

Advanced Micro-machining Processes and Application

**Course number: EENG 5940 Section(s) 006
and EENG 4010 Section(s) 006**

Semester: Spring 2026

**M W, 2:30 am – 3:50 pm
Classroom: K 150**

Instructor: Jungkwun 'JK' Kim, Ph.D.

Course Description

Advanced Micro-machining Processes and Application

- **Focus Areas:**
 - Nano/microfabrication techniques and applications in power generation, RF technology, and biomedical fields.
- **Key Processes Covered:**
 - Advanced lithography
 - Precision metallization
 - Selective etching
 - Intricate molding techniques
- **Topics Explored**
 - Design and fabrication of microfluidic channels for biological applications
 - Development of RF antennas for enhanced communication
 - Fabrication of MEMS inductors for electronic devices
- **Who Should Enroll**
 - Students in engineering, materials science, or related fields
 - Those interested in cutting-edge micro-machining processes and modern technological

Student learning/ outcome

- Students will gain a broad perspective in the area of nano/micro devices and their principles.
 - Be able to understand characteristics in nano/microscale devices
 - Will learn miniaturization issues and solutions
 - Be able to define and explain power microcomponents, including inductors and converters.
 - Be able to define and explain RF/Microwave concepts, e.g. antenna.
 - Be able to understand the microfluidic fundamentals through the microfluidic devices.
- Demonstrate creative solutions in the nano/micro device/systems.

Course flow

- Overview: **Advanced Micro-machining Processes and Application**
- **Research and Lab Safety**
- **Microfabrication**
 - Lithography
 - Metallization
 - Etching
- **Applications**
 - Inductor
 - Antenna
 - Microfluidic device
- **Recent literature review:** presentation, discussion, and debate

Literature-Books

- Reference Book

- M.J. Madou, Fundamentals of Microfabrication, CRC, 2002
- S.D. Senturia, Microsystem Design, Kluwer, 2001/2004
- G.T.A. Kovacs, Micromachined Transd. Sourcebook, McGraw-Hill, 1998
- M. Gad-El-Hak (Editor), The MEMS Handbook, CRC, 2005
- N. Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 2004
- A. Nathan, H. Baltes, Microtransducer CAD, Springer, 1999
- V. Kaajakari, Practical MEMS, Small Gear Publishing, 2009
- C. Liu, Foundations of MEMS, Prentice Hall, 2005
- J. Korvink, O. Paul, MEMS – A Practical Guide, William Andrew, 2005
- J.A. Pelesko, D.H. Bernstein, Modeling MEMS and NEMS, CRC, 2002
- T.-R. Hsu, MEMS & Microsystems, McGraw-Hill, 2002

Literature

Conferences, Journals & WWW

- Journals
 - IEEE Journal of Microelectromechanical Systems
 - Sensors and Actuators
 - Journal of Micromechanics and Microengineering
 - Lab on a Chip
 - IEEE Sensors Journal

- Conferences
 - Transducers
 - IEEE MEMS Conference
 - Hilton Head Conference
 - IEEE Sensors Conference
 - MicroTas

- WWW-Pages
 - <http://www.memsnet.org/>
 - Georgia Tech: <http://cmmt.gatech.edu/>

Grading

Attendance	30%	Bonus*
Midterm Exam	15%	
Quiz	15%	3 or 4 times
Assignment	10%	3 or 4 times
Presentation	15%	
Final Exam	15%	Comprehensive

Grading scale: 100-90=A, 89-80=B, 79-70=C, 69-55=D, 54 and below F

Please note that there won't be score curling or adjustment.

*Bonus:

- **Additional Credit for Engagement:** Earn extra credit by participating in extracurricular academic activities, such as involvement in departmental club events or contributing to the open house event.
- **Course Evaluation Completion:** Additional credit is available for students who complete the course evaluation form, providing valuable feedback for future improvements.

Completed the course evaluation

Exam/Quiz

- The exam will be closed book or note.
- A calculator may be needed.
- THERE IS NO MAKE-UP EXAM/Quiz.
 - Make-up exams may be given only in unforeseen, extreme emergency situations including cases of severe illness (e.g. hospitalization) and undue hardship that is verified by an outside authority (e.g. death in the immediate family). Should one such conflict occur, requests for any make-up exams must be made to the instructor prior to the examination hour or as soon as humanly possible. Official written documentation of your hardship (e.g. from hospital, police) is required for any consideration of a make-up exam at the discretion of the instructor. Original copies of documentation materials are required.
- Inadequate behavior or attitude: Student will be suspended immediately (without warning)

Presentation

- Topic: microfabrication and its applications
- Group presentation
- Grade:
 - Presentation slide will be considered as homework
 - 15 % Presentation

Quiz

- 2 – 3 quizzes are expected
- No pop-up quiz
- All quizzes will be started at the beginning of the class
 - Zero credit will be given for missed quizzes unless there are proper reasons

Class rules and etiquette

Class attendance: You are required to attend all lectures! Announcements concerning assignments, exams, and schedules will be made during class.

1. No eating or drinking in the classroom (I know it's lunchtime, but please do not bring food or drink into the class).
2. Homework will be assigned – there will be approximately 3-4 homework assignments during the semester. All homework must be handed in on time; late homework will not be accepted unless arrangements have been made in advance.
3. There are no make-up exams for this course. If you have a problem or conflict and cannot attend an exam, let me know about it in advance and we will try to work something out.

Zero credit will be given for a missed exam that we haven't made arrangements about beforehand unless you have a satisfactory medical excuse excusing you from exams on grounds of illness.

Office hour

- **Office Hours: 1:30-2:30 PM M, W**
- I will be in or near my office on Tuesdays and Thursdays. Please stop by if you are having problems understanding the material, doing the homework, etc., or if there is anything else (jobs, graduate school, etc.) you would like to discuss. You are free to come by at other times; however, be warned that I may or may not be in my office, and I may or may not have time to talk (I'm usually not unfriendly, just busy).

Academic Honesty

- The University of North Texas has an Honor and Integrity System based on personal integrity, which is presumed to be sufficient assurance that, in academic matters, one's work is performed honestly and without unauthorized assistance.
- Undergraduate and graduate students, by registration, acknowledge the jurisdiction of the Honor and Integrity System. The policies and procedures of the Honor and Integrity System apply to all full and part-time students enrolled in undergraduate and graduate courses on-campus, off-campus, and via distance learning.

Students with Disabilities

- Students with disabilities who need classroom accommodations, access to technology, or information about emergency building/campus evacuation processes should contact UNT - Office of Disability Access <ODA@post.accessiblelearning.com>.
- Services are available to students with a wide range of disabilities including, but not limited to, physical disabilities, medical conditions, learning disabilities, attention deficit disorder, depression, and anxiety. Please contact the UNT - Office of Disability Access <ODA@post.accessiblelearning.com>.

Campus Safety

University of North Texas is committed to providing a safe teaching and learning environment for students and faculty members. In order to enhance your safety in the unlikely case of a campus emergency make sure that you know where and how to exit your classroom quickly and how to follow any emergency directives.

- Police/fire/medical emergency: Call 911.
- Non-emergency: Call the UNT Police Department at Discovery Park: 940-565-3000

Pull the fire alarm and follow evacuation procedures.

- If you hear a fire alarm, follow evacuation procedures. Leave the building.
- Do not use elevators.
- Assist individuals with disabilities to a safe location and notify emergency personnel. Most buildings have an identified area of rescue near the top landing of staircases.
- Once outside, keep clear of entrances, move at least 100 feet away from the building, and stay clear of emergency vehicles. A campus authority will notify you when it is safe to return.

Tornado and severe weather

- Go to the building's designated tornado shelter. In most cases this is the lowest floor in the central core of the building and away from glass windows.

Other possible threats: Call 911.

- Remain calm.
- Give the dispatcher as much information as possible.

Serious student situations

Campus procedures

- **Threatening or disruptive student situations**

Call the UNT Police Department at Discovery Park: 940-565-3000

Discrimination, Harassment, Sexual Violence and Stalking

Unwanted contact or stalking

Missing students

Presentation 1

Homework Assignment: Exploring Innovations in Micro-machining at CES 2026

Objective: To understand the latest advancements and applications in micro-machining technology as presented at CES 2026, and to assess their potential impact on various industries.

Assignment: Each group is required to select an innovative micro-machining product or technology showcased at CES 2026. Your task is to prepare a detailed presentation covering the following aspects:

1. **Technology Overview:**
 - Description of the selected technology or product.
 - Micro-machining processes involved.
2. **Innovation and Advancements:**
 - What makes this technology innovative?
 - Novel micro-machining techniques or applications.
3. **Industry Applications:**
 - Potential industries that could benefit.
 - Impact on these industries.
4. **Challenges and Limitations:**
 - Challenges or limitations of the technology.
 - Possible solutions or future improvements.
5. **Personal Insight:**
 - Your perspective on the technology.
 - Speculation on future development and implications.

Presentation Guidelines:

- Length: 7 minutes.
- Number of Slides: Maximum of 7 PowerPoint slides.
- Visual Aids: Include slides that effectively illustrate key points.
- References: Cite all sources of information and images used.

Submission:

- Date of Presentation: Jan 21, Canvas submission (before class start)
- Format: In-class presentation.

Evaluation Criteria:

- Clarity and depth of technology overview.
- Insightfulness of analysis on innovation and industry applications.
- Quality of presentation (organization, visual aids, speaking).
- Originality and thoughtfulness of personal insights.

Example Topic: 3D Printing Technology for Micro-Machining

This innovative technology presented at CES 2026 represents a breakthrough in the field of micro-machining. Utilizing a novel nano-precision 3D printing process, this technique allows for the creation of highly detailed and complex micro-scale devices with unprecedented accuracy. The application of this technology ranges from creating intricate parts for micro-electromechanical systems (MEMS) to developing new microfluidic devices for biomedical engineering. Its impact on the industry is expected to revolutionize the production of micro-scale components, significantly reducing the time and cost of fabrication while enhancing the capabilities and performance of micro-devices.