Course Name
Foundations and the Field of Engineering Education Syllabus
Course Description
This course is open to all graduate students at the master's and doctoral levels and is designed to prepare them for future studies and careers in engineering education. Students will develop a foundational understanding of engineering education research (EER), including its history, key theories, and research methodologies. They will explore critical issues such as diversity, equity, inclusion, ethics, the role of engineers in society, and the global landscape of engineering education. Through readings, discussions, literature reviews, and presentations, students will examine how educational theories inform engineering teaching and learning, critically evaluate research, and connect findings to practice. By the end of the course, students will begin to identify and refine their individual research interests within the field. This course provides a foundational understanding of engineering education and equips students with the knowledge and skills to contribute meaningfully to the discipline.
3-Hour Course Works
Approximately: o 1/3rd of the class will focus on instructor-led lectures and discussions on assigned readings, providing foundational knowledge on key topics in engineering education research. These sessions will help students engage with theoretical frameworks, research methodologies, and contemporary issues in the field. o 1/3rd of the class will focus on student-led presentations, discussions, and activities based on the readings, allowing students to critically engage with the material, explore diverse perspectives, and apply concepts through interactive exercises. This component will foster active learning, peer collaboration, and deeper comprehension of engineering education literature. o 1/3rd of the class will focus on workshops dedicated to literature reviews, where students will develop their ability to synthesize research, identify gaps in the literature, and refine their research interests. These sessions will provide guidance on structuring a literature review, evaluating sources, and integrating research findings effectively. This section will be flexibly scheduled based on actual class time; specific course topics are not included in the Instructional Plan but are included in the Literature Review Workshop worksheet.

Learning Objectives	Week	Assignment Category/Evidence	Feedback/Assessment
LO1: Summarize the characteristics and historical development of engineering education as a research field.	Week 1-3	Jigsaw discussion	None
LO2: Exam teaching & learning and research methodologies in engineering education.	Week 4-8	Leading Seminar Discussions 1	Summative: Instrutor's Assessment and Feedback
LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections	Week 9-14	Leading Seminar Discussions 2	Summative: Instrutor's Assessment and Feedback
LO4: Build a literature review paper on an engineering education research topic that interests students.	Week 1-16	Literature Review	Summative: Instrutor's Assessment and Feedback
LO5: Present the topics in engineering education with clear, concise,ac and well-structured presentations	Week 4-11, 16	Leading Seminar Discussions & Literature Review	Formative: Structured Peer Feedback

Assignment Category	Points
The Discussion Board assignment requires students to post weekly responses. For the Leading Seminar Discussions assignment, groups will be formed, and presentation dates will be scheduled during class. Students are expected to collaborate within their assigned groups to prepare and deliver their presentations on the selected date. Refer to Literature Review Workshop sheet for the literature review	
Class Participation & Preparation	**25 (In total)**
Class Participation (in conjunction with the Class Attendance policy)	*15%*
Each Week Questions for Reading on Discussion Board	*10%*
Leading Seminar Discussions (Group)	**30% (In total)**
Leading Seminar Discussions 1	*15%*
Leading Seminar Discussions 2	*15%*
Literature Review (Individual)	**45% (In total)**
Literature Trace	*5%*
Literature Review - Draft	*10%*
Literature Review - Final Paper	*15%*
Literature Review - Final Presentation	*15%*

Week	Class Topics	Learning Objective (s)	Activity Roles	Active Learning Techniques	Feedback/Assessment	Smart Teaching Rationale
1	What is Engineering Education	LO1: Understand the characteristics and historical development of engineering education as a research field.	Instructor: - Facilitate student introductions using an interactive icebreaker activity (e.g., "Two Truths and a Lie"). - Establish classroom norms through a collaborative discussion, where students propose and agree on shared expectations for engagement. - Present the syllabus, grading policies, assignment formats, and major deadlines. - Explain how group presentations will be structured and share the registeration form. - Provide an overview of engineering education as an interdisciplinary field (e.g., journals, key research questions). Student Activities: - Read assigned foundational texts on engineering education. Identify key takeaways and prepare to discuss them in class.	Clarification Pauses Brainstorm Large-Group Discussion	None	Smart Teaching #6 Based on the research showing that students' development and course climate interact to influence learning, I co-created classroom norms with the students.
2	The History of the Field - U.S. & Global 1	LO1: Understand the characteristics and historical development of engineering education as a research field.	Instructor Activities: - Facilitate a brainstorming session by asking students, "When did engineering education begin? What factors influenced its development?" Have students write their thoughts on a shared document or whiteboard and discuss common themes. - Provide an overview of the historical evolution of engineering education in the U.S.and introduce key historical milestones - Present a case study of a U.S. engineering school and its evolution, guiding students to analyze its unique challenges and adaptations. - Facilitate a large-group discussion where students reflect on their reading materials and discuss global influences on engineering education. Student Activities: - Read assigned foundational texts on the history of U.S. and global engineering education. - Participate in a think-pair-share discussion in the case study - Engage in a large-group discussion comparing U.S. engineering education with other national models.	Large-group discussion Think-pair-share Case Study	None	Smart Teaching #4: Based on the belief that developing mastery requires building component skills, integrating them, and knowing when to apply them, I designed specific classroom activities to prompt students to apply their knowledge.
3	The History of the Field - Global 2	LO1: Understand the characteristics and historical development of engineering education as a research field.	Instructor Activities: - Provide an overview of engineering education systems worldwide, highlighting major global trends - Facilitate a jigsaw discussion where each student group researches a specific country's engineering education system, focusing on historical developments, current challenges, and best practices. Student Activities: - Research the history of engineering education in a chosen country and prepare a brief summary for discussion. - Engage in a jigsaw discussion, where each group presents key insights on their assigned country's education system and learns from their peers about other models.	Jigsaw discussion	None	Smart Teaching #1: Based on the principle that students' prior knowledge can support or interfere with learning, I connected classroom activities to students' own interests and experiences.
4	Teaching and Learning in Engineering 1	LO2: Exam teaching & learning and research methodologies in engineering education. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Interactive Lecture on Learning Theories in Engineering Education (e.g., Constructivism, Cognitive Load Theory, Communities of Practice) - Live Demonstration "Too Much Information" Activity: gives students a complex engineering problem with no structure and asks them to solve it. After 5 minutes, redesigns the problem using cognitive load principles. - Discussion: How did the second version make learning easier? How does cognitive load theory apply to engineering courses? Think of a time when you struggled to learn something in an engineering class. Which learning theory could explain why? - Assesses the presenting group's performance Student Activities: - Students read assigned literature on engineering learning theories. - One designated student group prepares a reading summary and an interactive activity (e.g., case study discussion, role-playing, problem-solving exercise) based on the assigned material. The group submits their activity design to the instructor for feedback before class. - The presenting group delivers a 10-15 minute summary of their assigned readings, and then facilitate their designed activity. - The rest of the class should provide structured feedback to the presenting group based on: Clarity of their reading summary; Level of engagement and interaction created by the presenters. Feedback is in short written reflections and will be shared to the group.	Live Demonstration Think-Pair-Share Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
5	Teaching and Learning in Engineering 2	LO2: Exam teaching & learning and research methodologies in engineering education. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Lecture on Effective Teaching Strategies in Engineering Education (e.g., Active Learning Strategies; Problem-Based Learning (PBL); Flipped Classroom Model) - Guided Discussion Questions: What challenges exist in implementing active learning in engineering classrooms? What are the advantages and limitations of project-based learning? - A redesign activity: Students will redesign a traditional engineering lesson by applying one or more innovative teaching strategies from the assigned readings. - Assesses the presenting group's performance. Student Activities: Similar as Week 4	Case Study Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
6	Assessment	LO2: Exam teaching & learning and research methodologies in engineering education. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Lecture on Assessment Strategies in Engineering Education (e.g., Types of Assessment, Common Assessment Tools). - Challenges in Engineering Assessment and Alternative assessment models for engineering education. - Role-Playing Activity: "What Makes a Good Assessment?" Students take on different stakeholder roles (e.g., professor, student, industry recruiter, university administrator) in a faculty meeting to debate and design an ideal engineering assessment. They discuss priorities such as fairness, real-world relevance, and grading transparency. Each group develops a policy proposal outlining their preferred assessment methods and compromises to balance all perspectives. The class then presents and critiques these proposals, reflecting on the challenges of designing effective assessments in engineering education. Student Activities: Similar as Week 4	Role Play Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
7	Research Methods in EER 1	LO2: Exam teaching & learning and research methodologies in engineering education. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Overview of qualitative, quantitative, and mixed-methods approaches. - Introduction to theoretical frameworks commonly used in EER - Jigsaw Learning "Theory Experts": Each student is assigned one research theory from the readings. Students first meet in "expert groups" to discuss their assigned theory and prepare a summary. They then form new mixed groups, where each student teaches their theory to their peers. - The class discusses how different theories apply to various engineering education research contexts. - Gather student feedback on the course structure, teaching methods, and learning experience to assess engagement and identify areas for improvement. Student Activities: Similar as Week 4	Jigsaw Learning Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	Smart Teaching #4: Based on the belief that developing mastery requires building component skills, integrating them, and knowing when to apply them, I designed specific classroom activities to prompt students to apply their knowledge. Smart Teaching #5: Based on the finding that goal-directed practice and timely, targeted feedback enhance learning, I provided feedback on students' class presentations. Smart Teaching #7: Based on the principle that students become self-directed learners by monitoring and adjusting their learning strategies, I included student-led discussions and opportunities for them to provide feedback on their peers' presentations.
8	Research Methods in EER 2	LO2: Exam teaching & learning and research methodologies in engineering education. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Overview of survey design, interviews, observations, and secondary data analysis. - Speed Research Design Challenge: Instructor provides 3 different research problems in engineering education. Students group have 10 minutes to design a research study for one problem, specifying: Research question, Methodology, Data collection tools, Expected challenges. Groups present their designs in one-minute pitches, and the class votes on which design is most feasible. Student Activities: Similar as Week 4	Project-Based Learning Brainstorm Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
9	Diversity and Inclusion in Engineering 1	LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Introduce challenges of diversity and inclusion in engineering - Present demographic data and research findings on representation gaps in engineering - Effectiveness of Diversity Policies: Students participate in a debate, arguing for or against the effectiveness of current diversity initiatives in engineering education. Each side prepares evidence from the EED Handbook, research studies, and current news reports. Student Activities: Similar as Week 4	Case Study	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
10	Diversity and Inclusion in Engineering 2	LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Lecture on intersectionality in engineering education, discussing how multiple identities (e.g., gender, race, socioeconomic status, disability) influence students' experiences and opportunities in STEM fields. - Jigsaw Learning Activity, Diversity Frameworks in Engineering Education: Each group is assigned a different diversity framework or initiative (e.g., mentorship programs, inclusive curricula, workplace equity policies). After researching and discussing, students teach their findings to peers, synthesizing key takeaways for class-wide discussion. Student Activities: Similar as Week 4	Jigsaw discussion Large-Group Discussion	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
11	Engineering Education at the Intersection of Technology and Computing	LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Lecture on the evolving role of computing and technology in engineering education, covering topics such as digital simulations, artificial intelligence, and data-driven decision-making in engineering curricula. - Collaborate with the university's engineering lab or innovation center (e.g., OSU library) to arrange a hands-on VR session where students experience virtual engineering simulations (e.g., structural design modeling, circuit simulations, or fluid dynamics visualization). - Discussion on the ethical implications of computing in engineering, including issues such as algorithmic bias, data privacy, and the responsibility of engineers in designing equitable technology solutions. Student Activities: Similar as Week 4	Field Visit Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	
12	Engineering in the Workplace	LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections.	Instructor Activities: - Discuss the differences between academic training and workplace expectations in engineering. - Explore the balance between technical skills and soft skills (e.g., teamwork, leadership, and communication). - Facilitate a brainstorming session where students propose and vote on topics for the next two weeks, ensuring alignment with their interests and course objectives. - Industry Guest Speaker Panel (if feasible) Invite engineers from different industries to discuss their career experiences, challenges in the workplace, and the skills they wish they had learned earlier. - Facilitate a Q&A session where students engage with professionals about industry expectations and career growth. Student Activities: - Read and discuss real-world case studies on engineers adapting to industry expectations. - Identify key skills that facilitated or hindered success and propose strategies for improvement. Take on different engineering workplace roles and navigate challenges like team conflict resolution, ethical dilemmas, and project management. - Attend and Engage with Industry Guest Speakers (if applicable)	Role Play	None	Smart Teaching #4: Based on the belief that developing mastery requires building component skills, integrating them, and knowing when to apply them, I designed specific classroom activities to prompt students to apply their knowledge.
13	Integrating student interests to decide the topic	LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections.	Instructor Activities: TBD Student Activities: TBD	TBD	None	Smart Teaching #3: Based on the idea that students' motivation shapes their engagement and persistence in learning, I selected course topics based on their academic interests.
14	Integrating student interests to decide the topic	LO3: Exam major topics in engineering education, including inclusivity and diversity, technology integration, and workplace connections.	Instructor Activities: TBD Student Activities: TBD	TBD	None	Smart Teaching #3: Based on the idea that students' motivation shapes their engagement and persistence in learning, I selected course topics based on their academic interests.
15	*Thanksgiving Holiday*					
16	Literature Review Presentation	LO5 Write engineering education research literature. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations	Instructor Activities: - Provides a concise recap of the key skills developed throughout the course. - Evaluates student presentations based on clarity, synthesis, structure. - Facilitates a post-presentation discussion, encouraging students to reflect on their learning progress. Student Activities: - Deliver structured presentations, focusing on key themes, research gaps, and synthesis of literature. - Provide structured feedback to peers, evaluating clarity, synthesis, and presentation quality. - Reflect on their learning progress	Peer Review	Formative: Structured Peer Feedback Summative: Instrutor's Assessment and Feedback	Smart Teaching #5: Based on the finding that goal-directed practice and timely, targeted feedback enhance learning, I provided feedback on students' class presentations. Smart Teaching #7: Based on the principle that students become self-directed learners by monitoring and adjusting their learning strategies, I included student-led discussions and opportunities for them to provide feedback on their peers' presentations.

Week	Workshop Topic	Learning Objective (s)	Assignment Assigned	Assignment Due
1	What is a literature review?	LO4: Build a literature review paper on an engineering education research topic that interests students. LO5: Present the topics in engineering education with clear, concise, and well-structured presentations		
2	Topic Brainstorming			
3	Lecture search strategies		Literature Trace	
4	Abstract		Literature Review - Draft	
5	Peer review			
6	Peer review			Literature Trace
7	Positionality			
8	Peer review			
9	Findings - Part 1			Literature Review - Draft
10	Findings - Part 2		Literature Review - Final	
11	Peer review			
12	Discussion			
13	Peer review			
14	Peer review			
15	*Thanksgiving Holiday*			
16	Literature Review Presentation			Literature Review Presentation Literature Review - Final