

## NUCL551: MASS, MOMENTUM, AND ENERGY TRANSFER IN ENERGY SYSTEMS

**Course Description:** Formulations for analyzing complicated thermal-hydraulic phenomena in energy systems. Thermal-hydraulic modeling of nuclear reactor systems. Derivation of two-phase flow field equations and constitutive relations. Analyses of nuclear reactor safety related phenomena based on conservation principles

**Prerequisites:** NUCL351 (or equivalent)

**Instructor:** Dr. Seungjin Kim [seungjin@purdue.edu](mailto:seungjin@purdue.edu)

Office Hours: Online Wednesday, 9:30AM-10:30AM, or by appointments.

**Guest Lecturer:** Dr. Ran Kong [kongr@purdue.edu](mailto:kongr@purdue.edu)

**References:** No textbook is required. References related to the course include:

R. Byron Bird, Warren E. Stewart and Edwin N. Lightfoot, *Transport Phenomena*, 2<sup>nd</sup> Ed., John Wiley & Sons. Inc.

Neil E. Todreas and Mujid S. Kazimi, *Nuclear Systems I*, Taylor & Francis

Mamoru Ishii and Takashi Hibiki, *Thermo-fluid Dynamics of Two-phase Flow*, Springer

G. B. Wallis, *One Dimensional Two-phase Flow*, McGraw Hill

R. Aris, *Vectors, Tensors, and Basic Equations of Fluid Mechanics*, Prentice Hall

### Responsibilities & Policies:

- **Assignments**

- Due one week from the day assigned (before midnight), unless specified otherwise.
- No late assignments are accepted, unless a request for an extension has been made to the instructor *at least three days in advance before the due day* for any extenuating circumstances.
- One assignment with lowest score will be dropped.

- **Exams**

- Three exams will be given (2 Midterm Exams & Final Exam).
- No make-up exam is allowed, unless a request for change in exam date has been made to the instructor *at least one week in advance before the scheduled exam date* for any extenuating circumstances.
- Anybody who earns an A grade after the second exam (accounting for the assignments and exams) may opt out of the Final Exam with an A grade.
- The final grade will be calculated based on two best exams out of three.
- Should one decided not to take the final exam without earning A grade after the second exam, the grade will be calculated based on THREE exams (instead of two) with ZERO final exam score.'

- **Lecture Videos / Reference Materials**

- Under the current circumstance with COVID-19 pandemic, lectures will be captured in videos and made available in on-demand format via the course BrightSpace.
- Recording, image capturing, and releasing of the lecture videos to the public domain are prohibited and will be regarded as a violation of academic integrity.
- All the course related materials available in BrightSpace are intended for personal use only by authenticated users who are enrolled for NUCL551 in Fall 2020 semester. Release of course material to any other people without obtaining written permission from the instructor will be regarded as a violation of academic integrity.

- **Grade Proportion**

- Exams: 35% each for two best exams out of three (23.33% each in case all three exams need to be accounted for).
- Assignments: 30%.
- The grade will be partitioned into A, B, C, D and F. Ranges of grades are:

<b>Final Avg. Score</b>	<b>Grade</b>
$85 \leq \text{Avg.}$	A
$75 \leq \text{Avg.} < 85$	B
$60 \leq \text{Avg.} < 75$	C
$50 \leq \text{Avg.} < 60$	D
$\text{Avg.} < 50$	F

- **Academic Integrity**

Academic integrity is one of the highest values that Purdue University holds. Information on Purdue's policies with regard to academic misconduct can be found [here](#). Individuals are encouraged to alert university officials to potential breaches of this value by either emailing [integrity@purdue.edu](mailto:integrity@purdue.edu) or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

- **Attendance**

In accordance with University policy, students are expected to attend all the classes. If a student has a valid reason for missing class such as a University-sponsored activity, religious observances, illness, or family emergency, you need to inform the instructor in writing regarding your absence in advance. Students who fail to attend class without a valid excuse should not expect the instructor to supply class notes or provide special help. The official university policy can be found [here](#).

**In the current context of the COVID-19 pandemic**, students must follow the guidelines in the [Protect Purdue Pledge](#). Most specifically, students must refrain from attending class if they are exhibiting any symptoms of COVID-19, are otherwise ill, or are quarantined or isolated. Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student

from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via [email](#) or phone at 765-494-1747.

**If you become quarantined or isolated at any point in time during the semester**, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at [acmq@purdue.edu](mailto:acmq@purdue.edu) and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students ([odos@purdue.edu](mailto:odos@purdue.edu)) is also available to support you should this situation occur.

- **Classroom Guidance Regarding Protect Purdue**

The [Protect Purdue Plan](#), which includes the [Protect Purdue Pledge](#), is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask [in classrooms and campus building](#), at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#).