The University of Texas at TYLER
COLLEGE OF ENGINEERING

Department of Mechanical Engineering
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MENG 4345/5345 – Energy Conversion Systems
Course Syllabus

Semester / Year	Fall 2022
Catalog Description	This course introduces students to the different energy conversion systems as an integrated form of application of different knowledge bases such as: thermodynamics, chemistry, heat transfer and fluid mechanics. Analysis and design of systems for energy conversion and storage will be carried out with emphasis on efficiency, performance and environmental impact. Graduate students are expected to carry out a major project as an assignment within this course.
Prerequisites	**MENG 3316 Heat Transfer**
Section number	030 & 040
Instructor name	Dr. Mohammad A. Rafe Biswas
Contact info	Office: HEC A214 or via Zoom (details posted on Canvas) E-mail: mbiswas@uttyler.edu Phone & Zoom ID: 903 566 6115
Class Type / Location	Houston Engineering Ctr A216 and Ratliff Building North 3041 *via* Zoom (details posted on Canvas)
Class Time	MW 12:30PM - 1:55PM
Office Hours	T 11:00 am to 12:30 pm and MW 2:30 to 3:30 pm or By appointment
Credit Hours	3 (3 hours lecture and 0 hours laboratory per week).
Required Textbook	Demirel, Yaşar. Energy : Production, Conversion, Storage, Conservation, and Coupling, Praxis, 2012. (ProQuest Ebook Central, https://ebookcentral.proquest.com/lib/uttyler/detail.action?docID=883989)
Optional References	Rauf, S. Bobby. (2011). *Finance and Accounting for Energy Engineers.* Fairmont Press, Inc. Retrieved from https://ebookcentral.proquest.com/lib/uttyler/reader.action?docID=3239056&ppg=1 Physics of Energy Conversion by Katharina Krischer, Konrad Schönleber, and Konrad Schönleber, De Gruyter, Inc., 2015. (https://ebookcentral.proquest.com/lib/uttyler/reader.action?docID=1867270) Fuel Cell Fundamentals by Suk-Won Cha, Whitney Colella, Fritz B. Prinz, and Ryan O'Hayre, John Wiley & Sons, Incorporated, 2016. (https://ebookcentral.proquest.com/lib/uttyler/reader.action?docID=4505263&ppg=1) Additional Material on Canvas: Websites, Class Handouts, Tutorials on MATLAB and Simulink by Mathworks, Inc.

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Additional requirements	MATLAB, Simulink & Simscape by MathWorks, Inc. (available through virtual desktop – one.uttyler.edu)
Evaluation Method	Grading (BSME): Assignments, Class Participation and Conduct 30% Quizzes 20% Project (Energy & Cost Analysis of pair of systems) 50% Grading (MSME): Assignments, Class Participation and Conduct 30% Quizzes 20% Project (Energy & Cost Analysis of triplet of systems) 50%
Grading Policy / Scale	Letter grades Scale: A 90 – 100 B 80 – 89 C 70 – 79 D 60 – 69 F < 60
Important events / dates	Census date: Sept 2 Scope Report: Sept 12 Progress Project Report: Oct 26 Final Report (during Finals week): Dec 7
Attendance / Makeup policy	Attendance and participation to lectures are expected per university's Class Attendance policy. Any violation of the Student Behavior (see below) will result in 1% or more grade reduction for each incident. Students may appeal the grade reduction to the instructor if valid excuse or reason can be given. Make-up assignments if approved will be administered during finals week.
Course Learning Objectives / ABET & PEOs relation	**Course Learning Objectives** By the end of this course students will be able to: 1. Demonstrate knowledge of the different energy conversion systems and their typical applications. 2. Analyze, perform and conduct preliminary design of various energy conversion systems. 3. Explain the physics of the environmental issues, including the greenhouse effect and global climate change 4. Conduct energy and cost analysis of various energy conversion systems, as well as compare social acceptability and environmental consequences of such systems 5. Apply engineering design and analysis techniques to emerging energy conversion technologies 6. Only for Graduate Students: Conduct the design of a complete integrated conversion system with simulation and produce a draft of a publishable level report.

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<table>
<tr><td>Topics</td><td>

Energy Types
Internal Energy and Enthalpy
Mass and Energy Balances
Selected Energy Production and Conversion systems

Fossil fuel systems including Engines
Renewable systems including solar energy, wind energy, and biomass energy
Alternative technologies including Fuel cell

Selected discussion on Energy Conservation, Environmental issues and Engineering Economics

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<tr><td>Other</td><td>
Course schedule:
<table>
<tr><th>Week of</th><th>Lecture Topic/Class Activity</th><th>Major Assignments due</th></tr>
<tr><td>Aug 22</td><td>Syllabus/Chapter 1</td><td>MATLAB onramp tutorial certificate credit</td></tr>
<tr><td>29</td><td>Chapter 2 Lecture / Energy Types</td><td>Quiz 1: covers Ch. 1 / Thermodynamics and Heat Transfer</td></tr>
<tr><td>Sep 5</td><td>Chapter 3 Lecture Mechanical and Electrical Energy</td><td>Simulink/Simscape onramp tutorial certificate credit</td></tr>
<tr><td>12</td><td>Chapter 4 Lecture Internal Energy and Enthalpy</td><td>Video Scope Report due on Canvas</td></tr>
<tr><td>19</td><td>Chapter 5 Lecture Mass and Energy Balances</td><td></td></tr>
<tr><td>26</td><td>Chapter 6/7 Lecture Energy Production and Conversion systems</td><td></td></tr>
<tr><td>Oct 3</td><td>Chapter 6/7 Lecture Energy Production and Conversion systems</td><td>Quiz 2</td></tr>
<tr><td>10</td><td>Chapter 6/7 Lecture Energy Production and Conversion systems</td><td></td></tr>
<tr><td>17</td><td>Chapter 6/7 Lecture Energy Production and Conversion systems</td><td></td></tr>
<tr><td>24</td><td>Chapter 7/8 Lecture Energy Storage</td><td>Video Progress Report due on Canvas</td></tr>
<tr><td>31</td><td>Chapter 7/8 Lecture Energy Storage</td><td></td></tr>
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Nov	7	Chapter 9 Lecture Energy Conservation /Engineering Economics	
	14	Chapter 9 Lecture Energy Conservation/Environmental Issues	***Quiz 3***
	21	Thanksgiving Week - No Classes	
	28	Work on Project	
Dec	5	**Finals week (No classes)**	**Final Project Video Report due on Canvas**

Evaluation activities

- Quiz: 3 Canvas announced timed quizzes (no late submissions accepted) will be given according to the topics covered in lectures. Solutions will not be given. Questions involving knowledge covered in class will be answered if the student has attempted the question unsuccessfully. However, students can check their work with the instructor. No late submission for quizzes will be accepted and will result in automatic grade of zero.

- Assignments (including Class Participation and Conduct): Check class and Canvas regularly for any announced assignments including Exams according to the topics covered in lectures. Questions involving knowledge covered in class can be checked if your work is shown to the instructor, but no solutions will be posted on Canvas. Come prepared to class by reviewing relevant material, bringing textbook, taking notes, solving problems and participating in discussions, which are all expected. *Only for Graduate Students: Each student is expected to complete additional assignments relevant to the project for graded submissions. In addition, unlike undergraduate students, it is required to submit progress/literature review video reports that will be assigned from lectures to keep track of progress in the topic and project.*

- Project: Each student within a Canvas group will choose a pair of energy conversion systems to model, analyze and compare in terms of energy and cost analysis. Students may choose to collaborate with classmates to form a group (1-5 students) by informing the instructor no later than 4th week of class. Each student group must propose a project, which must be approved by instructor, and

design/develop/analyze/test a model of a pair of energy conversion systems for a specific application, conduct economic and environmental cost analysis of a system compared to the other energy conversion system, and provide conclusions and recommendations through submission of video reports by the end of the semester. The video report grades count to the final project grade. *Only for Graduate Students: Each student individually conducts the design/simulation and analysis of 3 different energy conversion systems or an integrated conversion system to produce a draft of a publishable level report.*

Note: Instructions on the written and oral report format/style, grading rubric and peer evaluation forms will be given separately on Canvas. Late submissions of assignments including quizzes and project reports (e.g. if due at 11:59:00 pm, then any time after such as 11:59:30 pm is late) will result in 10% deduction per day (or 24 hours) from the graded score. All late assignments must be submitted on Canvas by last class day of the semester (before midnight). After that time, all late assignments will result in automatic grade of zero.

Student Behavior

- Academic dishonesty, in the form of cheating, fabrication, falsification, multiple submissions, plagiarism, and complicity, will not be tolerated. Regulations about academic dishonesty are contained in *A Student Guide to Conduct and Discipline at UT Tyler*, which may be obtained from the Office of Student Affairs.
- The Student Conduct and Lab Safety Form available electronically should be used to follow guidelines and will be used to assess part of Assignment grade.
- **The use of cellular phones during the class and lab is prohibited**.
- **No food or drink is allowed in the classroom or laboratories**.
- Student attitude: Given this is a professional, educational setting you are expected to dress and behave appropriately including wearing full pants and closed-toed shoes. A positive, mature attitude/behavior is expected from the students in all classes (lectures and laboratories). Students disturbing directly or indirectly the class or other students will be asked to leave the classroom or laboratory with the consequences associated to an absence.
- Students are encouraged to utilize any tutoring services available if needed and come prepared to each week's class and lab. Each student is expected to work with the group in a professional manner. It is important to communicate clearly and professionally of any concerns or

	issues to the instructor or lab assistant, who will relay to the instructor if they cannot be resolved independently. ➢ Canvas should be the primary mode of contacting the instructors so check the Canvas announcements and discussion board to check for information about the course. In addition, university provided patriots email should be official communication mode for topics outside the class and you should check your email regularly. If you email us, please allow upto 24 hours to respond on weekdays and 48 hours on weekends. If you call us and we don't answer, then please leave a voicemail with your name and reason for calling so we can call or email back. Otherwise, the phone call will not be responded to. NOTE: The syllabus is subject to change during the course of semester as deemed necessary.

Figure 1 shows the recommended weekly hours to spend on this course. This is to be used as a guideline.

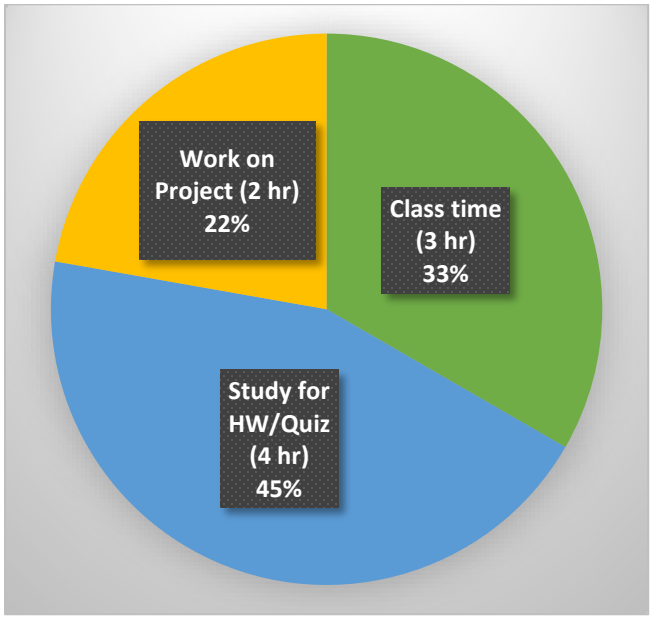

Figure 1. Weekly Invested Hours into the course

Note: ***Your experience in this class is important to me. If you have already established accommodations with Student Accessibility Services, please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course***. If you have not yet established services through SAS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but are not limited to: mental health, attention-related, learning, vision, hearing, physical or health impacts), you are

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welcome to please visit the SAR webpage at http://www.uttyler.edu/disabilityservices or call 903.566.7079. SAR offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s), and SAR. It is important to University of Texas at Tyler to create inclusive and accessible learning environments consistent with federal and state law.

Laptop System Requirements for Undergraduate Programs

Students taking courses from Mechanical Engineering (ME) are expected to have a laptop at their disposal. Certain courses may require that a laptop be brought to class or lab sessions.

Operating System Requirement

Undergraduate students will be required to install specific software packages on their laptops. Some of the software packages used in our program are **only** available on the Microsoft Windows Platform. Due to this need, all students are required to have a laptop with a **Windows** operating system. Required software for courses are **not** fully compatible with macOS devices.

PC Minimum Requirements

To accommodate software used in teaching Mechanical Engineering courses, a minimum level of hardware capacity is expected to be available in students' laptops. Consequently, students are advised that a new laptop may be required if their current system is more than three-years old, or if it fails to meet certain minimum specifications. Table 1 summarizes ME recommended minimum specifications for students purchasing a new computer for the upcoming academic year. If your current computer does not meet these minimum requirements, you may find that your system will need to be upgraded or replaced within three years and/or may not provide acceptable performance for some or all ME courses. ME does not recommend purchasing a new laptop with specifications less than those shown below.

Table 1: Recommended hardware specifications for ME students' laptop

Computer Spec	Minimum	Recommended
OS	Windows 10 64-Bit	Windows 10 64-Bit
Processor	Intel Core i5 (8th gen or higher)	Intel Core i7 (8700 or higher)
Memory (RAM)	16 GB	32 GB
Hard Drive	500 GB with 100 GB free for courseware	500GB Solid State Drive (SSD)
Graphics	Integrated graphics card	Dedicated graphics card for engineering/science applications
Port	Minimum of: 1 USB Port, 1 HDMI port	
Wireless	802.11 ac, Bluetooth 4.1	
Other	Built-in HD webcam with microphone	

Warranty	An extended warranty with accidental damage coverage is highly recommended	An extended warranty with accidental coverage is highly recommended
Backup	USB external hard drive, Microsoft One Drive	USB external hard drive, Microsoft One Drive

Required Software
All computers must have an active antivirus subscription before being connected to the campus network. Systems running Windows 8 and above have the built-in Microsoft Defender installed. In addition, many other software packages are available at steep discounts and further information is available at IT Purchases (https://www.uttyler.edu/it/it-purchases.php).

Package	Availability
Microsoft Office	Free to students (https://www.uttyler.edu/it/office365/365-students.php)
Anti-Virus	Free
MATLAB	Free students' install option – Request link from instructor
NI Labview	Free students' install option – Request link from instructor
Ansys	Free students' install option – Request link from instructor
Autodesk Inventor	Free students' install option – Request link from instructor
Arduino IDE	Free students' install option – Request link from instructor
Solid works	Special price students' option – Request link from instructor

Financial Aid
Students receiving aid and that are loan eligible may contact the Financial Aid Office https://www.uttyler.edu/financialaid/ to check if their aid can be adjusted to include the cost of their laptop.

University, College, and Department Policies:

1. UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

2. Student Standards of Academic Conduct

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, or material which has been submitted within a different course without explicit approval of the instructor, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:

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- copying from another student's test paper;
- using, during a test, materials not authorized by the person giving the test;
- failure to comply with instructions given by the person administering the test;
- possession during a test of materials, or devices and instruments allowing access to materials, which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes" as well as cell phones, to name a few. The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- collaborating with or seeking aid from another student or person during a test or other assignment without explicit authorization;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, or removing material from the exam location, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
- paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;
- taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
- misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by plagiarism software.

v. Penalty for any related infractions will be decided at the discretion of the instructor including, but not limited to, granting of a failing grade in part or the course or in the entire course.

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3. Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

4. Important Covid-19 Information for Classrooms and Laboratories

It is important to take the necessary precautions to ensure a healthy and successful year. UT Tyler continues to urge you to protect yourselves against the flu, COVID and any new threats that may be developing. Be diligent about preventive measures such as washing hands, covering sneezes/coughs, social distancing and vaccinations, which have proven to be successful in slowing the spread of viruses. Encourage those who don't feel well to stay home, and if they show symptoms, ask them to get tested for the flu or COVID. Self-isolation is important to reduce exposure (CDC quarantine/isolation guidelines). Please work with your faculty members to maintain coursework and please consult existing campus resources for support.

5. Recording of Class Sessions

Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.

6. Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

7. UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.
Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless
tobacco, snuff, chewing tobacco, and all other tobacco products.
There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support.
For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

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8. Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms , requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

9. State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

10. Disability/Accessibility Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible

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diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

The University of Texas at Tyler has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Like so many things this Fall, the need for accommodations and the process for arranging them may be altered by the COVID-19 changes we are experiencing and the safety protocols currently in place. Students with disabilities who may need accommodation(s) in order to fully participate in this class are urged to contact the Student Accessibility and Resources Office (SAR) as soon as possible, to explore what arrangements need to be made to ensure access. During the Fall 2020 semester, SAR will be conducting all appointments via ZOOM. If you have a disability, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student Application. For more information, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices or call 903.566.7079.

11. Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

12. Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

13. Social Security and FERPA Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

14. Emergency Exits and Evacuation

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

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15. UT Tyler Resources for Students

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254)