustion	9
41	Test 8	
42	<u>Balances on Transient Processes</u> The General Balance Equation, Material Balances, Energy Balances on Single-Phase Nonreactive Processes	10
43	Test 9	
	Final Examination	

Tuskegee University Policy on Attendance, Absenteeism, and Tardiness

Guidance for Students, Faculty and Staff

. Tuskegee University recognizes that regular class attendance and active participation are essential to academic success, student engagement, and professional development. Faculty members are responsible for establishing, communicating, and consistently enforcing attendance expectations in accordance with Tuskegee University policies, academic regulations, and applicable federal requirements.

Attendance and Absenteeism

Students are expected to attend all scheduled classes, laboratories, clinicals, practica, performances, and other required instructional activities. Attendance policies and related grading implications must be included in every course syllabus at the beginning of each academic term.

Attendance is considered a component of academic performance at Tuskegee University. Attendance expectations and related academic consequences are institutional requirements and are subject to consistent enforcement across all instructional areas.

Attendance policies must be clearly stated in the course syllabus, including grade reductions or penalties associated with excessive absences. Attendance policies must be enforced consistently for all students enrolled in the course. Approved accommodations and protected absences, including those related to disability accommodations under the Americans with Disabilities Act (ADA), Title IX matters, religious observances, military obligations, or University-sponsored activities, must be honored in accordance with University policy. Faculty members are expected to maintain accurate attendance records in compliance with institutional and federal reporting requirements.

Students who accumulate four (4) or more unexcused absences in any enrolled course, including Orientation, will have their final course grade reduced by one letter grade. For laboratory-, clinical-, practicum-, studio-, and field-based courses, the consequences of excessive unexcused absences, including grade reduction, course failure, or administrative withdrawal, will be determined by the respective academic department in accordance with established course requirements and accreditation standards.

Continued unexcused absences beyond the four-absence threshold may result in additional grade reductions, course failure, or administrative withdrawal, as deemed appropriate and consistent with Tuskegee University policies and procedure.

The following standards apply to all courses:

Tardiness

Tardiness is defined as arriving any time after the hour. Students are expected to arrive on time and remain for the duration of all class sessions and instructional activities.

Repeated tardiness or exiting class during instructional periods is considered disruptive to the instructional environment and adversely affects academic engagement, professionalism, and classroom continuity.

Faculty members will document repeated tardiness as part of attendance records. Three (3) incidents of tardiness will be considered equivalent to one unexcused absence, unless otherwise required by specialized program accreditation standards. Repeated tardiness may result in reductions in participation, professionalism, or engagement grades. Students may be denied entry after instruction, examinations, laboratories, performances, clinical activities, or other time-sensitive instructional experiences have begun.

Faculty members are expected to address excessive tardiness through direct communication with students and may refer students to Academic Advising, Counseling Services, Accessibility Services, Student Affairs, or other appropriate support offices when necessary. Tardiness policies must be applied consistently and in accordance with approved accommodation, excused absences, and applicable federal and institutional reporting guidelines.

Financial Aid and Academic Participation

In accordance with federal regulations established by the U.S. Department of Education, students who cease attending classes and fail to demonstrate academic participation may be reported as unofficial withdrawals. Such determinations may require Tuskegee University to adjust or return a portion of the student's Federal Financial Aid under Return to Title IV (R2T4) regulations.

Excessive absences will adversely affect a student's ability to maintain Satisfactory Academic Progress (SAP), which is required to remain eligible for Federal Financial Aid.

Faculty members are expected to maintain accurate attendance documentation and report excessive absences to Department Chairs and appropriate University offices in a timely manner.

Student Responsibilities

Students are expected to attend classes regularly, arrive on time, and participate fully in all required instructional activities. Students are also responsible for reviewing and complying with attendance and tardiness policies stated in each course syllabus.

Examples of Excused Absences

Excuse absences include circumstances that are documented, unavoidable, approved by the University, or protected under institutional or federal policy. All excused absences must be supported by official documentation and should be submitted in advance whenever possible, such as in cases involving scheduled medical appointments, Tuskegee University-sponsored activities, religious observances, military service obligations, or jury duty.

Examples may include:

- **Personal illness or medical emergency**
- **Serious illness or death of an immediate family member**
- **Medical appointments that cannot be scheduled outside of class time**
- **University-sponsored activities or official University business**
- **Religious observances**
- **Military service obligations**
- **Jury duty or court appearances**
- **Approved disability-related accommodation.**
- **Title IX-related circumstances**
- **Extreme weather emergencies or natural disasters experienced by the University Community**
- **Documented transportation accidents or emergencies**
- **Internship, clinical, or academic activities approved by the University.**

Students are expected to be proactive and notify their instructor via email of any excused or unexcused absence, while copying their Academic Advisor and Reach Advisor on the correspondence. Written documentation supporting the absence must be submitted to the appropriate advisor(s) within five (5) business days of the student's return to class. Faculty members will not accept documentation submitted after this deadline.

In cases involving extenuating circumstances that prevent timely submission, students are expected to notify their instructor and advisor(s) as soon as reasonably possible.

Examples of Unexcused Absences

Unexcused absences include absences that are undocumented, avoidable, or unrelated to approved institutional exceptions. Examples may include:

- **Oversleeping**
- **Missing class due to work schedule conflicts**
- **Vacations or personal travel not approved by the University.**
- **Social events or entertainment activities**
- **Membership Intake requirements for Local, State and National Organizations**
- **Leaving class early without permission**
- **Routine errands or appointments that could be scheduled outside class time.**
- **Non-emergency transportation issues without documentation**
- **Failure to provide required documentation for absence.**
- **Repeated tardiness resulting in missed instructional time.**
- **Weddings**

Repeated unexcused absences will result in academic consequences in accordance with Tuskegee University and course attendance policies.

Tuskegee University remains committed to supporting student success while upholding academic integrity, instructional continuity, institutional accountability, and compliance with federal and accreditation standards.

Dress Code Policy for Students

The purpose of this policy is to provide students with general dress coded parameters. It is not intended to be overly prescriptive but is designed to ensure decorum appropriate to a university environment.

Students are expected to maintain a professional appearance that supports a respectful learning environment and reflects the standards of their intended profession. Appropriate attire is required for all classes, laboratories, simulations, presentations, field experiences, cafeteria and other professional activities/settings.

The following expectations apply:

1. Clothing should be clean, neat, and appropriate for an academic and professional setting. Attire that is excessively revealing, excessively tight, transparent, or otherwise inconsistent with a professional environment is not appropriate or any other apparel or appearance that may be distracting in the classroom (as deemed by the administration) is not permitted. Examples include, but are not limited to, clothing that exposes the midriff, chest, undergarments, tops that show cleavage or excessive portions of the chest, back or sides.
2. Hats, bonnets, head scarves, caps, hoods, du-rags, bandanas, sunglasses, and other non-religious or non-medically required head coverings should be removed while in the classroom or cafeteria unless they are required for documented medical, religious, cultural, or University-approved purposes.
3. Clothing displaying profanity, discriminatory language, sexually explicit content, or images or messages promoting violence, illegal drugs, alcohol, tobacco, or other inappropriate material is prohibited.
4. Pants, skirts, dresses, and shorts should be worn in a manner that is appropriate for a professional educational environment. Clothing should fit properly and not expose undergarments or other private areas. Excessively short shorts, swimsuit bottoms, body suits, sleeveless undershirts, and similar casual garments are not appropriate for professional classroom settings. T-shirts worn as dresses and sagging pants are not permitted. Baggy or loose fitting pants must be worn with a belt that fits around the waist.
5. Undergarments must be worn in an appropriate manner and not visible. Clothing with rips, tears, and/or holes that expose underwear or inappropriate parts of the body are not permitted..
6. Footwear must be appropriate for the instructional setting. No bedroom shoes or skates allowed in the classroom or cafeteria setting.
7. Faculty may establish additional dress requirements for courses involving laboratories, clinical experiences, internships, field placements, simulations, or presentations to ensure compliance with professional, accreditation, safety, or agency standards.

Students who do not comply with the course dress expectations will be asked to correct the issue before participating in class activities. Repeated failure to adhere to the dress expectations may

result in being asked to leave the class for that session and may be addressed in accordance with applicable course and University policies.

Questions or disputes about the appropriateness of a particular mode of dress for the time, occasion or place should be referred to the Dean of Students.

Tuskegee University Cell Phone Policy

To maintain a professional and productive learning environment, students are expected to give their full attention during class.

1. Cell phones and other personal electronic devices must be silenced and stored before class begins unless otherwise authorized by the instructor.
2. The use of cell phones during class for texting, social media, gaming, web browsing, or making or receiving calls is prohibited.
3. Electronic devices may be used only for course-related activities when expressly authorized by the instructor.
4. If an emergency requires you to answer a call or message, quietly leave the classroom before using your device and return with minimal disruption.
5. Unauthorized use of electronic devices may result in a verbal warning, being directed to put the device away, or, for repeated violations, being asked to leave the classroom and/or being marked absent in accordance with University policy and the course attendance policy-which may adversely impact your final grade for the class and likewise lead to a disciplinary referral to the Office of the Dean of Students.
6. During quizzes, tests, and examinations, the use of cell phones, smartwatches, meta watches, earbuds, or other electronic devices is strongly prohibited unless approved as a documented accommodation or specifically required for the assessment. All such devices must be in airplane mode/turned off and placed in the student's backpack/purse or another location designated by the instructor before the assessment begins.

Professional courtesy and respect for your classmates and instructor require your full attention during class. Minimizing distractions promotes an environment that supports learning, engagement, and academic success for all students