Instructor Information

Instructor(s):
Ashfaq Adnan

Office Number:
315B Woolf Hall

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817-272-5010 (fax)

Email Address:
aadnan@uta.edu

Faculty Profile:
https://mentis.uta.edu/explore/profile/ashfaq-adnan

Office Hours: Tu-Th 2-3.30 pm or by appointment

Course Information

Section Information: ME/AE 5304-001/002/003
Time and Place of Class Meetings: GACB 103
Tu-Th 9.30 am – 10.50 am

Description of Course Content: This graduate level course will cover the calculation of stresses and strains in a body that experiences elastic, plastic and/or viscoelastic deformation. This course will also highlight hyperelasticity to show large deformation behavior of materials and piezoelectricity to demonstrate the voltage-displacement relations of piezoelectric materials.

Prerequisite: MAE 2312 (Solid Mechanics) or equivalent.
Textbooks: None. All necessary materials will be supplied by the instructor.

Suggested Reading:
2) Theory of Viscoelasticity (2nd Edition) by Richard M. Christenson
3) Theory of Plasticity (3rd Edition) by J. Chakrabarty
4) Classical and Computational Solid Mechanics by Y. C. Fung and Pin Tong
5) Special Topics in the Theory of Piezoelectricity by Jiashi Yang (Editor)
6) Nano Mechanics and Materials: Theory, Multiscale Methods and Applications by Wing Kam Liu, Eduard G. Karpov and Harold S. Park

Student Learning Outcomes:
After the completion of this course, students should be able to:
• describe the elastic, plastic and viscoelastic behavior of materials from their stress-strain curves;
• understand the physical interpretation of material constants in mathematical formulation of constitutive relations;
• solve analytically the simple boundary value/initial value problems with elastic, elasto-plastic, viscoelastic, thermoelastic or thermoviscoelastic properties;
• recognize the roles of surface elasticity and surface stress on the elastic deformation of nanomaterials.
• understand the constitutive relation between a mechanical stress and an electrical voltage in piezoelectric solids.

Course Content: The topics listed below will be covered during this course.
1. Stress and Strain
2. Constitutive Relations
   a. Elasticity
   b. Hyper-elasticity
   c. Viscoelasticity
   d. Plasticity
3. Benchmark Problems (Boundary value/Initial Value)
   a. Elasticity
   b. Viscoelasticity
   c. Plasticity
4. Special Topic:
   a. Piezoelectricity

Descriptions of major assignments and examinations:
• There will be homework assignments, project, one midterm exam and one final exam.
• Details about the project will be discussed in class.

• Homework: Assigned during the Tuesday classes and due dates are defined in the assignment.
• Midterm: Tentative schedule - October 29, 2019
• Final Project Due: December 3, 2019

• Homework turned in late (after 5.00 pm of the due date) will receive a 20% penalty per class until solution is posted. No late home work will be accepted after the solution is posted. UTA regulations permitting, missed midterms and/or final exams can only be rescheduled when missed due to major health problems or circumstances beyond the student’s control. With instructions discretion, students will be required to reschedule the missed exams at the earliest time possible.

Final Exam: The final exam schedule can be found here: https://www.uta.edu/records/_downloads/Fall_2019_Final_Exam_Dates_04022019.pdf

As of Aug 20, 2019, the final exam for this class is scheduled as follows:

Tuesday, Dec 10, 8.00 – 10:30 a.m. Please check the above link to confirm.

Grading Information

• Grading Policy: Final numerical grade for each student will be determined based on his/her total earned points on a scale from 0 to 100. The total earned points for each student will be computed by adding points obtained by the student from midterm exam, homework assignments and final exam.

• Point Distributions:
The final letter grade for each student will be determined from his/her final numerical grade according to the following ranges:

<table>
<thead>
<tr>
<th>Tentative Grading Scale</th>
<th>Letter Grade</th>
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<tbody>
<tr>
<td>90 – 100</td>
<td>A</td>
</tr>
<tr>
<td>80 – 89</td>
<td>B</td>
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<tr>
<td>70 – 79</td>
<td>C</td>
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<tr>
<td>60 – 69</td>
<td>D</td>
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<tr>
<td>00 – 59</td>
<td>F</td>
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</tbody>
</table>

**Course Schedule**

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Mechanics</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Statics and Solid Mechanics</td>
<td>Review of Mechanics of Material - I</td>
</tr>
<tr>
<td>2</td>
<td>Statics and Solid Mechanics</td>
<td>Review of Mechanics of Material - II</td>
</tr>
<tr>
<td>3</td>
<td>Elasticity</td>
<td>Foundation of Elasticity</td>
</tr>
<tr>
<td>4</td>
<td>Elasticity</td>
<td>2D problems in Rectangular Coordinates – I</td>
</tr>
<tr>
<td>5</td>
<td>Elasticity</td>
<td>2D problems in Rectangular Coordinates - II</td>
</tr>
<tr>
<td>6</td>
<td>Elasticity</td>
<td>2D problems in Polar Coordinates – I</td>
</tr>
<tr>
<td>7</td>
<td>Elasticity</td>
<td>2D problems in Polar Coordinates – II</td>
</tr>
<tr>
<td>8</td>
<td>Hyper-Elasticity and Thermo-Elasticity</td>
<td>Hyperplastic Materials</td>
</tr>
<tr>
<td>9</td>
<td>Hyper-Elasticity and Thermo-Elasticity</td>
<td>Thermal Stress Analysis</td>
</tr>
<tr>
<td>10</td>
<td>Reserve</td>
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<tr>
<td>11</td>
<td>Viscoelasticity</td>
<td>Foundation of Viscoelasticity</td>
</tr>
<tr>
<td>12</td>
<td>Viscoelasticity</td>
<td>Differential Constitutive Equations</td>
</tr>
<tr>
<td>13</td>
<td>Viscoelasticity</td>
<td>Hereditary Integral Representations of Stress and Strain</td>
</tr>
<tr>
<td>14</td>
<td>Viscoelasticity</td>
<td>Elementary Viscoelastic Stress Analysis for Bars and Beams</td>
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<tr>
<td>15</td>
<td>Viscoelasticity</td>
<td>Viscoelastic Stress Analysis in Two and Three Dimensions -I</td>
</tr>
<tr>
<td>16</td>
<td>Viscoelasticity</td>
<td>Viscoelastic Stress Analysis in Two and Three Dimensions -II</td>
</tr>
<tr>
<td>17</td>
<td>Midterm Exam (tentative)</td>
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<tr>
<td>18</td>
<td>Plasticity</td>
<td>Foundation of Plasticity</td>
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<tr>
<td>19</td>
<td>Plasticity</td>
<td>Elastoplastic Bending/Torsion</td>
</tr>
<tr>
<td>20</td>
<td>Plasticity</td>
<td>Elastoplastic Boundary Value Problems - I</td>
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<tr>
<td>21</td>
<td>Plasticity</td>
<td>Elastoplastic Boundary Value Problems - II</td>
</tr>
<tr>
<td>22</td>
<td>Plasticity</td>
<td>Plane Problems in Plastic Flow and Collapse -I</td>
</tr>
<tr>
<td>23</td>
<td>Plasticity</td>
<td>Plane Problems in Plastic Flow and Collapse -II</td>
</tr>
<tr>
<td>24</td>
<td>Reserve</td>
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</tr>
<tr>
<td>25</td>
<td>Piezoelectricity</td>
<td>Theory and Mathematical Foundation</td>
</tr>
<tr>
<td>26</td>
<td>Piezoelectricity</td>
<td>2D Piezoelectric Boundary Value Problem - I</td>
</tr>
<tr>
<td>27</td>
<td>Piezoelectricity</td>
<td>2D Piezoelectric Boundary Value Problem -II</td>
</tr>
<tr>
<td>28</td>
<td>Nanoelasticity &amp; Nanomechanics</td>
<td>Foundation of Surface Stress and Surface Elasticity</td>
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<tr>
<td>29</td>
<td>Nanoelasticity &amp; Nanomechanics</td>
<td>Size Effect and Mechanics of Nanostructures</td>
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<tr>
<td>30</td>
<td>Reserve</td>
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</tbody>
</table>

As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. – Ashfaq Adnan
Institution Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page (http://www.uta.edu/provost/administrative-forms/course-syllabus/syllabus-institutional-policies.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Additional Information

Attendance:
At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students’ academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients “begin attendance in a course.” UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report must the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

Final Review Week:
A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabi. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week.

For Fall Semester 2019: We designate November 27 to December 4 as review week. This gives students a full week before finals for review. While the 28th is Thanksgiving, November 27 and 29 are review days as are December 2, 3 and 4.

Emergency Exit Procedures:
Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Success Programs:
UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring by appointment, drop-in tutoring, etutoring, supplemental instruction, mentoring (time management, study skills, etc.), success coaching, TRIO Student Support Services, and
student success workshops. For additional information, please email resources@uta.edu, or view the Maverick Resources website.

Emergency Phone Numbers

In case of an on-campus emergency, call the UT Arlington Police Department at 817-272-3003 (non-campus phone), 2-3003 (campus phone). You may also dial 911. Non-emergency number 817-272-3381

Library Information

Research or General Library Help
Ask for Help
• Academic Plaza Consultation Services (library.uta.edu/academic-plaza)
• Ask Us (ask.uta.edu/)
• Research Coaches (http://libguides.uta.edu/researchcoach)

Resources
• Library Tutorials (library.uta.edu/how-to)
• Subject and Course Research Guides (libguides.uta.edu)
• Librarians by Subject (library.uta.edu/subject-librarians)
• A to Z List of Library Databases (libguides.uta.edu/az.php)
• Course Reserves (https://uta.summon.serialssolutions.com/#!/course_reserves)
• Study Room Reservations (openroom.uta.edu/)