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

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| A.1. [Course or program](#Proposal) | **CSCI 446 Cognitive Robotics** |  |
|  |  |
| A. 1b. Academic unit | **School of Business**  |  |
| A.2. [Proposal type](#type) | **Course: creation**  |  |
| A.3. [Originator](#Originator) | **Timothy Henry** | [Home department](#home_dept) | **Computer Science and Information Systems** |
| A.4. [Context and Rationale](#Rationale) Must include additional information listed in smart tip for all [new programs](#type). If **online** course or program, you need to explain what mode(s) you plan to use and why you need that specific delivery.  | In the rapidly evolving landscape of artificial intelligence (AI), cognitive robotics stands as a transformative field with the potential to revolutionize the way we interact with the world around us. Robots with the ability to perceive, learn, and adapt, are transforming industries such as manufacturing and enhancing human capabilities. This course provides students with the necessary knowledge and skills to contribute to this exciting and rapidly advancing field.The course introduces the fundamental concepts and principles of robotics, encompassing perception, motion planning, learning, and human-robot interaction. Students would gain a comprehensive understanding of how these core aspects enable robots to interact with their surroundings, navigate complex environments, and collaborate effectively with humans. The course would emphasize hands-on learning through practical exercises and projects. Students would engage in designing and implementing motion planning algorithms, exploring reinforcement learning techniques for cognitive robots, and developing human-robot interaction systems that foster natural and intuitive communication, especially important in factory or warehouse settings. These practical activities would provide students with the opportunity to apply their theoretical knowledge to solve real-world problems, fostering a deep understanding of the challenges and opportunities in cognitive robotics.The impact of cognitive robotics ethical considerations and societal implications that demand critical examination. The course would delve into these crucial aspects, prompting students to analyze the potential impact of cognitive robots on job displacement, privacy and data security, autonomous decision-making, and bias in AI-powered systems. By engaging in these discussions, students would develop a well-informed perspective on the ethical considerations and societal implications of cognitive robotics, preparing them to contribute responsibly in the workplace. |
| A.5. [Student impact](#student_impact)Must include to explain why this change is being made? | This course will be taken primarily by AI majors, but it can also serve as a very useful elective for CS and Data Science majors. |
| A.6. [Impact on other programs](#impact)  | Since this could serve as an elective for CS majors, that may reduce the number of students taking other 300- or 400-level CSCI elective courses. |
| A.7. [Resource impact](#Resource) | [*Faculty PT & FT*](#faculty):  | Existing CSCI faculty and/or adjunct faculty will teach the courses. Depending on the growth of the new AI Program, additional faculty and adjuncts may be needed. |
| [*Library*:](#library) | None |
| *Technology (for in person delivery)* | None. Courses will use existing classrooms and/or computer labs. (hence 25 cap) |
| *Technology: (for online delivery. Must be RIC supported)* | None |
| [*Facilities*](#facilities): | None. Courses will use existing classrooms and/or computer labs. |
| A.8. [Semester effective](#Semester_effective) | **Fall 2024** | A.9. [Rationale if sooner than next Fall](#Semester_effective) | **N/A** |
| 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/SAbbotson/Documents/Curriculum/ManualandWebsite/transfer%20agreements) **and if it does explain in what way. Please indicate clearly what will need to be updated, including any changes in prefix numbers/titles for TES. N/A** |
| 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. **N/A** |

**C.** [**NEW OR REVISED COURSES**](#delete_if) **THAT ARE DESIGNATED AS HYBRID**

|  |   | New |
| --- | --- | --- |
| C.1. [Course prefix and number](#cours_title)  |  | **CSCI 446** |
| C.2. Cross listing number if any |  | **N/A** |
| C.3. [Course title](#title)  |  | **Cognitive Robotics** |
| C.4. [Course description](#description)  |  | **Students explore fundamentals of cognitive robotics, from perception and motion planning to learning and human-robot interaction. Robot prototypes are designed and implemented for real-world business, manufacturing, and assistive applications.** |
| C.5. [Prerequisite(s)](#prereqs) |  | **CSCI 428** |
| C.6. [Offered](#Offered) please read the screen tips to do this correctly, alternate years needs to be assigned odd/even, and a specific semester. |  | **Spring** |
| C.7. [Contact hours](#contacthours)  |  | **4** |
| C.8. [Credit hours](#credits) |  | **4** |
| C.9. [Justify differences if any](#differences) |  |

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| --- | --- | --- |
| C.10. [Grading system](#grading)  |  | **Letter grade** |
| C.11. a. [Type of cours](#instr_methods)e  |  | **Lecture | Laboratory**  |
| C.11.b Instruction mode with percentage |  | **Hybrid:****51% in-person****49% online** Course will be offered one day a week in-person along with an in-person final project |
| Reminder: Instructors are responsible for ensuring their course meets accessibility standards and provides accommodations identified by Disability Services (find links).  |
| C.11.c. For online components only: How will students engage with the content  |  |  **Lectures (recorded) | Course readings | Videos or other recordings | Practice and lab activities | Online discussions** |
| C.11.d. How will students engage with other students  |  | **In-class discussions | Class activities | Online discussion boards | Team/group projects** |
| C.12. CATEGORIES 12. a. [How](#required) to be used |  | **Restricted elective for major** |
|  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**  |
|  12. d. Writing in the  Discipline (WID) |  | **NO** |
| C.13. [How will student performance be evaluated?](#performance)  |  | **Exams | Class Work | Quizzes | Projects | Discussion board**  |
| C.14 [Recommended class-size](#class_size) |  | **25 (computer lab)** |
| C.15. [Redundancy statement](#competing) |  |  |
| C. 16. Other changes, if any |  |

| C.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) |
| --- | --- | --- |
| Understand key concepts and principles of cognitive robotics, including perception, motion planning, learning, and human-robot interaction. |  | Homework, projects, in-class assignments, labs and exams. |
| Analyze and critique the ethical and societal implications of real-world cognitive robotics applications |  | Written homework, in-class assignments, presentations, and exams. |
| Compare and contrast different approaches to motion planning and various cognitive robotics architectures |  | Written homework, in-class assignments, presentations, and exams. |
| Analyze and critically assess human-robot interaction scenarios to develop a safe, natural and intuitive interface for a robot  |  | Written homework, labs, presentations, and exams. |
| Differentiate between reinforcement learning, unsupervised learning, and active learning techniques for cognitive robots |  | Written homework, labs, and exams. |

| C.18. [**Topical outline**](#outline)**:**  |
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| **Week 1: Introduction to Cognitive Robotics*** Definition and overview of cognitive robotics
* Historical development and evolution of cognitive robotics
* Types of cognitive robots and their applications
* Ethical considerations and societal implications of cognitive robotics

**Week 2: Perception and Sensory Processing in Cognitive Robotics*** Role of perception in cognitive robotics
* Sensory modalities in cognitive robots: vision, audition, proprioception, haptic sensing
* Sensor fusion and integration
* Perception-action coupling and sensorimotor control

**Week 3: Motion Planning and Navigation in Cognitive Robotics*** Fundamentals of motion planning
* Configuration space and obstacle representation
* Search algorithms for path planning
* Navigation strategies in dynamic and uncertain environments

**Week 4: Learning and Adaptation in Cognitive Robotics*** Reinforcement learning for cognitive robots
* Unsupervised learning and self-organization
* Active learning and exploration-exploitation trade-offs
* Adaptation to changing environments and task requirements

**Week 5: Human-Robot Interaction and Collaboration*** Human-robot communication and interfaces
* Natural language processing for human-robot interaction
* Collaborative tasks and co-working scenarios
* Safety and ethical considerations in human-robot interaction

**Week 6: Cognitive Architectures for Robotics*** Layered and modular architectures
* Hybrid architectures combining symbolic and sub-symbolic processing
* Embodiment and interaction in cognitive robotics
* Brain-inspired approaches to cognitive robotics

**Week 7: Robotics in Manufacturing and Warehousing*** History of robots in manufacturing and logistics
* Fixed and mobile robotics in manufacturing
* Rapid repurposing for annual new product production cycles

**Week 8: Robotics in Healthcare and Assistive Technologies*** History of robots in healthcare and assistive technologies
* Robotic surgeries and doctor assistance
* Patient care and assistance
* Home healthcare and nursing
* Other medical center and hospital uses of robotic

**Week 9: Other Robotics Applications*** Robots in education and training
* Robots in service industries and hospitality

**Week 10: Case Studies of Cognitive Robotics*** Deep Blue and AlphaGo
* Baxter and Atlas
* Social robots and AI companions
* Self-driving cars and autonomous vehicles

**Week 11: Robotics in Complex Environments*** Robots in Space and Extreme Environments
* Underwater Robotics
* Robotics in Urban and Domestic Settings

**Week 12: Ethical and Societal Implications of Robotics*** Job displacement and economic impact
* Privacy and data security
* Autonomous decision-making and accountability
* Bias and fairness in AI-powered robots

**Week 13: The Future of Robotics*** Emerging trends and future applications
* Challenges and opportunities in cognitive robotics research
* The role of cognitive robotics in shaping the future of society

**Week 14: Review and Discussion*** Students will review the key concepts of the course and engage in a discussion about the future of robotics.
* Students will finalize project work

**Week 15: Final Project Presentations and Demonstrations*** Students will present their projects to the class.
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**G. 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.**

##### G.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 |
| --- | --- | --- | --- |
| Suzanne Mello-Stark | Chair of Computer Science and Information Systems | \*approved by email | 2/23/24 |
| Marianne Raimondo | Dean of School of Business | \*approved by email | 2/23/24 |

##### G.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