Instructor: Dr. Gökhan Saygili
Office Hours*: 
RBS 1007  WED: 1 PM – 3 PM
(903) 565-5516  TUE: 11 AM – 2 PM
gsaygili@uttyler.edu  * I'll maintain an open door policy

Lectures: 
Monday and Wednesday: 10:10 AM-11:30AM, HPC 3010

Course Website: 
Blackboard will be used to manage the course material for the semester. There you will find homework assignments, solutions, handouts and other material pertaining to the class. Please check there regularly.

Catalog Description: 
Stress and strain; uniaxially loaded members; normal and shear stresses; torsion; flexural behavior; beam deflections; buckling of columns; pressure vessels; combined loading; failure criteria; shear/moment diagrams.

Learning Objectives: 

A. Block I: Fundamentals of Stress and Strain, and Axial Loads
1. Determine internal forces (axial forces, shears, moments, & torques) in a structural member.
2. Analyze/design a centric axially loaded (2 force) member.
3. Plot / interpret normal stress-normal strain (σ vs ε) and shear stress-shear strain (τ vs γ) curves.
4. Given a state of stress at a point, determine the principle stresses (σ₁ & σ₂) and the maximum in-plane shear stress (τ_max), the angle to the principal plane (θ_p), and the state of stress on any plane through the point (σ_x' & σ_y').
5. Given a state of strain at a point, determine the principle strains (ε₁ & ε₂) and the maximum in-plane shear strain (θ_max), the angle to the principal plane (θ_p), and the state of strain on any plane through the point (σ_x' & σ_y').
6. Determine the axial deformations (δ) and/or normal stress (σ) in a centric axially loaded (2 force) member due to applied loads and/or a change in temperature.
7. Analyze a statically indeterminate structure, based on compatibility of axial deformations (δ).
B. **Block II: Torsion and Bending**

8. Determine maximum stresses ($\sigma_{\text{max}} = K \sigma_{\text{avg}}$) at stress concentrations due to geometric anomalies such as holes and fillets.
9. Use a stress-cycle (S - N) diagram to predict the fatigue life of a structure.
10. Determine longitudinal stress ($\sigma_l$) and hoop stress ($\sigma_h$) for a thin walled pressure vessel.
11. Analyze and design circular members in torsion, including calculating shear stresses ($\tau$) and angles of twist ($\Phi$).
12. Analyze a statically indeterminate torsional member, based on compatibility of torsional deformations (i.e., the angle of twist)
14. Determine normal flexure stresses ($\sigma$) for a beam.
15. Determine the maximum elastic internal bending moment (MME) for a beam.
16. For inelastic conditions, determine the partially-plastic internal bending moment (MPP) and the fully-plastic internal bending moment (MFP) for a beam.
17. Determine transverse shear stress ($\tau$) at any point on a beam cross section.
18. Design a prismatic beam.

C. **Block III: Beam Deflections and Buckling**

19. Determine the elastic curve function for beam deflections.
20. Calculate beam deflections.
21. Analyze a statically indeterminate beam, based on compatibility of bending deformations.
22. Calculate stresses in a member subjected to combined loading due to axial, torsional, internal pressure (i.e., thin wall pressure vessels), and/or bending forces.
23. Analyze/design columns.

**Prerequisite:**
ENGR 2301: Engineering Statics

**Required Text:**

**Recommended supplementary material (not required):**
Mastering Engineering: Mechanics of materials online
Course Topics (Subject to Change):

I. Fundamentals of Stress and Strain
   - Internal Forces
   - Normal and Shear Stress
   - Introduction to Design
   - Strain
   - Mechanical Properties of Materials
   - Stress Transformation
   - Strain Transformation

II. Axial Loads and Torsional Loads
   - Fatigue & Stress Concentrations
   - Thin-Walled Pressure Vessels
   - Axial Deformation
   - Elastic Torsion
   - Theories of Failure
   - Statically Indeterminate Torsion Members
   - Inelastic Torsion

III. Bending
   - Shear and Bending Moment Diagrams
   - Elastic Bending
   - Inelastic Bending by Equilibrium
   - Transverse Shear Stress
   - Design of Prismatic Beams
   - Combined Loading

IV. Beam Deflections and Buckling
   - Introduction to Beam Deflections
   - Beam Deflection by Discontinuity Functions
   - Beam Deflection by Superposition
   - Column Buckling I
   - Column Buckling II & Laboratory IV: Column Buckling
   - Course Overview / Course Critique

Exams:
There will be 3 midterm examinations and one final examination. The exams are TENITATIVELY scheduled for:

- Exam 1: February 11th
- Exam 2: February 25th
- Exam 3: April 1st
- Final Exam: Final Exam Week

CENG 3306 – Spring 2015 Course Syllabus
Exams dates may be moved up or pushed back depending on the progress of the lectures. Exams are closed book. You can use a calculator and instructor approved reference material. Solutions to exams will NOT be posted on Blackboard. **THERE ARE NO MAKE-UP EXAMS GIVEN WITHOUT AN EXCUSED ABSENSES.** A note from a medical professional is required for any absence due to illness.

**Homework:**
Homework will be assigned on regular basis. Homework is due on the date assigned at the beginning of lecture. No late homework will be accepted except for unusual circumstances. Solutions will be posted on blackboard. Homework should be submitted on engineering paper (preferred) or plain white printer paper. Solutions should be presented in a clear methodical manner. Follow the “homework submission guidelines” when completing your assignment. Solutions which are not clearly presented will **NOT** receive credit. **Be sure that you use the correct edition/version of the textbook. Problems done from other edition/versions which do not match the assigned problems will not receive credit.**

**Homework Submission Guidelines (Professionalism Requirements):**

1. Homework should be submitted using letter size (8 ½ x 11”) paper. Engineering paper is preferred but plain white paper is allowed if you have no access to engineering paper.

2. The header of the first page should include the following:
   a. Name of Student
   b. Student Number
   c. Course Number and Name
   d. Homework Number

3. There should be no more than 2 problems per page. This is to ensure that there is enough space on the paper for the grader to add comments.

4. Multiple sheets should be stapled at the top left corner of the page.

5. The submitted papers should be free of frail edges, stains, smudges and wrinkles.

6. All problems should include:
   a. Problem Number
   b. A diagram of the problem (draw all free body diagrams when necessary)
   c. A set of given quantities
   d. A set of unknown quantities
   e. A set of assumptions

7. All numbers and writing should be clear and readable.

8. When required to produce a graph, use a computer program such as excel or matlab to generate the plot. Do not draw it by hand!
9. The **final answer should be boxed** and at the bottom of the problem.

<table>
<thead>
<tr>
<th>Grades:</th>
<th>Grade Scale:</th>
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<tbody>
<tr>
<td>Homework = 20%</td>
<td>A: 90-100</td>
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<tr>
<td>Professional Practice = 10%</td>
<td>B: 80-89</td>
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<tr>
<td>Midterm Exams (3) = 45%</td>
<td>C: 70-79</td>
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<tr>
<td>Final Exam = 25%</td>
<td>D: 60-69</td>
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<td>F: &lt;60</td>
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</table>

If necessary, I reserve the right to adjust the grade scale at the end of the semester to your benefit.

If you earn less than 65% on all Exams or if you fail to earn at least 50% on the Final you may fail the course, **regardless of your course grade**.

**NOTE:** There will be no makeup work or extra credit allowed/granted at the end of or during the semester unless allowed/granted to everyone by the instructor. All assignments must be turned in at the appropriate time to receive credit.

**Professional Practice:**
Your professional practice grade will be computed based upon your attendance and the number of assignments you turn in.

**20th Class Day:** February 4th 2015.

**Final day to withdraw:**
The final day to withdraw from the course without penalty is March 23rd 2015

**Census dates:**
The university requires that instructors to report the attendance to the register at various points in the semester. Therefore, on January 26th I will be taking attendance. Please make sure you are there for class on that date or notify ahead if you will not be there.

**Academic Misconduct:** Plagiarism of homework and cheating on examinations will be interpreted as academic misconduct and will not be tolerated. Please refer to the University of Texas at Tyler current Undergraduate Catalog for academic policies and Manual of Policies and Procedures for Student Affairs (MOPPS, Chapter 8) regarding academic integrity, cheating and plagiarism. Academic dishonesty will not be tolerated. Ignorance of the rules and policies provides no protection from the consequences.

**Collection of Student Work:**
Throughout the semester I will collect student work (best, average, and worst) for the ABET course and outcomes notebooks. This will require me to make a copy of your work, keep your original and return a copy of the graded work to you. I will not draw attention as to what level of work you accomplished.
**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.uttTyler.edu/wellness/StudentRightsandResponsibilities.html

**Grade Replacement/Forgiveness:** If you are repeating this course for a grade replacement, you must file intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to do so will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates will receive grade forgiveness (grade replacement) for only three course repeats; graduates, for two course repeats during his/her career at UT Tyler.

**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 12th day of class. Exceptions to the 6-drop rule include, but are not limited to, the following: totally withdrawing from the university; being administratively dropped from a course; dropping a course for a personal emergency; dropping a course for documented change of work schedule; or dropping a course for active duty service with the U.S. armed forces or Texas National Guard. Petitions for exemptions must be submitted to the Registrar's Office and must be accompanied by documentation of the extenuating circumstance. Please contact the Registrar's Office if you have any questions.

**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 offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including non-visible a disability diagnosis such as a chronic disease, learning disorder, head injury or ADHD, or you have a history of modifications or accommodations in a previous educational environment you are encouraged to contact the Student Accessibility and Resources office and schedule an interview with an Accessibility Case Manager. If you are unsure if the above criteria applies to you, but have questions or concerns please contact the SAR office. For more information or to set up an appointment please visit the SAR webpage (http://www.uttTyler.edu/disabilityservices/) or the SAR office located in the University Center, Room 3150 or call 903.566.7079. You may also send an email to saroffice@uttTyler.edu

**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.

**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.

**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.

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

Tentative Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Lesson</th>
<th>Date</th>
<th>Topic</th>
<th>Lesson Material</th>
<th>Assignment</th>
<th>Indicator</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>12-Jan</td>
<td>Overview of course; intro and internal forces</td>
<td>1.1 - 1.3</td>
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<tr>
<td>2</td>
<td>14-Jan</td>
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<td>Internal shear and normal stress, Analysis vs. Design</td>
<td>1.4 - 1.7</td>
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<td>3</td>
<td>21-Jan</td>
<td></td>
<td>Strain, Shear Strain, Mechanical Properties of Materials</td>
<td>2.1 - 2.2, 3.1 - 3.6</td>
<td>HW1 due</td>
<td>1c</td>
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<td>4</td>
<td>26-Jan</td>
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<td>Stress transformations - Equations</td>
<td>9.1, 9.3</td>
<td>HW2 due</td>
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<td>5</td>
<td>28-Jan</td>
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<td>Stress transformations - Mohr Circle</td>
<td>9.4, 9.5</td>
<td>HW3 due</td>
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<td>6</td>
<td>2-Feb</td>
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<td>Strain transformation, Strain to stress transformation - Hook's law</td>
<td>10.1 - 10.2, 10.5 - 10.6</td>
<td>HW4 due</td>
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<td>7</td>
<td>4-Feb</td>
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<td>Thin walled pressure vessels</td>
<td>8.1</td>
<td>HW5 due</td>
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<td>8</td>
<td>9-Feb</td>
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<td>Fatigue, Axial Deformations - Force Method, Stress Concentrations</td>
<td>3.8, 4.1, 4.4, 4.7</td>
<td>HW6 due</td>
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<tr>
<td>9</td>
<td>11-Feb</td>
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<td>Exam 1</td>
<td>HW7 due</td>
<td>1c, 3a, 13a</td>
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<td>10</td>
<td>16-Feb</td>
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<td>Axial temperature effects, Elastic torque</td>
<td>4.6, 5.1 - 5.4</td>
<td>HW8 due</td>
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<td>11</td>
<td>18-Feb</td>
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<td>Elastic Torsion Examples, Theory of Failures</td>
<td>5.1 - 5.4, 10.7</td>
<td>HW9 due</td>
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<td>12</td>
<td>20-Feb</td>
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<td>In-Elastic Torque, Statically Indeterminate Torque</td>
<td>5.9, 5.5</td>
<td>HW10 due</td>
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<td>13</td>
<td>25-Feb</td>
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<td>Exam 2</td>
<td>HW11 due</td>
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<td>14</td>
<td>2-Mar</td>
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<td>Combined loading, Shear Moment Diagrams - 1 (Methods pf sections)</td>
<td>8.2</td>
<td>HW12 due</td>
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<td>15</td>
<td>4-Mar</td>
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<td>Shear and Moment Diagrams - 2 (Integration method)</td>
<td>6.1 - 6.3</td>
<td>HW13 due</td>
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<td>16</td>
<td>16-Mar</td>
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<td>Elastic bending stress</td>
<td>6.4</td>
<td>HW14 due</td>
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<td>18-Mar</td>
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<td>In-Elastic bending</td>
<td>6.10</td>
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<td>18</td>
<td>23-Mar</td>
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<td>Transverse shear stress</td>
<td>7.1, 7.2</td>
<td>HW16 due</td>
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<td>19</td>
<td>25-Mar</td>
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<td>Design prismatic members</td>
<td>11.1, 11.2</td>
<td>HW17 due</td>
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<td>20</td>
<td>30-Mar</td>
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<td>Beam deflection</td>
<td>12.1 - 12.2</td>
<td>HW18 due</td>
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<td>21</td>
<td>1-Apr</td>
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<td>Exam 3</td>
<td>HW19 due</td>
<td>9a, 9b: Exam 1</td>
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<td>22</td>
<td>6-Apr</td>
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<td>Beam deflection</td>
<td>12.2</td>
<td>HW20 due</td>
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<tr>
<td>23</td>
<td>8-Apr</td>
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<td>HW21 due</td>
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<td>24</td>
<td>13-Apr</td>
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<td>Superposition</td>
<td>12.5</td>
<td>HW22 due</td>
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<td>25</td>
<td>15-Apr</td>
<td></td>
<td>Buckling</td>
<td>13.2 - 13.3</td>
<td>HW23 due</td>
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<td>26</td>
<td>20-Apr</td>
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<td>HW24 due</td>
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<td>27</td>
<td>22-Apr</td>
<td></td>
<td>Final Exam Review</td>
<td>Final Exam 1a</td>
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Prepared by: Gökhan Saygili, Ph.D., PE.
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Department of Civil Engineering