

Abilene Approval Chart for Curriculum Changes

A = Approve I = Information Item R = Respond In Writing

Course Number: NSE 602 Nuclear Reactor Theory

or Degree Plan(s):

NSE 602 (Nuclear Reactor Theory) presents students with the theoretical underpinning of nuclear reactor operation, particularly the behavior of neutrons in nuclear systems. Students also learn computational methods for reactor analysis.

		Dept./School	College	Dean	TEC	AUAC/Grad	Provost
	Campus-Level Academic Review¹						
	Change to a Course Include signatures from all chairs/program directors for cross-listed courses. ¹						
1.	Title (description unchanged)	A	A	A	I	I	I
2.	Description (not affecting content)	A	A	A	I	I	I
3.	Course term(s)	A	I	A	I	I	I
4.	Content (change of course outcomes)	A	A	A	I	I	A
5.	Number of credit hours	A	A	A	A	A	A
6.	Course number within the hundred	A	A	I	I	I	I
7.	Course number beyond the hundred	A	A	A	A	A	A
8.	Prerequisites	A	A	A	I	I	I
9.	Course restriction (e.g., majors only, junior standing)	A	A	A	A	A	A
10.	Level change (U to G or G to U)	A	A	A	A	A	A
11.	Cross list course	A	A	A	A	A	A
12.	Department of record	A	A	A	A	A	A
13.	Open or close a course	A	A	A	A	A	A
	Change to a Degree Plan						
14.	Educational Program — Revise	A	A	A	A	A	A
15.	Educational Program — Adopt/revise admission requirements	A	A	A	A	A	A
16.	GPA — Revise program-required GPA	A	A	A	A	A	A
17.	Minor — Revise	A	A	A	A	A	A

		Dept./School	College	Dean	TEC	AUAC/Grad	Provost	Campus Faculty	Senior VPAA	President
	Full Review									
	Change to Catalog Information (for Campus)									
18.	General requirements for Bachelor's and Associate Degrees	-	-	-	-	A	A	A	A	I
19.	Policies governing academic probation and suspension	-	-	-	-	A	A	A	A	I
20.	Requirements for graduating with honors	-	-	-	-	A	A	A	A	I
	Change to a Degree Plan									
21.	Educational Program — Add or Discontinue ^{2 3}	A	A	A	A	A	A	A	A	I
22.	Educational Program — Discontinue (Provost-proposed)	R	-	R	A	A	A	A	A	I
23.	Minor — Add or Discontinue	A	A	A	A	A	A	-	A	I
24.	Minor — Discontinue (Provost-proposed)	R	-	R	A	A	A	-	A	I
25.	Degree — Add or Discontinue	A	A	A	A	A	A	A	A	I
26.	Degree — Discontinue (Provost-proposed)	R	-	R	A	A	A	A	A	I

		Dept./School	College	Dean	AUAC	Provost	UGEC	University Faculty	Senior VPAA	President
	Change to General Education Requirements for Undergraduates (System)									
27.	Change course outcomes of an included course	A	A	A	A	A	A	-	A	I
28.	Add or drop a required course from the General Education Requirements	A	-	A	-	A	A	A	A	I
29.	Add or drop a course from a menu within the General Education Requirements	A	-	A	-	A	A	-	A	I
30.	Comprehensive revision of General Education Requirements	-	-	-	-	A	A	A	A	I

Notes

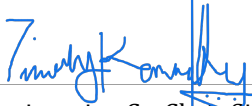
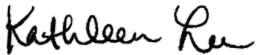
² Any change to a cross-listed course requires the signature of both department chairs or program directors overseeing the course to ensure that the courses stay in sync. This includes courses taught at other campuses (e.g. BIBL 101 and BIBO 101).

³ For undergraduate majors, a minimum of 30 hours is required. These programs must have a minimum of 6 elective hours, unless the requirements of external accrediting bodies make it impossible. Master's programs

must include a minimum of 30 hours, and doctoral programs must include a minimum of 30 hours beyond the master's.

⁴ When a department/school or dean proposes closing a program, approval routing follows the typical process beginning with the department/school. An administrative proposal by the provost or senior vice president for academic affairs would follow the "provost-proposed" routing on the chart.

Updated 8/1/2023

Department/School(s)	
	3/18/2026
Engineering Co-Chair Signature	Date
	March 18, 2026
Physics Co-Chair Signature	Date
	March 18, 2026
Chair/Program Director Signature	Date
College Academic Council(s)	
	March 18, 2026
Chair Signature	Date
Chair Signature	Date
Dean(s)	
	3/19/2026
Signature	Date
Signature	Date
Teacher Education Council	
Signature	Date
Campus Academic Council: Abilene Undergraduate or Abilene Graduate	
Signature	Date

Provost

Signature

Date

University General Education Council

Signature

Date

University Faculty

Abilene Faculty Senate Chair signature

Date

Dallas Faculty Council Chair signature

Date

Senior Vice President for Academic Affairs

Signature

Date

President

Signature

Date

Abilene New Course Application

You may delete the preceding instructional pages before submitting application.

Course ID (<i>Subject Code and Number</i>)	NSE 602
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1. Systems and Catalog Information Complete each item.

A	Course Developer	Jim Drachenberg
B	Course Instructor	Rusty Towell
C	Course Title	Nuclear Reactor Theory
D	Course Abbreviation for Banner if title is more than 30 characters	
E	College	OSE - Onstead Science and Engineering
F	Department or School	PHYS - Engineering & Physics
G	Number of Credit Hours	3
G1	Number of Lecture Contact Hours	3
G2	Number of Lab Contact Hours	0
H	Is the course for a fixed or variable number of credit hours?	Fixed If variable, explain rationale:
I	Is the course repeatable for additional credit?	No
J	Maximum total number of credit hours a student can earn for this course	3
K	Course Schedule Type	Lecture (LEC) See Schedule Type definitions in the Reference section.

L	Number of Faculty Workload Hours	3
M	Grading Mode	Standard
N	Maximum Enrollment	18
O	Catalog Description (50 words or less)	Steady-state and time-dependent multigroup diffusion theory, neutron balance equations, boundary conditions, criticality criteria, reactor kinetics, linear Boltzmann transport equation, scattering theory, angular flux, and multigroup approximations. Computational methods for particle transport and continuous-energy analysis. Multiphysics concepts and contemporary approaches to reactor simulation frameworks
P	List any prerequisites (course/s, test scores, class standing, major, etc.)	NSE 601
Q	List any corequisites (these <i>must</i> be taken at the same time; note that a single requirement cannot be both a prerequisite <i>and</i> a corequisite)	
R	If the course is cross-listed, specify the subject code and course number of the other course	
S	Does this course require any additional student course fees?	No If yes, attach a completed course fee form (see form "Request to Add or Change Course Fees").
T1	Will the course be offered in fall terms?	No
T2	Will the course be offered in spring terms?	Yes, every year
T3	Will the course be offered in summer terms?	No

U	First semester this course will be offered under new Course ID. <i>May not be earlier than the coming fall semester.</i>	Spring 2027
V	Is this course required for a program(s)?	Yes If yes, submit a separate completed curriculum proposal to change the program(s).
W	Should the addition of this course be retroactively applied to the degree plan it supports? <i>This is rare, and rationale should explain compelling extenuating circumstances.</i>	No If yes, provide rationale:
X	Has this course been offered as a Special Topics course? <i>New courses are not required to be taught as Special Topics courses prior to approval.</i>	No If yes, provide course ID, term, and enrollment:
Y	List any courses in which the content overlaps the proposed course. (Course ID and Name). <i>Attach a statement from the instructor/dept chair of the existing course justifying the new offering.</i>	

2. Curriculum

- A. Explain any effects of this course on any degree plans. If the addition of the course alters program requirements, submit a separate [Approval Chart for Curriculum Change](#) to update the program.

Graduate Nuclear Science and Engineering

NSE 602 added as required course in the new graduate NSE curriculum

- B. Justify the addition of this course to the current curriculum, explaining the gap it meets.

NSE 602 covers the detailed theoretical and computational foundations of nuclear reactors. As the introductory graduate course, NSE 601 will introduce basic concepts of neutron theory alongside many other foundational concepts in nuclear science and engineering. NSE 602 equips students with the deeper understanding of neutron theory and expands into the other aspects of reactor theory needed for their careers and success in the program, including research. There is currently no existing course at ACU that does this.

3. Course Design

A. Audience and Course Goal

1. Describe the intended audience, including prerequisite skills.

The intended audience is first-year graduate students in nuclear science and engineering. Prerequisite skills involve the introductory nuclear science and engineering concepts covered by NSE 601.

2. State the overarching course goal(s) in performance terms.

Students completing this course will demonstrate a solid understanding of the theoretical underpinnings of nuclear reactors by solving problems in neutron transport theory, multigroup diffusion, reactor kinetics, and applying the Boltzmann transport equation. They will demonstrate familiarity with Monte Carlo methods by applying numerical techniques to solve transport equations and to benchmark models. Students will describe how neutronics couples with thermal-hydraulics and fuel depletion and explain the role of feedback modeling and simulation frameworks in analyzing heterogeneous reactor systems.

B. Student Learning Outcomes and Measurements

	Student Learning Outcome	Measurement
1	Students <u>apply</u> theoretical principles of nuclear reactors to <u>solve</u> neutron transport problems	Homework, Exams
2	Students <u>apply</u> numerical techniques to <u>solve</u> transport equations and <u>analyze</u> models	Homework, Exams
3	Students <u>describe</u> how neutronics couples with thermal hydraulics and fuel depletion	Homework, Exams
4	Students <u>explain</u> the role of feedback modeling and simulation in reactor systems	Homework, Exams
5	Students <u>apply</u> simulation frameworks to <u>analyze</u> heterogeneous reactor systems	Homework, Exams

C. Text and Resources

Give the full publication information of the textbook/s and other required resources and outside readings. For **combined undergraduate/graduate** courses, make two lists:

- A. full publication information; label **Undergraduate**.
- B. full publication information; label **Graduate**.

Nuclear Reactor Analysis, James J. Duderstadt and Louis J. Hamilton, Wiley, 1976, ISBN 978-0-471-22363-4

4. Supporting Documentation

Required of all applications	
1	Approval Chart for Curriculum Changes
2	Syllabus — Attach the syllabus for the course based upon the anticipated first-semester offering.
4	Library — Submit new course application and syllabus to the Library dean's office. Attach the Library's memo.
Attach if applicable	
5	Content Overlap — Include one document for each course you listed in Section 1Y. Attach statement from instructor/dept chair of existing course justifying the new offering.
6	Departmental Resources — List the resources that support the course and are available only through the department, if applicable. Attach the list of the holdings and the location(s).
7	Resources — List resources (other than library or departmental resources) that are needed to support this course (computers, lab equipment, other technology, etc.). Attach a complete list of all items and indicate possible sources or estimated cost of each. List the sources of any needed funds.
8	Expenses — List additional expenses needed to implement this course (full-time or part-time faculty, graduate or lab assistants, student employees, travel, special student costs, room renovation, storage facility, etc.). Attach a complete list of all items, the estimated cost of each and the source of the funds.
9	Justification — Attach any documents to which you refer in Section 2B.

Nuclear Reactor Theory

Instructor: Dr. Rusty Towell (rusty.towell@acu.edu)

About the Course

In this course, we discuss the theoretical and computational foundations of nuclear systems, particularly focusing on neutron behavior. You will develop a solid understanding of neutron transport theory and familiarity with using numerical techniques to analyze reactor systems.

Course number and title: NSE 602 –Nuclear Reactor Theory

Credit hours: 3

Semester and year: Spring 2027

Meeting time: Tuesdays and Thursdays at 9:30-10:50 AM

Meeting place: Onstead Science Center (OSC) 345

For your convenience, here is a [link to the ACU campus map](#)

Prerequisites/corequisites: NSE 601

Catalog description: Steady-state and time-dependent multigroup diffusion theory, neutron balance equations, boundary conditions, criticality criteria, reactor kinetics, linear Boltzmann transport equation, scattering theory, angular flux, and multigroup approximations. Computational methods for particle transport and continuous-energy analysis. Multiphysics concepts and contemporary approaches to reactor simulation frameworks.

Intended audience: First-year graduate students in nuclear science and engineering.

About the Teacher

Instructor: Dr. Rusty Towell, Professor, Director of NEXT Lab

Office location: Dillard Science and Engineering Research Center (DEC) 205A

Phone number(s): (325) 674-2034

Email address: rusty.towell@acu.edu

Office hours/Contact expectations: MWF 3:00 – 4:00 PM or by appointment

Mission Statements

ACU Mission: The mission of Abilene Christian University is to educate students for Christian service and leadership throughout the world.

College Mission: The mission of the Onstead College of Science and Engineering is to explore and understand God's creation in the natural world and apply the acquired knowledge and principles to address its issues and challenges. The college offers programs in the natural sciences, engineering, and mathematics. These programs combine the rigor of scientific and technical disciplines with the critical thinking, ethical reasoning, and spiritual perspectives that are central to a Christian liberal arts education.

Department Mission: To prepare graduate students for impactful careers across the spectrum of nuclear science and engineering by equipping them with deep scientific knowledge, cutting-edge research experience, and versatile technical and professional skills. The program emphasizes integrity, leadership, and service, modeled through rigorous academic standards and Christian values, while promoting innovation, interdisciplinary collaboration, and professional excellence within the evolving field of nuclear science and engineering.

Unique Christian Perspective:

“Lord, how many are Your works!
In wisdom You have made them all;
The earth is full of Your possessions.”
—Psalm 104:24

In NSE 602, we develop a solid understanding of the theoretical underpinnings of nuclear reactors. As our questions and problems become more realistic, we quickly encounter scenarios that cannot be solved without numerical approximations. We are on the one hand reminded of the vast wisdom of God in creating natural laws of this sophistication. At the same time, we marvel that in His grace He gives us minds that sync with these laws and tools to navigate them successfully enough to design, innovate, and ultimately bless the world. May we be good stewards of the portions of wisdom He shares with us through this study!

Course Content

Outline of topics:

- Steady-state and time-dependent multigroup diffusion theory
- Neutron balance equations
- Boundary conditions
- Criticality conditions
- Reactor kinetics
- Linear Boltzmann transport equation
- Scattering theory
- Angular flux
- Multigroup approximations
- Computational methods for particle transport and continuous-energy analysis
- Multiphysics concepts
- Contemporary approaches to reactor simulation frameworks

Format of Class

Format of Class: Nuclear Reactor Theory is delivered in a traditional, face-to-face lecture format. You will be given readings to complete prior to class time. We will present example problems as well as questions designed to generate discussion with your peers. Come ready to ask questions and engage class discussion!

On-line: If we ever need to meet on-line, we will use Zoom. In such instances, we will generally meet during our normal class times and do our best to recreate the face-to-face experience. In light of this, it is extremely important that you continue to come prepared.

Instructional Materials

Course texts:

Nuclear Reactor Analysis, James J. Duderstadt and Louis J. Hamilton, Wiley, 1976, ISBN 978-0-471-22363-4

Modelling of Nuclear Reactor Multi-physics: From Local Balance Equations to Macroscopic Models in Neutronics and Thermal-Hydraulics, Christophe Demazière, Academic Press, 2019, Paperback ISBN: 9780128150696, eBook ISBN: 9780128150702

Learning Outcomes

Student Learning Outcome	Measurement
1 Students <u>apply</u> theoretical principles of nuclear reactors to <u>solve</u> neutron transport problems	Homework, Exams
2 Students <u>apply</u> numerical techniques to <u>solve</u> transport equations and <u>analyze</u> models	Homework, Exams
3 Students <u>describe</u> how neutronics couples with thermal hydraulics and fuel depletion	Homework, Exams
4 Students <u>explain</u> the role of feedback modeling and simulation in reactor systems	Homework, Exams
5 Students <u>apply</u> simulation frameworks to <u>analyze</u> heterogeneous reactor systems	Homework, Exams

Assessment and Grading

Assessment activities: Your course grade is determined from assignments and exams. Approximate weights are as follows:

Weekly Homework Assignments	25%
Exam 1	25%
Exam 2	25%
Final Exam	25%

Final grade calculation:

Range of Points	Final Letter Grade
90%-100%	A
80%- 89%	B
70%-79%	C
60%-69%	D
Below 60%	F

Rules for discussing grades: Please respect the privacy of your peers and do not pressure your classmates to discuss their grades with you. I welcome the opportunity to discuss any of your grades. Grades are considered set two weeks after the grades have been posted to Canvas. Any objection must be received prior to conclusion of the two-week period, otherwise I will assume you consent to the posted grade.

Weekly Homework: Each week you will be assigned a set of homework problems to complete. You will generally be given one week to complete the assignment. Problems will be drawn from a variety of sources, including the course textbook, original problems written by your instructor, and real-life scenarios. By attaching your name to the assignment, it is expected that you are capable of reproducing the solution independent of your classmates or other tools such as AI.

In-class Exams: Twice during the semester, you will be given a written exam to be completed in class. The exam will draw from assigned problems, example problems, lectures, and outside readings. The exams are to be completed without assistance of your classmates. You will be provided instructions on any approved external aids.

Final Exam: You will be given a cumulative final exam during the standard final exam time for the class. You will complete the exam without assistance of your classmates. You will be provided instructions on any approved external aids.

Use of unapproved external aids on homework or exams is a violation of academic integrity.

University Resources

I care about your class experience. The university also has a number of resources in place to support the ACU community both in this class and all aspects of university life.

Reporting Violations / Concerns / Complaints

Incident reports alleging violations of Student Conduct or concerns/complaints can be submitted [here](#). Please use the form to submit information about an incident to Student Life / Office of the Dean of Students.

SOAR (Student Opportunities, Advocacy, and Resources):

SOAR partners with faculty, staff, parents and students to assist ACU students and connect them to resources available to support their path to success. For more information about SOAR or to make a SOAR recommendation, see <https://acu.edu/soar-program/>.

Mental Health Resources

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. Abilene Christian University is committed to supporting students addressing any of these concerns.

You can contact the [Medical and Counseling Care Center](#) at counseling@acu.edu, or by calling 325-674-2626. In addition, you can access free confidential counseling services through the Timely Care app by downloading their app on any device. In a crisis situation contact the National Suicide Prevention Hotline open 24/7 by dialing 988, or call the Police at 911.

University Policies

ADA Compliance Policy:

Abilene Christian University is dedicated to removing barriers and opening access for students with disabilities in compliance with ADA and Section 504 of the Rehabilitation Act. The ACU website provides more information at <https://acu.edu/about/uap/overview-2/about-2/>. Please contact me to discuss any approved accommodations that you require for this class.

Title IX Policy:

At ACU, we strive to comply with all applicable legal requirements prohibiting, preventing, and responding to sexual misconduct against any member of the ACU community. The full Title IX policy and process can be found at <https://acu.edu/human-resources/title-ix-and-sexual-misconduct-information/>.

Academic Integrity Policy:

Academic integrity is demonstrated by behavior that honors the learning environment, regardless of setting, context, location or modality. ACU's Academic Integrity Policy can be found at <https://acu.edu/office-of-the-provost/academic-policies/>.

Course Policies

Attendance/tardiness: Please do not attend in person if you feel ill, are experiencing symptoms of illness, or have a confirmed exposure to someone with a contagious illness, e.g., COVID-19. At your earliest convenience, please let me know that you need to join remotely. Our class will be accessible to you in a virtual environment, and I will work with you to ensure you have access to the necessary course material and a reasonable opportunity to submit assignments for full credit. Unless you are ill, taking precautions for illness, or engaged in a university-approved activity, daily attendance is *essential*. If you need to be absent, notify me **beforehand**. If you cannot notify me beforehand, contact me as soon as possible to let me know the reason. Regardless of absence, you are responsible for the material. If absent from a presentation, your grade will be zero unless I grant prior approval. You must be on-time to class. Persistent tardiness is grounds for a reduction in your overall grade.

Participation: Participation in class is critical for you, your peers, and for me to be the effective instructor you deserve. Participation is considered in your final grade assessment. Misconduct in class will not be tolerated. Mistreatment of others, including breach of verbal decorum, is grounds for removal from class. Refer to the [ACU student handbook](#) for more information on such policies.

Late assignment/exams: No late assignments will be accepted.

On-line Decorum: Just as you treat people with respect in the classroom, I expect you to extend that respect to on-line forums, as well. Exercise the Golden Rule with liberality and give each other the benefit of the doubt, when possible.

Dress Code: Please follow the student guide. If you are unsure, do not wear it. Respect your classmates. I reserve the right to ask you to remove hats, e.g., during exams.

Drop Policy: All university policies and deadlines must be followed.

Technology use: Cell phones, laptops, iPods, or other electronic devices are not allowed in face-to-face class unless we use them corporately. If I determine your electronic device is disturbing the class or distracting you or others, whether in a face-to-face or virtual setting, you will be dismissed. If such distractions become a pattern, I will not hesitate from further action, including expulsion from the course.

Academic Integrity: DO. NOT. CHEAT. All university policies concerning academic misconduct—including plagiarism and cheating—apply implicitly to all assessment activities whether or not it is explicitly stated on the assignment. Additionally, I expect you to report academic misconduct if you witness it. ***Failure to report academic dishonesty is considered academic dishonesty, at my discretion.*** Assignments submitted in your name must reflect your original work. Copying the work of *anyone*, past or present, is a

violation of Academic Integrity and will lead to disciplinary action including but not limited to loss of credit, course grade reduction, and automatic course failure.

AI: Machine learning and artificial intelligence are increasingly important tools that show up in ways we may not even realize. Generative AI, e.g., Chat-GPT, has raised challenging questions related to education and ethics. It will likely be many years before we begin to understand the impact on student learning. While there is no one-size-fits-all solution and policies will surely evolve, at this time, the use of generative AI is not authorized as a tool in my class. The goal in my course is not to get you to the point where you can tell a bot to solve or write something for you. My goal is to help you develop the skills to think critically and write scientifically, yourself. In general, generative AI is also not authorized as a tool for writing code or solving problems. If you believe that use of generative AI is essential to your assignment, you must discuss it with me before using it as a tool. In your professional life, you will almost certainly use AI as an aid. We want you to be fully equipped to understand and evaluate the quality of the information it provides you. To that end and at this time, use of generative AI is a violation of academic integrity.

Calendar

Refer to Canvas Calendar for the most up-to-date information. Modules are already in place for each week's activity. Please refer to the [university academic calendar](#) for key dates relevant to our campus.

DATE	TOPICS COVERED	Assignment
Week 1	Fundamentals, physics of nuclear fission, and fission chain reactions	HW 1
Week 2	Neutron modeling methods, transport, and diffusion theory	HW 2
Week 3	Diffusion theory applications	HW 3
Week 4	Diffusion theory applications and multigroup methods	HW 4
Week 5	Applications to reactor configurations	HW 5
Week 6	Reactor kinetics	Exam 1
Week 7	Reactor modeling	HW 6
Week 8	Feedback methods	HW 7
Week 9	Buildup and depletion calculations	HW 8
Week 10	Reactor operation analysis	HW 9
Week 11	Nuclear fuel cycles	Exam 2
Week 12	Thermal hydraulics	HW 10
Week 13	Thermal hydraulics	HW 11
Week 14	Design principles and Multiphysics modeling	HW 12
Week 15	Design principles and Multiphysics modeling	
Finals Week	Final Exam during the scheduled time	



January 8, 2026

Dr. Mark DeHart
Associate Professor
Director, Nuclear Science and Engineering Graduate Program
Onstead College of Science and Engineering
(325) 674-2066

Re: Review of Nuclear Reactor Theory (NSE 602)

Dear Dr. DeHart,

Thank you for submitting Nuclear Reactor Theory (NSE 602) to us for review. I have reviewed it based on the ACU Syllabus Guidelines. I found the syllabus to meet all aspects of the checklist.

Please note that this letter is intended as a reference, which will be read by the department chair and members of the council, who may also have questions or comments of their own. If you have any questions, please feel free to let me know.

Please also let me know if we can be of any help in the design and facilitation of this course.

Sincerely,

A handwritten signature in black ink that reads 'Amy Boone'. The signature is written in a cursive, flowing style.

Amy Boone M.Ed.,
Teaching and Learning Specialist, Adams Center

ABILENE CHRISTIAN UNIVERSITY

LIBRARY

M E M O R A N D U M

DATE: December 12, 2025
TO: Dr. Mark DeHart
FROM: Mark McCallon, Associate Dean for Library Services
RE: Course Application for NSE 602 – Nuclear Reactor Theory

After reviewing the course application and syllabus, the library can support the proposed course. Please contact Mark McCallon (mccallonm@acu.edu), Librarian Liaison to the Department of Engineering and Physics, if you will require additional library resources in the future to support the course. Thank you for letting us review the course application and syllabus.