MTSE 3040- Transport Phenomena in Materials
 (Required) Fall Semester

Catalogue data: Principles of transport phenomena in materials processes including momentum, heat and mass transport.

Prerequisites: Math 3310 and MFET 3450.

Time distribution: 2-1.5 hr classes per week.

Objectives: To provide students with the concepts related to fluid flow, heat and mass transfer and their common applications to specific systems in materials engineering. ABET criterion 3 outcomes 1, 2, 3, 5, 6, 7

Instructor: Dr. Zhenhai Xia

Office: Discovery Park E-104
Office Hours: Open door policy
Phone: 940-369-5805
Email: zhenhai.xia@unt.edu

TA: Devendra Ray

email: Devendraray@my.unt.edu

Lectures: T/Th 11:30a.m.-12:50p.m.
Room: Remote
[Makeup lectures will be scheduled for missed class sessions.]

Textbook:

Reference Book

Topics:
I. Fluid Flow (3 weeks)
   Fluxes, Phenomenological laws, and Conservation laws
   Momentum transfer and viscosity
   Convective and diffusive momentum transport

II. Heat Transfer (3 weeks)
   Modes of heat transfer (Conduction, Convection, and Radiation)
   Steady and unsteady state heat conduction
   Heat transfer coefficients
III. Mass Transport (3 weeks)
   Fick's law and diffusivity of materials
   Mass transfer in fluid systems, mass transfer coefficient
   Diffusion as random thermal jumps of atoms (1 d random walk)
   Self-diffusion coefficients
   Vacancy and interstitial mechanisms of self-diffusion
   Diffusion in presence of driving force and mobility
   Interdiffusion and Darken’s equation
   Simple solution of diffusion equation
   Grain boundary and surface diffusion

IV. Similarities, Coupling and Boundary Conditions (2 weeks)
   Coefficients of transfer
   Balance equations
   Coupling of different types of transport
   Solid/Liquid/Gas interfaces

V. Applications in Materials Processing (1 week)
   Liquid-Solid processing
   Solid-Solid processing
   Gas-Solid processing

Grading plan:

(1) Homework 30%
(2) Mid-term examination 30%
(3) Final 40%

Relationship to program Objectives:
The course is integral to program objectives 1 and 2. It provides students opportunities (1) to learn basic science and engineering concepts of transport phenomena (heat, mass and momentum transfer) and apply them to materials processing and (2) to understand the effect of materials processing on properties or quality of material produced.

Attendance Policy
Mandatory attendance.

COVID-19 Impact on Attendance
While attendance is expected as outlined above, it is important for all of us to be mindful of the health and safety of everyone in our community, especially given concerns about COVID-19. Please contact me if you are unable to attend class because you are ill, or unable to attend class due to a related issue regarding COVID-19. It is important that you communicate with me prior to being absent so I may make a decision about accommodating your request to be excused from class.

If you are experiencing any symptoms of COVID-19 (https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or
askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Hotline at 844-366-5892 or COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure. While attendance is an important part of succeeding in this class, your own health, and those of others in the community, is more important.

**Class Materials for Remote Instruction**
The UNT fall schedule requires this course to have fully remote instruction beginning November 28th. Additional remote instruction may be necessary if community health conditions change or you need to self-isolate or quarantine due to COVID-19. Students will need access to a [webcam and microphone – faculty member to include what other basic equipment is needed] to participate in fully remote portions of the class. Additional required classroom materials for remote learning include: [list specific software, supplies, equipment or system requirements needed for the course]. Information on how to be successful in a remote learning environment can be found at https://online.unt.edu/learn.

**Statement on Face Covering**
Face coverings are required in all UNT facilities. Students are expected to wear face coverings in the case of in-person class. If you are unable to wear a face covering due to a disability, please contact the Office of Disability Access to request an accommodation. UNT face covering requirements are subject to change due to community health guidelines. Any changes will be communicated via the instructor.

**Class Recordings & Student Likenesses**
Synchronous (live) sessions in this course will be recorded for students enrolled in this class section to refer to throughout the semester. Class recordings are the intellectual property of the university or instructor and are reserved for use only by students in this class and only for educational purposes. Students may not post or otherwise share the recordings outside the class, or outside the Canvas Learning Management System, in any form. Failing to follow this restriction is a violation of the UNT Code of Student Conduct and could lead to disciplinary action.