**MEET 4130/MEEN 4130 – Failure of Deformable Bodies**

**Fall 2025**

**Instructor**

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**Catalog Course Description:**

Continuum mechanics approach to failure mechanisms in deformable solid bodies with their system design applications and use of engineering plasticity fundamentals to describe the permanent deformation in solids. The indentation hardness tests are related to plasticity. The fracture, fatigue, and creep modes-of-failure analysis seeks to explain the mechanism, the use in mechanical systems design, service reliability, and their interrelation. **Prerequisite:** ENGR 2332, ENGR 3450.

**Topics Covered:**

* Deformation Behavior
  + Overview of historic engineering failures
  + Review of materials structure
  + Microstructural Effects
  + Elastic Behavior
  + Yield Criteria and Plastic Deformation
  + Failure modes and propensity for fracture in different materials
* Fracture Mechanics
  + Historical Development: Ductile and Brittle Fractures
  + Griffith Fracture theory
  + Experimental methods
  + Fracture mechanisms and models
  + Microstructure effects
  + Environmentally assisted and time-dependent crack growth
* Fatigue and Creep
  + Historical prospective
  + Fatigue characterization
  + Experimental Methods
  + Fatigue mechanisms and models
  + Micro mechanisms of fatigue failure
  + Creep mechanisms and models
* Design consideration, and failure analysis
  + Damage tolerances in materials
  + Design consideration
  + Methodologies for failure analysis

**Learning Evaluation Method**

This course will be taught using an active and cooperative environment. The course grades will be comprised of 4 team projects and 4 quizzes. Each project will utilize teams and will require both an oral presentation to the class and a technical write-up. Each team member will provide a self-assessment and team assessment. Each project will utilize a different combination of students in the teams.

1. *Deformation Behavior (25%):* *Quiz 20 points Project 80 points, Total* 100 points
2. *Fracture Mechanic (25%)):* Quiz 20 points Project 80 points, Total 100 points
3. *Fatigue and creep (25%):* Quiz 20 points Project 80 points, Total 100 points
4. *Design considerations and failure analysis (25%):*  Project 100 points, Total 100 points

* Extra Credit
  + Up to 5 Extra Credit Points will be assigned based upon the level of class participation, class attendance, office hours, etc.
  + 10 points will be awarded if 100% of the class completes the Course Evaluation; 5

points will be awarded if >85% complete the Course Evaluations.

* + Up to 25 points are available for extra quiz/exam questions.
* Quizzes will be completed via CANVAS and instruction for submission of projects will be provided.
* Any issues with grading should be addressed within 2 weeks of the return of the assignment and the grade assignment.

**Assessment Breakdown**

Quizzes (4 quizzes, 20 points each): 20%

Projects (4 projects, 100 points each): 80%

**TOTAL**  100%

**Grading Scale**

A: 90 % - 100%; B: 75% - 89 %; C: 60% - 74%; D: 50% - 59%; F: Below 55%

These grade cut-offs can move down at the instructor's discretion.

**Course Reading Materials**

A set of course notes for the topics in PPT format will be incrementally provided via the UNT-Canvas website. These notes will provide sufficient basis for basic knowledge and guidance to read relevant topics in the recommended textbook and references.

* **Recommended Textbook:**

1. *Deformation and Fracture Mechanics of Engineering Materials*, by R.W. Hertzberg, R.P. Vinci, J.L. Hertzberg, 6th Edition, 2020.

* **Recommended Reference Books:**

1. *Mechanical Behavior of Materials,* Third Edition, M. A. Meyers and K. K. Chawla,Cambridge University Press, 2025.
2. *Deformable Bodies and Their Material Behavior*, Henry W. Haslach Jr., Ronald W. Armstrong, Wiley, 2003.
3. *Fatigue of Materials,* S. Suresh, 2nd edition, Cambridge, 1998.
4. *Applied Creep Mechanics,* T. Hyde, W. Sun and C. Hyde, McGraw Hill, 2013.
5. *Corrosion Engineering, Principles and Practices,* P.R. Roberge, McGraw Hill, 2008.
6. *Metals Handbook*, 9th ed., vol. 8 (American Society for Metals)
7. *Metals Handbook*, 9th ed., vol. 12 (American Society for Metals)
8. *ASTM Standards*

* ***Introductory Background Reference Books***

1. *Introduction to Mechanics of Materials,* Beer and Johnson, 8th edition, McGraw Hill, 2020.
2. *Introduction to Materials Science and Engineering,* Hashemi and Smith, 7th edition, McGraw Hill, 2023.

**Course Policies**

**Late Assignments:**

There is a zero tolerance for late submission of assignments; LATE ASSIGNMENTS WILL

RECEIVE A ZERO. Individual cases will be subjectively evaluated, if mitigating circumstances

are communicated to the instructor PRIOR to the deadline.

**Class Attendance**

1. Visit the University of North Texas’ Attendance Policy [Student Attendance and Authorized Absences | University Policy Office](https://policy.unt.edu/policy/06-039) to learn more.
2. Attendance is required, however, there will not be a penalty for not class attendance.
3. Class attendance will be recorded by **iClicker**. You must download **iClicker** app (<https://join.iclicker.com/DUHR>) for students on your mobile phone (iPhone and Android) or Tablet and register in this course.

**Examination Policy**

1. Grades for the course will be assigned as shown on the Evaluation Values. There will NOT be curving of the exam scores or total scores for assigning a grade.
2. No make-up will be given for the scheduled quizzes or exams, unless the student has a legitimate excuse documented properly (e.g., letter from court clerk that he/she must appear in a court, letter from physician that he/she is sick).
3. Requests for a review of a graded exam problem must be submitted during the following class hour after which the grade is posted. In this matter, the review is not limited to a single problem requested by the student. Upon review, the exam score may increase, remain the same, or decrease.
4. Refer to the course modules of this syllabus for a general description and schedule of the subject matters that will be discussed.
5. This syllabus is subject to change during the semester, with changes announced during the class hours and posted in the Canvas.

**ADA Policy**

UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one’s specific course needs. Students may request accommodation at any time; however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each faculty member prior to implementation in each class. For more information see the [ODA website](https://disability.unt.edu/) (<https://disability.unt.edu/>).

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