COURSE NUMBER – COURSE NAME
MKTX 410 – Robotics Analysis and Synthesis

Created by: Lucas Craig, Ph.D.
Updated by: J. Miles Canino, Ph.D.

Canino School of Engineering Technology
Department: Mechatronics Engineering Technology
Semester/Year: Fall/2018
A. **TITLE:** Robotics Analysis and Synthesis

B. **COURSE NUMBER:** MKTX 410

C. **CREDIT HOURS:** (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)
   
   # Credit Hours: 3
   # Lecture Hours: 2 per week
   # Lab Hours: per week
   Other: 2 hours recitation per week

   **Course Length:** 15 Weeks

D. **WRITING INTENSIVE COURSE:** Yes ☒ No □

E. **GER CATEGORY:** None: ☒ Yes: GER
   
   *If course satisfies more than one:* GER

F. **SEMESTER(S) OFFERED:** Fall ☒ Spring □ Fall & Spring □

G. **COURSE DESCRIPTION:**

   This course teaches the fundamentals of robotics through implementation of control theory and high level system dynamics and modeling. Students write computer code, implement system controllers, use sensory equipment, collect and analyze data, and design and develop robotic systems.

H. **PRE-REQUISITES:** None □ Yes ☒ If yes, list below:
   
   MKTX 310: Instrumentation and Controls

   **CO-REQUISITES:** None ☒ Yes □ If yes, list below:
I. **STUDENT LEARNING OUTCOMES:** *(see key below)*

By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Student Learning Outcome [SLO]</th>
<th>Program Student Learning Outcome [PSLO]</th>
<th>GER [If Applicable]</th>
<th>ISLO &amp; SUBSETS</th>
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</thead>
<tbody>
<tr>
<td>Understand the dynamics of open and closed chain systems</td>
<td>a, e</td>
<td>2-Crit Think ISLO ISLO</td>
<td>CA IA PS Subsets</td>
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<tr>
<td>Demonstrate an understanding of trajectory generation through system design</td>
<td>a, e</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>CA IA PS Subsets</td>
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<tr>
<td>Understand motion planning and motion optimization schemas</td>
<td>a, e</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>Subsets</td>
</tr>
<tr>
<td>Implement sensor-based feedback control into robotic systems.</td>
<td>a, b, d, e</td>
<td>1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills</td>
<td>W CA IA PS</td>
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<tr>
<td>Understand contact kinematics and apply them to robotic manipulators</td>
<td>a, b, e</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>IA PS CA Subsets</td>
</tr>
<tr>
<td>Apply understanding of robotic systems to mobile and paired robotic systems</td>
<td>a, b, d, e</td>
<td>2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>CA PS PS Subsets</td>
</tr>
<tr>
<td>Apply essential techniques, skills, and modern engineering tools to overcome common issues observed in industry</td>
<td>d, e</td>
<td>4-Soc Respons 5-Ind, Prof, Disc, Know Skills ISLO</td>
<td>T Subsets Subsets Subsets</td>
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**KEY**

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<thead>
<tr>
<th>Institutional Student Learning Outcomes [ISLO 1 – 5]</th>
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<tr>
<td>ISLO #</td>
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<tr>
<td>1</td>
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<td>3</td>
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<td>4</td>
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<td>5</td>
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J. **APPLIED LEARNING COMPONENT:**

Yes [ ] No [ ]

If YES, select one or more of the following categories:

- Classroom/Lab
- Internship
- Clinical Placement
- Practicum
- Service Learning
- Community Service
- Civic Engagement
- Creative Works/Senior Project
- Research
- Entrepreneurship
  (program, class, project)

K. **TEXTS:**


L. **REFERENCES:**


M. **EQUIPMENT:** None [ ] Needed: Computers with MatLab, Robotic Workstations

N. **GRADING METHOD:** A-F

O. **SUGGESTED MEASUREMENT CRITERIA/METHODS:**

- Exams
- Quizzes
- Homework
- Projects

P. **DETAILED COURSE OUTLINE:**

I. Configuration Space
II. Rigid-Body Motion Review
III. Forward Kinematics
IV. Velocity/Kinematics/Statics Review
V. Inverse Kinematics
VI. Closed Chain Kinematics
VII. Open Chain Dynamics
VIII. Trajectory Generation
IX. Motion Planning
X. Robot Control
XI. Grasping and Manipulation
XII. System Mobility
Q. **LABORATORY OUTLINE:** None ☒ Yes ☐