UNIVERSITY OF CENTRAL ARKANSAS
ACADEMIC ASSESSMENT PLAN
Requirements, Template, and Example

Requirements

1. *Submit with New Program Proposal*
    a. *Programs are encouraged to consult with the Office of University Assessment.*
    b. *Contact information assessment@uca.edu*
2. *Send copy of Assessment Plan to the Office of University Assessment, Wingo 215.*
3. *Update the Program Assessment Plan based upon EAPR or Accreditation Cycles.*

Basic Information

Program Name: BS in Physics

College: COSE

Department: Physics, Astronomy, and Engineering

Program Level (check all that apply)

- ☐ Associate's
- ☐ Bachelor's
- ☐ Undergraduate Certificate
- ☐ Master's
- ☐ Doctoral
- ☐ Graduate Certificate

Date Plan Submitted: Nov 4, 2026

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College Curriculum Committee Chairperson & Email: Hal Halvorson, hhalvorson@uca.edu
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1. **Introduction** (identify college, unit, and degree programs)

The BS in Physics program is designed to educate students in concepts, knowledge, and methods of physics in both theoretical and experimental areas. Program graduates should be well prepared to succeed in their future endeavors, whether they pursue graduate studies or enter the work force.

The mission of the Department of Physics and Astronomy is to provide UCA students with an exemplary education in physics and astronomy, to advance knowledge and understanding of physics and astronomy, and to provide information and services regarding physics and astronomy to the public.

Please note: this mission statement needs to be updated and is on the to do list for the newly named Department of Physics, Astronomy, and Engineering.

2. Student Outcomes

1. Students will articulate physics principles and solve problems through clear written reports and oral presentations using standard scientific vocabulary.

2. Graduates will analyze quantitative data to solve real-world physical and technical problems.

3. Graduates will be able to design experiments, collect and analyze experimental data, and draw evidence-based conclusions.

4. Students will be able to construct and validate computational or theoretical models to simulate physical systems.

5. Graduates will analyze and explain physical phenomena using qualitative reasoning and core physics concepts

3. Assessment Cycle

Data will be collected each semester. Data will be analyzed every 3 years to match with Academic Assessment Committee's Reporting cycle.

4. Curriculum Map

	SLO1	SLO2	SLO3	SLO4	SLO5
1100 PROJECTS IN PHYSICS					
1301 INTRODUCTION TO PHYSICS					
1441 UNIVERSITY PHYSICS 1	I	I	I	I	I
1442 UNIVERSITY PHYSICS 2	R	R	R	R	R
2320 INTRODUCTORY COMPUTATIONAL PHYSICS	E		E	E	
2430 COLLEGE PHYSICS 3	R	R	R		R
2443 UNIVERSITY PHYSICS 3	R	R	R		R
3210 EXPERIMENTS IN PHYSICS 1	R	R	R	R	R
3220 EXPERIMENTS IN PHYSICS 2	R	R	R	R	R
3341 MATHEMATICAL METHODS IN PHYSICS					
3342 MECHANICS	R			R	E
3343 THERMAL PHYSICS	R	R	R	R	R
3345 OPTICS	R	R	R	R	R

3353 QUANTUM THEORY 1					
3354 QUANTUM THEORY 2					
3360 ELECTROMAGNETISM 1	R	E		E	E
3361 ELECTROMAGNETISM 2	E	E	R	E	E
3412 INTRODUCTION TO BIOPHYSICS	E	R	R	R	E
4V02 TOPICS IN THEORETICAL PHYSICS					
4V03 SPECIAL PROBLEMS IN PHYSICS					
4V04 SPECIAL PROBLEMS IN ASTRONOMY	E	E	E	E	E
4110 SENIOR LABORATORY					
4111 SENIOR CAPSTONE 1	E	E	E	E	E
4211 SENIOR CAPSTONE 2	E	E	E	E	E
4341 ADVANCED MATHEMATICAL PHYSICS					
4351 COMPUTATIONAL PHYSICS	E		E	E	
4380 INTERNSHIP IN APPLIED PHYSICS					

5. Assessment Methods and Measures (Formative and Summative recommended)

- Record the assessment measure(s) that evaluate each student learning outcome (note: each learning outcome should have an associated assessment measure).

SLO 1: Students will articulate physics principles and solve problems through clear written reports and oral presentations using standard scientific vocabulary.

In Capstone 1 and 2 students are to complete a year-long research/design project. Students must present their research results in both written and oral formats. All students will make an oral presentation to the department at the end of the term. Students will gain experience identifying a research question and designing an experiment to study it.
The rubric to assess oral presentations is in Appendix A. The written document will be assessed via the UCA Core Written Rubric.

SLO 2: Graduates will analyze quantitative data to solve real-world physical and technical problems.

Sample questions of exam problem solving attempts will be scored with a problem-solving scoring rubric (Appendix B), in upper division elective courses, which measures the following aspects of a problem solution:

Useful Description: Drawing pictures, drawing motion/force diagrams, writing knowns and unknowns, identifying target variables
Physics Approach: Identifying correct physics principles to approach the solution
Specific Application of Physics: Correctly applying chosen physics principles to specific aspects of problem
Mathematical Procedures: Correctly performing mathematical methods (e.g. algebraic derivation, calculus derivation)
Logical Progression: Clearly expressing the entire solution with a logically connected focus.

SLO 3: Graduates will be able to design experiments, collect and analyze experimental data, and draw evidence-based conclusions.

This SLO will be assessed in Capstone 2. Students will be assessed based on their research project as the end of this class using an Experimental Design Rubric found in Appendix C.

SLO 4: Students will be able to construct and validate computational or theoretical models to simulate physical systems.

This SLO will be assessed in Capstone 2. Students will again be assessed on the computational or theoretical models created during their research projects. The rubric is in Appendix D.

SLO 5: Graduates will analyze and explain physical phenomena using qualitative reasoning and core physics concepts

This SLO will be assessed in Capstone 2, using nationally recognized and externally validated conceptual physics exams like Force Concept Inventory, Mechanics Baseline Test, Conceptual Survey of Electricity and Magnetism (Appendix E).

6. Data Collection and Review

- When will data be collected for each outcome?
  - Data will be collected at the end of each semester
- How will data be collected for each outcome?
  - Instructors of each course will assess artifacts using the rubrics described in this plan. With the exams, the assessment committee will acquire the artifacts from the instructors and score according to the exam instructions.
- What will be the benchmark/target for each outcome?
  - With no student learning outcome data, the benchmark for each SLO will be 75% of students will score 75% or better on each rubric or exam.
- What individuals/groups will be responsible for data collection?
  - BS in Physics Assessment Committee

7. Participation in Assessment Process

- Who will participate in carrying out the assessment plan?
  - All instructors involved in teaching Physics majors will participate.
- What will be their specific role/s?

- The Assessment committee will organize the process, requesting data submission from instructors, compiling and analyzing the data, and finally presenting the results and changes to curriculum or assessment plan.

8. Data Analysis

- How will the data and findings be shared with faculty?
  - At a faculty meeting early fall after the 3rd year of data collection
- Who was involved in analyzing the results?
  - BS in Physics Assessment Committee
- How are results aligned to outcomes and benchmarks?
  - BS in Physics Assessment Committee will determine average scores (from three years of courses) for each assessment. There is one assessment or rubric for each Student Learning Outcome. If a benchmark is not met, then we will proceed to Part 9.

9. Plan for Using Assessment Results to Improve Program

- How will you use the results to improve your program?
  - If we fall below our benchmark or close to our benchmark we will determine where the specific weaknesses lie. From there we will implement workshops or alter curriculum as needed. If we are significantly higher than our benchmark we will determine whether we should raise benchmarks.

10. What are the plans to evaluate students' post-graduate success?

We plan to use alumni surveys 1 year post graduation.

11. What are the plans to evaluate teaching effectiveness?

Teaching effectiveness is automatically assessed by students meeting benchmarks as described above. If there are significant concerns and curriculum redesign does not mitigate these, the department will implement peer teaching review and the department chair can review student teaching evaluations.

12. Appendices-Required….Curriculum Maps by Program, Assessment Tools (examples: Rubrics, Surveys, Tests, etc.), any other important materials/documentation

13. Submit Assessment Plan

- Send completed form electronically to assessment@uca.edu

For questions or concerns please contact:
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Appendix A: Presentation and Oral Defense Rubric

Student Name:_____

Project Name:_____

Criterion	Excellent (4 pts.)	Solid (3 pts.)	Questionable (2 pts.)	Unsatisfactory (1 pt.)
CONTENT				
Introduction and Background (introduction of topic, background knowledge)	Knowledgeable of content and includes an engaging and detailed introduction and background	Knowledgeable of content and includes satisfactory introduction and background	Somewhat knowledgeable of content and is missing an introduction and/or some background	Some content facts seem questionable and is missing introduction
Description of Instrument (e.g. apparatus, code)	Knowledgeable of instrument, describes with detail and clarity	Knowledgeable of instrument and able to describe it accurately	Somewhat knowledgeable of instrument, missing some needed description	Understanding of instrument is questionable, lack of explanation about how it works
Current Progress (results thus far)	Describes progress in detailed fashion and has made satisfactory progress	Describes progress done thus far clearly, has made satisfactory progress	Is somewhat unclear about progress thus far, and/or has made questionable progress	Is very unclear about progress thus far, and/or has made unsatisfactory progress
Future Research (effectively the conclusion)	Describes results' implications, limitations, and future progress clearly and in full detail	Describes results' implications, limitations, and future progress adequately	Only somewhat describes results' implications, limitations, and future progress	Does not adequately discuss results' implications, limitations, and future progress
PRESENTATION				
Flow and Polish	The speech flows nicely and in full coherent train of thought, spoken clearly and with polish	The speech flows consistently with a little bit of disorganization, frequent "um-uh" pauses	The speech appears somewhat disjointed, noticeable stuttering or mumbling	The speech is disorganized and difficult to follow; speaker appears lost at times or can't be understood
Visual Aid	The visual aid complements the speech and is neat colorful and creative	The visual aid connects to the speech and is mostly neat, colorful and creative	The visual aid somewhat connects to the speech and is somewhat neat, colorful and creative	The visual aid does not connect to the speech and is messy, lacks color and creativity

Time	Speech is given within 1 minute of the time allotted	Speech is 1-2 minutes short or over the allotted time	Speech is 2-3 minutes short or over the allotted time	Speech is over 3 minutes short or over the allotted time

Comments:

Senior Capstone
Presentation and Oral Defense Rubric (page 2/2)

Notes for interpreting "content" criteria:

A "4" should indicate the student has "ownership" of the given criterion – in other words, the student has really mastered it to the point of being able to talk about it independently of the adviser.

A "3" should indicate the student has a functional understanding of a given criterion; the student is able to explain what's going on, but might not be clear on certain details, and possibly needs the adviser's explanation on minor details.

A "2" should reflect that the student has significant issues with a given criterion. There would be adequate coverage in some ways, inadequate in others; or alternately there is a "bare minimum" working knowledge that the student exhibits, but little to nothing further than this. This might require the adviser to offer more detailed explanations.

A "1" should reflect that the student has effectively failed to meet the criterion's expectations. The content knowledge would be questionable, and/or the discussion of it would be too lacking.

Appendix B: Problem-Solving Scoring Rubric
Student Name:_____

Course:_____ Topic:_____

Aspect	5 pts.	4 pts.	3 pts.	2 pts.	1 pt.	0 pts.	N/A
Useful Description	Useful, appropriate, and complete	Useful, but contains minor omissions or errors	Significant parts are not useful, missing, and/or contain errors.	Mostly not useful, missing, and/or incorrect	Entirely not useful and/or incorrect	Absent from solution, even though it is necessary for this problem and solver	Unnecessary for problem structure and/or solver's correct attempt.
Physics Approach	Appropriate and complete	Mostly appropriate with minor omissions or errors	Significant parts of physics concepts and principles are missing and/or inappropriate	Most of the concepts and principles are missing and/or inappropriate	All of the concepts and principles are inappropriate	Absent from solution, even though it is necessary for this problem and solver	Unnecessary for problem structure and/or solver's correct attempt.
Specific Application of Physics	Appropriate and complete	Mostly appropriate with minor omissions or errors	Significant parts of physics applications are missing and/or contain errors	Most of the physics applications are missing and/or contain errors	Entire specific application is inappropriate and/or contains errors	Absent from solution, even though it is necessary for this problem and solver	Unnecessary for problem structure and/or solver's correct attempt.
Mathematical Procedures	Appropriate and complete	Mostly appropriate with minor omissions or errors	Significant parts of procedures are missing and/or contain errors	Most procedures are missing and/or contain errors	All procedures are inappropriate and/or contains errors	Absent from solution, even though it is necessary for this problem and solver	Unnecessary for problem structure and/or solver's correct attempt.

Logical Progression	Entire solution is clear, focused, logically connected	Entire solution is clear and focused, minor consistency issues	Significant parts of the solution are unclear, unfocused, and/or inconsistent	Most of the solution is unclear, unfocused, and/or inconsistent	Entire solution is unclear, unfocused, and/or inconsistent	No evidence of logical progression, even though it is necessary for this problem and solver	Unnecessary for problem structure and/or solver's correct attempt.
TOTAL POINTS:							
PERCENTAGE = (TOTAL POINTS)/(TOTAL POSSIBLE POINTS) x 100% *(in case of 1 or more categories being N/A)*							

Comments:

Appendix C: Experimental Design Rubric

Evaluation Criteria	Exemplary (4)	Proficient (3)	Developing (2)	Unsatisfactory (1)
1. Experimental Design	Formulates clear, testable hypotheses. Identifies and controls all relevant variables. Designs a rigorous, safe, and reproducible methodology with appropriate sample sizes and controls.	Formulates testable hypotheses. Identifies key variables and controls most of them. Methodology is clear, reproducible, and generally sound with minor gaps in controls or sample size.	Formulates vague or partially testable hypotheses. Identifies some variables but omits key controls. Methodology lacks sufficient detail for exact replication.	Fails to state a clear hypothesis. Variables and controls are omitted or incorrect. Methodology is flawed, unsafe, or impossible to replicate.
2. Data Collection	Executes procedures accurately and systematically. Uses appropriate tools/instruments correctly. Records data meticulously with clear labeling, units, and estimated uncertainties.	Executes procedures with minor errors. Uses tools correctly. Records complete data with appropriate labeling and units, missing only minor details (e.g., uncertainties).	Executes procedures with noticeable procedural errors. Omits key measurements or records data haphazardly (e.g., missing units or labels).	Fails to collect necessary data or uses equipment incorrectly, leading to invalid or corrupt data sets.
3. Data Analysis	Applies correct quantitative/qualitative analysis techniques (e.g., statistical tests, curve fitting). accurately represents data via clear, properly formatted figures/tables. Correctly accounts for error/uncertainty.	Applies appropriate analysis methods with minor analytical or formatting errors. Graphs/tables are clear and correctly labeled. Basic error analysis is present.	Applies inappropriate or incomplete analysis techniques. Displays data in confusing or mislabeled charts/tables. Ignores error or uncertainty.	Incorrect or missing analysis. Raw data is presented without processing, or representations (graphs/tables) are inaccurate and misleading.

Evaluation Criteria	Exemplary (4)	Proficient (3)	Developing (2)	Unsatisfactory (1)
4. Evidence-Based Conclusions	Draws logical conclusions directly supported by the data. Critically addresses hypotheses, sources of error, limitations, and practical/theoretical implications.	Draws valid conclusions supported by data. Directly addresses the original hypotheses and identifies major sources of error or limitations.	Draws conclusions that are only partially supported by data or overreached. Briefly mentions errors without critical reflection.	Conclusions are unsupported by the data, missing, or driven by personal opinion rather than experimental evidence.

Appendix D: Model Formation Rubric

Performance Dimension	Exceeds Expectations (4)	Meets Expectations (3)	Developing (2)	Unsatisfactory (1)
1. Model Formulation & Assumptions	Formulates a rigorous model rooted in core physical laws. Explicitly states and justifies all simplifying assumptions, boundary conditions, and approximations.	Formulates a valid model based on relevant physical principles. States main assumptions and boundary conditions clearly.	Formulates a partially correct model with minor physics errors. States assumptions but fails to justify them or omits key boundary conditions.	Model is missing, mathematically flawed, or misapplies core physical principles. Ignores essential assumptions.
2. Implementation & Execution	Translates physics into code or theory flawlessly. Computational setup is efficient, robust, well-documented, and handles edge cases gracefully.	Correctly implements the mathematical/computational model. Code or theoretical derivation runs smoothly with minor style or efficiency issues.	Implements model with errors that cause partial failure, incorrect outputs, or require heavy debugging/manual intervention.	Implementation fails to run or contains fundamental theoretical errors that prevent model execution.
3. Model Validation & Verification	Rigorously validates model against experimental data, known analytical limits, or benchmark solutions. Performs thorough error/uncertainty analysis.	Validates model against relevant reference data or limit cases. Identifies basic discrepancies between simulation and reality.	Performs superficial validation (e.g., checks only one case). Acknowledges errors but does not analyze sources of discrepancy.	No validation attempt is made, or invalid claims are made without checking against known results or physical limits.

Performance Dimension	Exceeds Expectations (4)	Meets Expectations (3)	Developing (2)	Unsatisfactory (1)
4. Analysis & Physical Interpretation	Extracts deep physical insight from model results. Accurately explains systemic behavior, sensitivity to parameters, and limits of model validity.	Explains model output accurately in physical terms. Correctly interprets primary trends, parameters, and key system behaviors.	Describes output mechanically (describes graphs/numbers) with limited physical interpretation or incorrect reasoning about trends.	Misinterprets results completely or fails to connect model output back to the real-world physical system.

Appendix E: Gemini description of chosen physics exams

These are **physics concept inventories**—standardized diagnostic tests used in physics education research (PER) to assess student understanding of core concepts and uncover common scientific misconceptions.

1. Force Concept Inventory (FCI)

- **Focus:** Newtonian Mechanics (forces, velocity, acceleration, Newton's laws).
- **Format:** Multiple-choice assessment designed for everyday language rather than math formulas.
- **Key Feature:** The incorrect choices ("distractors") are based on real, deeply held, commonsense misconceptions that students bring into the classroom—such as the idea that a continuous force is needed to keep an object moving at a constant speed.

2. Mechanics Baseline Test (MBT)

- **Focus:** Introductory Mechanics (kinematics, forces, energy, momentum).
- **Format:** Multiple-choice test requiring quantitative application and basic mathematical problem-solving.
- **Key Feature:** Unlike the qualitative FCI, the MBT tests whether students can apply mechanics concepts quantitatively. It is often given alongside or immediately after the FCI as a post-test for students who have received formal instruction.

3. Conceptual Survey of Electricity and Magnetism (CSEM)

- **Focus:** Introductory Electricity and Magnetism (electrostatics, electric fields/forces, circuits, magnetic fields, and Faraday's Law).
- **Format:** Multiple-choice survey designed for calculus- and algebra-based physics courses.
- **Key Feature:** It extends conceptual assessment into electromagnetism, pinpointing where students struggle with abstract visual models, field lines, vector directions, and induction.

Summary Comparison

Diagnostic Assessment	Primary Subject Area	Level of Math Required	Primary Use Case
Force Concept Inventory (FCI)	Newtonian Kinematics & Dynamics	Minimal / Qualitative	Catching fundamental misconceptions about force & motion
Mechanics Baseline Test (MBT)	Mechanics (Kinematics, Energy, Momentum)	Basic Quantitative & Formula Application	Post-instruction assessment of mechanics problem solving

Diagnostic Assessment	Primary Subject Area	Level of Math Required	Primary Use Case
Conceptual Survey of E&M (CSEM)	Electricity & Magnetism	Qualitative / Conceptual reasoning	Assessing understanding of fields, charges, and induction