MECE 6397 | Selected Topics

Section: 21579 | Synchronous Online

Instructor Information

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Office Hours

Fridays 1:00–2:00 pm, on Zoom (link posted on Canvas), and by appointment — email anytime.

General Course Information

Secondary Course Title	Thermal Transport and Management in Semiconductors
Course Meeting Time	Mondays and Wednesdays, 4:00–5:30 pm, August 24 – December 14, 2026
Course Meeting Location	SEC 105 (face-to-face); online students join the live lecture on Zoom — link posted on Canvas
Prerequisite	Graduate standing; undergraduate heat transfer recommended. No prior quantum mechanics or solid-state physics is assumed.
TA	TBA

Course Format

This course is offered face-to-face and synchronously online. Face-to-face students meet in SEC 105; online students join the live lecture on Zoom (link posted on Canvas). Lecture recordings will be posted on Canvas as a make-up resource; they are discouraged as a primary way to take the course. Both exams are given in class during the regular lecture time; online students take them at the same time through a remotely proctored sitting (see Course Policies), so no course component requires campus presence.

Course Objectives and Student Learning Outcomes

Heat is now a first-order constraint on computing: power density in modern processors rivals that of a rocket nozzle, thermal limits cap the clock speeds and packing density of chips, and cooling accounts for a substantial share of data-center energy use. This course teaches how heat is generated, transported, and managed in semiconductor devices and systems — from a single transistor to a packaged processor to the cooling plant that serves it.

Course Learning Outcomes

By the end of this course, students should be able to:

1. Apply classical conduction analysis — thermal resistance networks, spreading resistance, extended surfaces (fins and heat sinks), and transient response — to chip-scale geometries.
2. Describe how heat is generated and carried in semiconductors using the electron and phonon pictures: energy bands, phonon dispersion, density of states, and carrier statistics.
3. Calculate thermal properties of semiconductor materials — specific heat and thermal conductivity — from carrier-level models (Debye model, kinetic theory, scattering rules).
4. Identify when Fourier's law breaks down, and quantify size effects on thermal conductivity in thin films, nanowires, and superlattices using carrier-transport reasoning.
5. Analyze thermal boundary resistance and self-heating in modern transistor architectures and wide-bandgap power devices.
6. Select and interpret appropriate thermal metrology techniques (3-omega, TDTR/FDTR, thermoreflectance, Raman thermometry, infrared thermography) for device and material characterization.
7. Construct chip-to-ambient thermal models (resistance networks, compact models, numerical simulation) and evaluate packaging and cooling solutions against design targets.
8. Use AI-assisted computation to implement, visualize, and physically interpret thermal transport models — and critically evaluate AI-generated technical content for correctness.

Required Instructional Materials

Textbook

There is no required textbook to purchase. The instructor's class notes, posted on Canvas chapter by chapter, are the canonical study resource for this course: everything testable is in the class notes. The notes draw from the references below, which are recommended for deeper reading. Please respect copyright and do not redistribute any class materials without permission.

References (recommended, not required)

- F. P. Incropera, D. P. DeWitt, T. L. Bergman, and A. S. Lavine, Fundamentals of Heat and Mass Transfer, 8th ed., Wiley — for the classical conduction arc.
- G. Chen, Nanoscale Energy Transport and Conversion, Oxford University Press (2005).
- Z. M. Zhang, Nano/Microscale Heat Transfer, 2nd ed., Springer (2020).
- C. Kittel, Introduction to Solid State Physics, 8th ed., Wiley (2005).
- Y. Shabany, Heat Transfer: Thermal Management of Electronics, CRC Press (2010).
- E. Pop, "Energy dissipation and transport in nanoscale devices," Nano Research 3, 147 (2010).
- D. G. Cahill et al., "Nanoscale thermal transport. II. 2003–2012," Applied Physics Reviews 1, 011305 (2014).
- A. L. Moore and L. Shi, "Emerging challenges and materials for thermal management of electronics," Materials Today 17, 163 (2014).

Course Schedule, Assignments, and Assessments

Assessment instruments at a glance

- Homework (20%) — five biweekly assignments (HW 1–5) with four embedded numerical labs; release and due dates fixed on the schedule below; due Mondays at 5:00 pm via Canvas (PDF upload); self-graded against posted solutions with instructor spot-checks.
- Exam I (40%) — in class, Wednesday, October 14; 90 minutes, open book (hardcopy materials only), covering the physics arc (Weeks 1–8).
- Exam II (40%) — in class, Wednesday, December 2 (last class meeting; no final-exam slot); 90 minutes, open book (hardcopy materials only), covering the engineering arc (Weeks 9–15).

- Optional video project (replacement credit) — topic approval due Monday, November 2; optional draft due Friday, November 20; complete submission package due Friday, December 4, 5:00 pm.

Tentative Course Schedule

Dates follow the official UH Fall 2026 academic calendar. Once the semester begins, we will try our best not to move exam dates, homework due dates, or project milestones; any change will be announced on Canvas.

WeekDateClass ActivityMilestones / Due

1	Aug 24 (M)	L1: The chip thermal problem — power density, dark silicon, data-center energy; syllabus; the "follow one joule" roadmap	
	Aug 26 (W)	L2: Fourier's law, the heat diffusion equation, boundary conditions; 1D steady conduction (plane wall, cylinder); the thermal-resistance concept	
2	Aug 31 (M)	L3: Composite multilayer stacks, contact resistance, and spreading resistance (die to spreader)	HW 1 released
	Sep 2 (W)	L4: Extended surfaces: fin theory, fin efficiency, and heat sinks as fin arrays	
3	Sep 7 (M)	Labor Day — no class	

	Sep 9 (W)	L5: Transient conduction: lumped capacitance, the Biot number, thermal time constants, semi-infinite solids, pulsed heating	
4	Sep 14 (M)	L6: 2D conduction and how it is actually solved: shape factors, series solutions (survey), and finite differences	HW 1 due; HW 2 released (Lab 1); Supplement S1 (open-source solvers) posted
	Sep 16 (W)	L7: Semiconductors 101: crystals and bonding; the band picture; electrons, holes, doping, and bandgaps (Si, III-V, SiC, GaN)	
5	Sep 21 (M)	L8: Phonons I: lattice waves, 1D-chain dispersion, acoustic and optical branches, group velocity	
	Sep 23 (W)	L9: Phonons II: phonon density of states, thermal occupation, and specific heat (Einstein and Debye models)	
6	Sep 28 (M)	L10: Kinetic theory of thermal conductivity: the carrier-gas picture and mean free paths	HW 2 due; HW 3 released (Lab 2)
	Sep 30 (W)	L11: Phonon scattering (Umklapp, impurity, alloy, boundary) and the thermal conductivity of real semiconductors	

7	Oct 5 (M)	L12: Electrons as heat carriers; the Wiedemann–Franz law; the microscopic picture of Joule heating	Practice Exam I posted
	Oct 7 (W)	L13: When Fourier fails: ballistic vs. diffusive transport and the Knudsen number (Boltzmann-transport results, with the formalism as Deeper Dive reading)	
8	Oct 12 (M)	L14: Size effects and engineering thermal conductivity (with the physics-arc synthesis woven in) + Exam I review (practice-exam walkthrough)	HW 3 due
8	Oct 14 (W)	Exam I — in class (90 minutes, open book, hardcopy materials only)	
9	Oct 19 (M)	L16: Thermal boundary resistance: physical picture, mismatch-model results, and the interfaces that matter in a real die	HW 4 released (Lab 3)
	Oct 21 (W)	L17: Transistor self-heating: FinFET / GAA / SOI, hotspots, electrothermal coupling	
10	Oct 26 (M)	L18: Wide-bandgap power devices: GaN HEMTs, SiC MOSFETs, and near-junction thermal management	

	Oct 28 (W)	L19: Thermal metrology I: 3-omega, TDTR and FDTR	
11	Nov 2 (M)	L20: Metrology II: thermoreflectance imaging, Raman thermometry, and infrared thermography (with the radiation fundamentals they require)	Project topic approval due
	Nov 4 (W)	L21: Package thermal analysis I: junction-to-ambient resistance networks, thermal metrics, compact models, power maps	
12	Nov 9 (M)	L22: Package thermal II: thermal interface materials, heat spreaders, vapor chambers	HW 4 due; HW 5 released (Lab 4)
	Nov 11 (W)	L23: Advanced packaging: 3D stacking, chiplets, TSVs, backside power delivery — thermal co-design	
13	Nov 16 (M)	L24: System-level cooling I: air, cold plates, liquid and immersion cooling	
	Nov 18 (W)	L25: System-level cooling II: the data-center energy context; thermal-aware design and AI in the thermal-engineering workflow	Optional project draft due Fri Nov 20

14	Nov 23 (M)	L26: Radiative and photonic thermal management for electronics; research frontier: nonreciprocal thermal photonics (TPX Lab)	Practice Exam II posted
	Nov 25 (W)	Thanksgiving — no class	
15	Nov 30 (M)	L27: The full chain, revisited: one joule from transistor to data center — synthesis + Exam II review (practice-exam walkthrough)	HW 5 due
15	Dec 2 (W)	Exam II — in class (90 minutes, open book, hardcopy materials only; last class meeting)	Final project video due Fri. Dec. 4, 5:00 pm

Important dates (UH Fall 2026 academic calendar)

- August 24, 2026 (Mon) — First day of classes
- August 31, 2026 (Mon) — Last day to add a class
- September 7, 2026 (Mon) — Labor Day holiday
- September 9, 2026 (Wed) — Official Reporting Day; last day to drop without receiving a grade
- November 18, 2026 (Wed) — Last day to drop a course or withdraw with a "W"
- November 25–29, 2026 (Wed–Sun) — Thanksgiving holiday
- December 5, 2026 (Sat) — Last day of classes
- December 8–14, 2026 — Final examination period (this course does not use a final-exam slot; Exam II is given in class on December 2)

Discussion and Lecture Topics

The course follows one storyline across the semester: follow one joule of heat. A switching transistor dissipates energy; that energy is born as lattice vibrations (phonons); it crosses the die, crosses material interfaces, spreads through the package, and is finally rejected to the environment. The semester has three arcs.

Arc 1 — The classical conduction toolkit (Weeks 1–3)

The toolkit every chip thermal engineer uses daily:

- The chip thermal problem: power density, dark silicon, data-center energy
- Fourier's law, the heat diffusion equation, boundary conditions; 1D steady conduction and the thermal-resistance concept
- Composite multilayer stacks, contact resistance, and spreading resistance (die to spreader)
- Extended surfaces: fin theory, fin efficiency, and heat sinks as fin arrays
- Transient conduction: lumped capacitance, the Biot number, thermal time constants, semi-infinite solids, pulsed heating
- 2D conduction and how it is actually solved: shape factors, series solutions (survey), and finite differences

Arc 2 — Where thermal properties come from (Weeks 4–8)

The microscopic picture: what the heat carriers in a semiconductor are, how they move, and where they jam:

- Semiconductors 101: crystals and bonding; the band picture; electrons, holes, doping, and bandgaps (Si, III-V, SiC, GaN)
- Phonons: lattice waves, 1D-chain dispersion, acoustic and optical branches, group velocity; density of states, thermal occupation, and specific heat (Einstein and Debye models)
- Kinetic theory of thermal conductivity: the carrier-gas picture and mean free paths
- Phonon scattering (Umklapp, impurity, alloy, boundary) and the thermal conductivity of real semiconductors
- Electrons as heat carriers; the Wiedemann–Franz law; the microscopic picture of Joule heating
- When Fourier fails: ballistic vs. diffusive transport and the Knudsen number
- Size effects and engineering thermal conductivity

Arc 3 — Engineering the thermal path (Weeks 9–15)

From device to data center:

- Thermal boundary resistance and the interfaces that matter in a real die
- Transistor self-heating: FinFET / GAA / SOI, hotspots, electrothermal coupling
- Wide-bandgap power devices: GaN HEMTs, SiC MOSFETs, near-junction thermal management
- Thermal metrology: 3-omega, TDTR/FDTR, thermoreflectance imaging, Raman

thermometry, infrared thermography
- Package thermal analysis: junction-to-ambient resistance networks, thermal metrics, compact models, power maps; thermal interface materials, heat spreaders, vapor chambers
- Advanced packaging: 3D stacking, chiplets, TSVs, backside power delivery — thermal co-design
- System-level cooling: air, cold plates, liquid and immersion cooling; the data-center energy context; thermal-aware design and AI in the thermal-engineering workflow
- Radiative and photonic thermal management for electronics; research frontier: nonreciprocal thermal photonics

Depth policy. Lectures carry the key physical pictures and the engineering-usable results. Full derivations (quantum-mechanical formalism, Boltzmann-transport mathematics, interface-model derivations) are provided as clearly marked Deeper Dive optional readings at the end of each chapter of the class notes — recommended for students who want the complete theory, but not testable.

Grading Rubrics and Weights

Grade weights

- Homework (20%) — five biweekly assignments with embedded numerical labs, self-graded against posted solutions with instructor spot-checks (see Course Policies for the homework policy).
- Exam I (40%) — in class, Wednesday, October 14; 90 minutes, open book (hardcopy materials only), covering the physics arc (Weeks 1–8).
- Exam II (40%) — in class, Wednesday, December 2; 90 minutes, open book (hardcopy materials only), covering the engineering arc (Weeks 9–15), with the physics arc available as foundation.
- Optional video project (replacement credit) — an individual instructional video that can replace your lower exam score if the project scores higher. The project is entirely optional: students who do not submit one lose nothing.

Project-to-exam replacement rule

If you submit a final project and its score is higher than your lower exam score, the project score replaces the lower exam score for that 40% weight category in the grade calculation. This rule:

- is one-way (a strong exam does not replace a lower project score, and a weak

project cannot hurt you);
- applies only to the lower of the two exams;
- is automatic — no application is needed; the gradebook applies the higher of the two values for that 40% slot.

Both exams must still be submitted. The higher exam is always counted at its actual score. This rule gives motivated students an upward path and a single-bad-week safety net, without removing the requirement that every student demonstrate analysis competency on at least one exam.

How homework scores are produced (self-grading)

- Homework release and due dates are fixed on the course schedule (roughly biweekly; due Mondays at 5:00 pm via Canvas, PDF upload).
- Detailed worked solutions are released within 24 hours of the due time. Late submissions are not accepted after solutions are posted.
- Self-grading: within 5 days of the solutions being posted, you submit a self-graded copy of your own work: a score for each problem against the posted rubric, with brief notes on any errors you found. Grading your own work against a correct solution is one of the most effective study techniques known, and it is how practicing engineers audit their own analyses.
- Spot-checks: the instructor audits a random subset of self-graded submissions each cycle. If a self-assigned score is materially inflated, the instructor's score replaces it for that set; a repeated pattern of inflation is an academic-honesty issue.
- The lowest single homework score is dropped at the end of the semester.

Letter grade scale

We do not curve. Letter grades are assigned from your final numeric score:

Point RangeGradeDescription

90.00 – 100.00	A	Excellent, superior achievement
87.00 – 89.99	A−	
83.00 – 86.99	B+	
80.00 – 82.99	B	Good, exceeding all requirements
77.00 – 79.99	B−	
73.00 – 76.99	C+	
70.00 – 72.99	C	Average, satisfactorily meeting all requirements

67.00 – 69.99	C−	
63.00 – 66.99	D+	
60.00 – 62.99	D	Poor, unsatisfactory
56.00 – 59.99	D−	
0.00 – 55.99	F	Failing or withdrawal while doing failing work
—	I	Incomplete

Video project rubric (100 points)

CriterionExcellent (90–100%)Proficient (75–89%)Developing (60–74%)Needs Work (below 60%)

Technical Mastery (40 pts) Correctness and depth of the physics and modeling	Topic treated correctly with quantitative analysis, correct governing physics, and an original working numerical demonstration. Limitations acknowledged.	Mostly correct; minor gaps in the analysis or demonstration. Physics is present and used correctly.	Noticeable inaccuracies or oversimplifications. Numerical demonstration absent or partially incorrect.	Major technical errors. The work does not demonstrate understanding of the core transport physics.
Clarity for Non-Expert Audience (30 pts) Engineering communication	A non-expert can follow the explanation and articulate the main idea afterwards. Jargon defined or avoided. Logical flow.	Mostly clear; a few passages require effort.	Difficult to follow without prior background. Sounds like a slide deck recited verbatim.	Unclear or confusing throughout.
Structure and Production Quality (20 pts) Organization, pacing, audio/visual quality	Clear introduction, body, conclusion. Clean, clearly audible audio; legible, well-designed visuals that support the argument; pacing and editing that hold attention. Feels carefully made.	Mostly clean; minor lapses in audio, pacing, or visuals.	Distracting issues, but content can still be followed.	Production issues significantly hinder the audience.

Originality and Effort (10 pts) Personal engagement with the material	Clear evidence of personal engagement, original framing or example, careful editing.	Reasonable effort; standard but solid execution.	Minimal personal input visible.	Appears to be raw AI / automated output with no personal editing or framing.

Course Policies and Procedures

Workload expectation

Students are expected to spend at least 6 hours per week outside of class on readings, homework, and the numerical labs.

Communication with the Instructor

For all course-related communication, please use email (bzhao8@uh.edu). I do not use Microsoft Teams for this course. Use email for any course-related question, including lectures, homework, exams, the course project, scheduling office hours, grade questions, and absences. Please use your Cougarnet (UH) email account when writing, so that FERPA-protected information (grades, progress) can be discussed properly.

Homework Policy

Homework is the primary tool for building both the physical reasoning and the working analysis skill the course is testing. The architecture is deliberate. Each homework set contains 5–7 problems, organized into three layers:

- Layer 1 — Foundation (about 50% of points). Hand calculations that build unaided fluency: thermal resistance networks, spreading resistance, fin and heat-sink analysis, transient response, Debye specific heat, kinetic-theory conductivity estimates, interface resistance stacking. These are the calculation muscle the exams assume.
- Layer 2 — Conceptual / First-Principle Reasoning (about 35% of points). Predict the direction of an outcome before computing, sketch a dispersion relation or band diagram, explain a trend (why does alloying suppress thermal conductivity? where inside a transistor is the heat generated, and why there?), or analyze a misconception. Reasoning is the primary thing graded; the number is secondary.
- Layer 3 — Numerical Lab (about 15% of points). A computational mini-project (see below). Submitted as code + visualization + a half-page physical interpretation in your own words.

Each problem is explicitly labeled (L1 / L2 / L3) along with its individual AI policy. Homework cadence, self-grading mechanics, and the lowest-score drop are described under Grading Rubrics and Weights.

The numerical labs

Four labs are embedded in the homework sets. They trace the course storyline in code:

- Lab 1 (HW2) — Build a 2D transient finite-difference model of a chip with a realistic power map; animate the hotspot. (By Week 4 you will have written your own chip thermal simulator.)
- Lab 2 (HW3) — Compute and animate the phonon dispersion of 1D monatomic and diatomic chains; visualize acoustic vs. optical modes.
- Lab 3 (HW4) — Model the thin-film size effect on thermal conductivity and compare your curve against published silicon data.
- Lab 4 (HW5) — Build a junction-to-ambient RC-network compact model of a stacked die and simulate its response to a duty-cycled workload.

AI tools are fully permitted — and encouraged — for writing the lab code. The operating principle: AI may write your code; it may not understand the physics for you. You are graded on the correctness of the model, the quality of the visualization, and the physical interpretation you write yourself. Document your prompts and process briefly at the end of the lab write-up.

AI usage policy on homework

- Layer 1 (Foundation): AI tools are prohibited. The purpose of these problems is unaided fluency.
- Layer 2 (Conceptual): AI tools may be used only as a checker after you have drafted a complete answer yourself. You must submit (i) your own original reasoning, (ii) a brief note on what AI told you, and (iii) any disagreements you had with the AI and your final position. Submissions that look like raw AI output without (i)–(iii) will receive zero credit on the problem.
- Layer 3 (Numerical lab): AI tools are fully permitted with prompt documentation, as described above.

Misuse of AI on Layer 1 is an Academic Honesty Policy violation.

Exam Policy

Format and scheduling

Both exams are given in class, in SEC 105, during the regular lecture time: 90 minutes, designed for about 75 minutes of focused work, with suggested per-problem pacing printed on the exam. The exams are concept-forward — they test the physical reasoning practiced all semester — and every computation is short and calculator-friendly by design.

- Exam I — Wednesday, October 14, in class. Covers Weeks 1–8: the classical conduction toolkit, carriers and phonons, thermal conductivity, and size effects.
- Exam II — Wednesday, December 2, in class (the last class meeting; this course does not use a final-exam slot, so you are done on December 2). Covers Weeks 9–15: interfaces, self-heating, metrology, the package, 3D integration, cooling, and photonic thermal management — with the Week 1–8 material available as foundation.

Rules (what to bring)

- Open book, hardcopy only: any printed or handwritten materials — class notes, homework and solutions, textbooks, your own notes.
- No computers, tablets, phones, smartwatches, or any internet-connected device. A basic scientific calculator is allowed and sufficient — the numbers are chosen so that no computation needs more.
- Show your work with units at every step; highlight final answers.
- Exam questions are written fresh each semester and are designed around the specific models, notation, and worked examples of this course's class notes.
- Discussing exam content with anyone who has not yet completed the exam (for example, a student with an approved alternate sitting) is an academic-honesty violation.
- As a standard practice, the instructor may invite any student to a brief (15-minute) follow-up conversation about their exam solutions; being invited is not an accusation.

Online students: proctored remote sitting

Online students take each exam at the same time as the in-person section, remotely proctored, under the same rules. The default arrangement — and the minimum standard — is a live Zoom session with your camera positioned for a top-down (overhead) view of your workspace, so that your papers, hands, and materials are visible for the whole sitting; the device running Zoom is used for nothing else. You then scan and upload your work to Canvas within 15 minutes of the end. As noted at registration, this course may require proctoring services; where a commercial proctoring service or approved testing center is the better arrangement, we will set it up case by case — contact the instructor within the first two weeks of class to work out your setup (and early in the semester if the class time is unworkable in your time zone, so an alternate proctored sitting can be arranged).

Webcam statement. A webcam is required only for remotely proctored exam sittings, and it must remain on for the duration of the sitting; the academic basis for this requirement is ensuring the integrity of exam administration. Webcams are never required at any other time in this course — lectures and office hours do not require your camera.

What to expect from remote proctoring. You are not required to use your own personal computer or to sit the exam at home: a campus computer lab, a library room, or any other suitable quiet space works. Choose an environment with as little background noise and movement as possible, so nothing ordinary about your surroundings is mistaken for a concern. If a commercial proctoring service is used for your sitting, be aware it may include a brief environmental scan of your workspace at the start; the default Zoom arrangement uses no software beyond Zoom itself — just the overhead camera view described above.

Practice exam and question alignment

A practice exam is posted on Canvas about one week before each exam, matched in skeleton, point split, length, and difficulty — the real exam runs the same structure with fresh scenarios and numbers. It is worked through in the review session before the exam (see schedule), and its full solutions are posted afterward. Every exam question maps to a problem type you have practiced on a homework set or seen in a worked example. In addition, two comprehensive workout sets — longer, take-home-style problem sets with full solutions, one per arc — are posted as optional extra preparation for students who want more mileage. Exam questions are drafted and individually reviewed by the instructor; AI tools, if used in drafting, are only a starting point and every question is verified by hand before the exam is finalized.

Grade discussion deadline

All discussions of grade changes on exams must be initiated within seven days of receiving the grade. After the seven-day deadline, grade-correction requests will not be accepted.

Make-up policy

For excused absences with strong supporting proof (e.g., medical note, police report) per the UH Graduate Excused Absence Policy: contact the instructor within 48 hours of the missed sitting to finalize an alternate proctored sitting; once scheduled, the make-up must be completed within one week (Exam I) or within three days (Exam II) of the original exam date. If either deadline is missed, the missed assessment receives a score of zero.

Classroom Courtesy

Please try not to eat during class, especially food that makes noise. Please mute your phone during class, and feel free to step out to pick up a call if needed. Online students: please stay muted unless speaking, and use the chat or raise-hand feature freely — questions from Zoom are welcome at any time.

Syllabus Stability

You should be able to plan your whole semester from this document on Day 1. To make that possible, we will try our best not to change the following after the start of the semester: grade weights, exam dates and format, homework structure, project milestone dates, and the project rubric. The modifications we expect to make, if any, fall into three kinds: (i) corrections of factual errors or typos in this document, (ii) responses to University-level changes (e.g., a revised UH academic calendar), and (iii) clarifications that do not change a stated policy. Any change will be announced via Canvas with as much notice as we can give, and no grading rule will be tightened mid-semester.

Optional Video Project

A senior thermal engineer must be able to explain technical content clearly to people who are not specialists — a manager, a customer, a junior team member. This optional project develops that skill while requiring genuine mastery of a course topic, and it gives motivated students an upward grade path via the replacement rule under Grading Rubrics and Weights.

Format

An individual instructional video, 8–10 minutes long, that teaches a course-connected topic. The project is single-author — one student, one video; teams are not permitted. A natural and encouraged path is to extend one of your numerical labs into a complete analysis — for example, "the thermal analysis of a modern GPU from die to heat sink," built on your Lab 3 and Lab 4 models. The video must include:

- the relevant governing physics, presented correctly;
- one original numerical demonstration (your own code; AI-assisted is fine, consistent with the lab policy);
- a brief discussion of the engineering trade-offs or real-world relevance.

The engineering — clarity of explanation, technical correctness, depth of mastery — is the core of the grade, and production quality counts too: clean audio, legible and well-designed visuals, and deliberate pacing and editing are part of what makes an instructional video work, and the rubric rewards them. What is not required is expensive equipment: a phone camera and a free screen recorder, used with care, are fully capable of producing a top-score video.

For a feel of the format — concise, well-paced explanations of electronics-cooling topics — browse the EverythingThermal channel on YouTube. One important calibration, though: those videos are aimed at a broad engineering audience, while your video is a graduate-level deliverable — it should go quantitatively deeper than a general-audience video ever would: governing equations used honestly, your own computed numbers with units, and the kind of trade-off reasoning this course has practiced. Think "EverythingThermal pacing, MECE 6397 depth." A topic menu and starter kit with concrete project ideas is posted on Canvas alongside this syllabus.

Video is required (rather than a written report) because voice narration, paced delivery, and visual sequencing produce evidence of genuine personal engagement that is difficult to fabricate. A human voice (your own) must narrate; AI-generated voices are not permitted as the primary narration.

Milestones

- Monday, November 2 — topic declared and approved by email (short paragraph: topic + planned numerical demonstration). Exam I grades will be returned before this date, so you can make an informed decision about whether the project is worth your time.
- Friday, November 20 — optional draft milestone: submit an outline, transcript, or partial video for instructor feedback (returned within one week).
- Friday, December 4, 5:00 pm — complete submission package due in your folder (see Submission package below). Late submissions are not accepted. (The deadline sits two days after Exam II so the two never compete for the same evening.) With your permission, highlight clips may be shared with the class on Canvas.

Submission package

Everything is submitted through the course's Video Project folder on SharePoint (folder link posted on Canvas): create a folder there named with your own name (Last_First) and place your complete package inside by the deadline —

- the video file;
- your code and any data it needs (so the numerical demonstration can be rerun);
- slides or other assets used in the video, if any;
- the one-paragraph AI-disclosure appendix (see below).

AI use and citations

You may use AI tools freely for drafting, ideation, code, visualization, and narration assistance (subject to the human-voice rule). You must verify all technical content yourself — you are responsible for any error regardless of its source — and disclose AI use in a one-paragraph appendix. Cite any text, images, figures, or clips from other sources; uncredited borrowing is an academic-honesty issue.

Project archive

After grading, projects may be retained for instructor reference and for showing future students (with attribution) as examples of strong work. No public posting and no use outside the course occurs without separate written, opt-in consent, and consent has no effect on the grade. A short consent form will be distributed with the project so you can indicate exactly which permissions, if any, you wish to grant.

University Policies and Student Support Resources

Mental Health and Wellness Resources

The University of Houston has a number of resources to support students' mental health and overall wellness, including CoogsCARE and the UH Go App. UH Counseling and Psychological Services (CAPS) offers 24/7 mental health support for all students, addressing various concerns like stress, college adjustment and sadness. CAPS provides individual and couples counseling, group therapy, workshops and connections to other support services on and off- campus. For assistance visit uh.edu/caps, call 713-743-5454, or visit a Let's Talk location in-person or virtually. Let's Talk are daily, informal confidential consultations with CAPS therapists where no appointment or paperwork is needed.

Need Support Now? If you or someone you know is struggling or in crisis, help is available. Call CAPS crisis support 24/7 at 713-743-5454, or the National Suicide and Crisis Lifeline: call or text 988, or chat 988lifeline.org.

Title IX/Sexual Misconduct

Per the UHS Sexual Misconduct Policy, your instructor is a "responsible employee" for reporting purposes under Title IX regulations and state law and must report incidents of sexual misconduct (sexual harassment, non-consensual sexual contact, sexual assault, sexual exploitation, sexual intimidation, intimate partner violence, or stalking) about which they become aware to the Title IX office (known at UH as the Equal Opportunity Services office or "EOS"). Please know there are places on campus where you can make a report in confidence. You can find more information about resources on the UH Title IX/Sexual Misconduct Resources page. Please note that you may also report concerns of discrimination based on your protected class identity to EOS.

Reasonable Academic Adjustments/Auxiliary Aids

The University of Houston is committed to providing an academic environment and educational programs that are accessible for its students. Any student with a disability who is experiencing barriers to learning, assessment or participation is encouraged to contact the Justin Dart, Jr. Student Accessibility Center (Dart Center) to learn more about academic accommodations and support that may be available to them. Students seeking academic accommodations will need to register with the Dart Center as soon as possible to ensure timely implementation of approved accommodations. Please contact the Dart Center by visiting the website: https://uh.edu/accessibility/ calling (713) 743-5400, or emailing jdcenter@Central.UH.EDU.

The Student Health Center offers a Psychiatry Clinic for enrolled UH students. Call 713-743-5149 during clinic hours, Monday through Friday 8 a.m. - 4:30 p.m. to schedule an appointment.

The A.D. Bruce Religion Center offers spiritual support and a variety of programs centered on well-being.

The Center for Student Advocacy and Community (CSAC) is where you can go if you need help but don't know where to start. CSAC is a "home away from home" and serves as a resource hub to help you get the resources needed to support academic and personal success. Through our Cougar Cupboard, all students can get up to 30 lbs of FREE groceries a week. Additionally, we provide 1:1 appointments to get you connected to on- and off-campus resources related to essential needs, safety and advocacy, and more. The Cougar Closet is a registered student organization advised by our office and offers free clothes to students so that all Coogs can feel good in their fit. We also host a series of cultural and community-based events that foster social connection and helps the cougar community come closer together. Visit the CSAC homepage or follow us on Instagram: @uh_CSAC and @uhcupbrd. YOU belong here.

Cougar Parent and Family Engagement Office

This office, under the Dean of Students Office (https://www.uh.edu/dos/), coordinates resources for Pregnant and Parenting Students (https://www.uh.edu/dos/parenting-students/), Parents and Family members of UH students (https://www.uh.edu/dos/parents/), and Sexual Misconduct Support Services (https://www.uh.edu/dos/sexual-misconduct-support-services/). A description of available support and resources are provided on the respective web pages. The Cougar Parent and Family Engagement Office is located in Student Center South, room B12.

Academic Honesty Policy

High ethical standards are critical to the integrity of any institution, and bear directly on the ultimate value of conferred degrees. All UH community members are expected to contribute to an atmosphere of the highest possible ethical standards. Maintaining such an atmosphere requires that any instances of academic dishonesty be recognized and addressed. The UH Academic Honesty Policy is designed to handle those instances with fairness to all parties involved: the students, the instructors, and the University itself. All students and faculty of the University of Houston are responsible for being familiar with this policy.

Excused Absence Policy

Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Class

Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Justin Dart, Jr. Student Accessibility Center. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor’s recordings for their own studying and notetaking. Instructor’s recordings are not authorized to be shared with anyone without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.