# http://www.ric.edu/webcommunications/images/SealWithText_Small_Black.pngUNDERGRADUATE CURRICULUM COMMITTEE (UCC)PROPOSAL FORM

## Cover page scroll over blue text to see further important [instructions](#instructions): [if not working select “COMMents on rollover” in your Word preferences under view] **please read these.**

**N.B. ALL numbered categories in section (A) must be completed. Please do not use highlight to select choices within a category but simply delete the options that do not apply to your proposal (e.g. in A.2 if this is a course revision proposal, just delete the creation and deletion options and the various program ones, so it reads “course revision”) Do not delete any of the numbered categories—if they do not apply leave them blank. If there are no resources impacted please put “none” in each A. 7 category.**

|  |  |  |
| --- | --- | --- |
| A.1. [Course or program](#Proposal) | **Physics 307 Quantum Mechanics I** |  |
| [Replacing](#Ifapplicable)  |  |
| A. 1b. Academic unit | **Faculty of Arts and Sciences**  |  |
| A.2. [Proposal type](#type) | **Course: revision**  |  |
| A.3. [Originator](#Originator) | **Andrea Del Vecchio** | [Home department](#home_dept) | **Physical Sciences** |
| A.4. [Context and Rationale](#Rationale) Note: Must include additional information in smart tip for all [new programs](#type) | **For more flexibility for students, we are breaking Junior Lab into two one credit labs one associated with Quantum Mechanics and one with Thermodynamics. This will restructure Quantum Mechanics into two courses: a three-credit lecture course (this proposal) and a one credit lab. This will also help align this course to have the same structure as a similar course in the Chemistry program. This proposal is to revise the current lecture course to change from 4 to 3 credits.****When this course was changed from a 3-credit to a 4-credit course in 2017, there were two main areas added to the course: a computational physics element and more material on the hydrogen atom and electron spin. However, integrating the computation into the lecture course did not work out as we had hoped. After reflection, we feel that moving all the computational material to the lab will be more pedagogically sound. We will also move some of material to the lab such as the failures of classical mechanics, mathematical visualization of wavefunctions and magnetism and spin. These topics will be covered in a more cursory way in lecture with the in-depth treatment occurring in lab, and the description will be slightly revised.****We would also like to revise the prerequisites to better reflect what is needed for the course and allow the Chemistry program to count it in their ACS certification.** |
| A.5. [Student impact](#student_impact)Must include to explain why this change is being made? | **The material that was covered in the additional credit will be shifted to the new lab course, so the students will still cover the same material, and this course should be easier to schedule.** |
| A.6. [Impact on other programs](#impact)  | **None** |
| A.7. [Resource impact](#Resource) | [*Faculty PT & FT*](#faculty):  | **None** |
| [*Library*:](#library) | **None** |
| [*Technology*](#technology) | **None** |
| [*Facilities*](#facilities): | **None** |
| A.8. [Semester effective](#Semester_effective) | **Fall, 2023** | A.9. [Rationale if sooner than next Fall](#Semester_effective) |  |
| A.10. INSTRUCTIONS FOR CATALOG COPY: Use the Word copy versions of the catalog sections found on the UCC Forms and Information page. Cut and paste into a single file **ALL the relevant pages from the college catalog that need to be changed.** Use tracked changes feature to show how the catalog will be revised as you type in the revisions. If totally new copy, indicate where it should go in the catalog. If making related proposals a single catalog copy that includes all changes is preferred. Send catalog copy as a separate single Word file along with this form. |
| A.11. List here (with the relevant urls), any RIC website pages that will need to be updated (to which your department does not have access) if this proposal is approved, with an explanation as to what needs to be revised: |
| A. 12 **Check to see if your proposal will impact any of our** [**transfer** **agreements,**](file:///Users/adelvecchio/Downloads/transfer%20agreements) **and if it does explain in what way. Please indicate clearly what will need to be updated.** |
| A. 13 Check the section that lists “Possible NECHE considerations” on the UCC Forms and Information page and if any apply, indicate what that might be here and contact Institutional Research for further guidance. |

B. [NEW OR REVISED COURSES](#delete_if)  **Delete section B if the proposal does not include a new or revised course. As in section A. do not highlight but simply delete suggested options not being used. Always fill in b. 1 and B. 3 for context. NOTE: course learning outcomes and topical outlines only needed for new or substantially revised courses.**

|  | Old ([for revisions only](#Revisions))ONLY include information that is being revised, otherwise leave blank.  | NewExamples are provided within some of the boxes for guidance, delete just the examples that do not apply. |
| --- | --- | --- |
| B.1. [Course prefix and number](#cours_title)  | **PHYS 307** |  |
| B.2. Cross listing number if any |  |  |
| B.3. [Course title](#title)  | **Quantum Mechanics I** |  |
| B.4. [Course description](#description)  | Topics include relativistic mechanics, the failures of classical physics, the structure of the atom, and the wave description of matter, including the Schrödinger Equation, the hydrogen atom, angular momentum and spin. | Students cover topics including the failures of classical physics, structure of the atom, and the wave description of matter, including the Schrödinger Equation, the hydrogen atom, angular momentum and spin. |
| B.5. [Prerequisite(s)](#prereqs) | **PHYS 102** | **PHYS 102 and MATH 212 or CHEM 405** |
| B.6. [Offered](#Offered) |  |  |
| B.7. [Contact hours](#contacthours)  | **4** | **3** |
| B.8. [Credit hours](#credits) | **4** | **3** |
| B.9. [Justify differences if any](#differences) |  |
| B.10. [Grading system](#grading)  |  |  |
| B.11. [Instructional methods](#instr_methods) |  |  |
| B.11.a [Delivery Method](#instr_methods) |  |  |
| B.12. CATEGORIES 12. a. [How](#required) to be used |  |  |
|  12 b. Is this an Honors  course? | **NO** |  |
|  12. c. [General Education](#ge) N.B. Connections must include at  least 50% Standard Classroom instruction. | **NO** **category:** | **category:** |
|  12. d. Writing in the  Discipline (WID) | **NO** |  |
| B.13. [How will student performance be evaluated?](#performance) |  |  |
| B.14 [Recommended class-size](#class_size" \o "Check appendix XVIII in the UCC Manual for Best Practices) |  |  |
| B.15. [Redundancy statement](#competing) |  |  |
| B. 16. Other changes, if any |  |

| B.17**.** [**Course learning outcomes**](#outcomes)**: List each one in a separate row** | [**Professional Org.Standard(s)**](#standards)**, if relevant** | [**How will each outcome be measured**](#measured)**?** |
| --- | --- | --- |
| The student hasgained knowledge of the failures of classical mechanics and how they led to the development of quantum mechanics |  | Homework and exams |
| The student has gained knowledge of wave-particle duality. |  | Homework and exams |
| The student has gained knowledge of the Heisenberg Uncertainty Principle and how it fundamentally limits knowledge of the state of a system. |  | Homework and exams |
| The student can apply the time-independent Schrödinger equation for simple potentials such as the particle in a box, the harmonic oscillator and hydrogen like atoms,. |  | Homework and exams |
| The student can apply principles of quantum mechanics to calculate observables on known wave functions. |  | Homework and exams |
| The student has gained knowledge of electron spin. |  | Homework and exams |

| B.18. [**Topical outline**](#outline)**: DO NOT INSERT WHOLE SYLLABUS, JUST A TWO-TIER TOPIC OUTLINE suitable for the contact hours requested. Proposals that ignore this request will be returned for revision.** |
| --- |
| Failures of classical physics* Quantization of light and matter
* Blackbody radiation
* Photoelectric effect
* Bohr model of the atom

Matter waves* De Broglie hypothesis
* Uncertainty principle

Schrodinger equation* Standing waves, stationary states
* Particle in a rigid box
* Free particle
* Non-rigid box
* Simple harmonic oscillator
* Tunneling
* Time dependent Schrodinger equation

3-dimensional Schrodinger equation* Central Force Problem
* Angular momentum
* Hydrogen atom

Spin * Spin quantum number
* Applications
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## D. Signatures

* **Changes that affect General Education in any way MUST be approved by ALL Deans and COGE Chair**.
* Changes that directly impact more than one department/program MUST have the signatures of all relevant department chairs, program directors, and their relevant dean (e.g. when creating/revising a program using courses from other departments/programs). Check UCC manual 4.2 for further guidelines on whether the signatures need to be approval or acknowledgement.
* Proposals that do not have appropriate approval signatures will not be considered.
* Type in name of person signing and their position/affiliation.
* Send electronic files of this proposal and accompanying catalog copy to curriculum@ric.edu to the current Chair of UCC. Check UCC website for due dates. Do NOT convert to a .pdf.

##### D.1. Approvals: required from programs/departments/deans who originate the proposal. THESE may include multiple departments, e.g., for joint/interdisciplinary proposals.

| Name | Position/affiliation | [Signature](#_Signature" \o "Insert electronic signature, if available, in this column) | Date |
| --- | --- | --- | --- |
| Andrea Del Vecchio | Chair of Physical Sciences | Andrea Del Vecchio | 3/26/23 |
| Earl Simson | Dean of Arts and Sciences | Earl Simson | 3/27/23 |

##### D.2. [Acknowledgements](#acknowledge): REQUIRED from OTHER PROGRAMS/DEPARTMENTS (and their relevant deans if not already included above) that are IMPACTED BY THE PROPOSAL. SIGNATURE DOES NOT INDICATE APPROVAL, ONLY AWARENESS THAT THE PROPOSAL IS BEING