Washtenaw Community College Comprehensive Report

ROB 222 Robotics Simulation
Effective Term: Spring/Summer 2020

Course Cover

Division: Advanced Technologies and Public Service Careers
Department: Advanced Manufacturing
Discipline: Robotics
Course Number: 222
Org Number: 14430
Full Course Title: Robotics Simulation
Transcript Title: Robotics Simulation
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Three Year Review / Assessment Report
Change Information:
Course description
Pre-requisite, co-requisite, or enrollment restrictions
Outcomes/Assessment
Objectives/Evaluation
Other:
Rationale: The current existing syllabus does not contain any Student Learning Outcomes. Updating master syllabus for ROB222 to reflect current course content, add learning outcomes and course objectives.
Proposed Start Semester: Winter 2020
Course Description: In this course, students are introduced to Robotic Simulation using the ABB RobotStudio software. They will learn how to build computer simulated models of robotic workcells. Programming and running these simulations is also covered. Hands-on use of the software is an integral part of the course.

Course Credit Hours

Variable hours: No
Credits: 2
Lecture Hours: Instructor: 15 **Student:** 15
Lab: Instructor: 30 **Student:** 30
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 45 **Student:** 45
Repeatable for Credit: NO
Grading Methods: Letter Grades
Audit
Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

Corequisite

ROB 223

General Education

Request Course Transfer

Proposed For:

Student Learning Outcomes

1. Recognize the features of simulation software and simulation workflow procedure.
   Assessment 1
   Assessment Tool: Departmental exam
   Assessment Date: Spring/Summer 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students will score 75% or greater.
   Who will score and analyze the data: Department faculty

2. Create a robot program and verify robot motion.
   Assessment 1
   Assessment Tool: Departmental exam
   Assessment Date: Spring/Summer 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students will score 75% or greater.
   Who will score and analyze the data: Department faculty

3. Create robot frames and modify robot targets.
   Assessment 1
   Assessment Tool: Departmental exam
   Assessment Date: Spring/Summer 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students will score 75% or greater.
   Who will score and analyze the data: Department faculty

4. Model 3-dimensional devices and incorporate them in simulation environments.
   Assessment 1
   Assessment Tool: Departmental exam
   Assessment Date: Spring/Summer 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students

How the assessment will be scored: Departmentally-developed rubric
Standard of success to be used for this assessment: 75% of the students will score 75% or greater.
Who will score and analyze the data: Department faculty

5. Utilize off-line programming techniques and crash avoidance feature for an existing simulation project.
   Assessment 1
   Assessment Tool: Departmental exam
   Assessment Date: Spring/Summer 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All sections
   Number students to be assessed: All students
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students will score 75% or greater.
   Who will score and analyze the data: Department faculty

Course Objectives

1. Explain simulation tools and proper software workflow.
2. Differentiate between simulation and animation.
3. Create an empty project with a Robot model and its accompanying controller.
4. Utilize JOINT and LINEAR mode jogging in a simulated environment.
5. Write basic robot programs to create robot motion in a simulated environment.
6. Cruise the workcell and view the simulation from various angles.
7. Translate devices to new positions.
8. Retrieve and position devices in relation to each other.
9. Create workobjects and toolobjects (frames) for a robot.
10. Modify and store target points in various frames of reference.
11. Utilize auto-configuration for JOINTS configuration.
12. Build a simple device in the computer-aided design (CAD) world.
13. Incorporate a modeled device into a workcell.
14. Utilize in-built physics tools for joint actuation of 3-D modeled devices.
15. Create, activate, and use crash detection in a simulated environment.
16. Prevent crashes when two robots are working in the same area.
17. Retrieve previously stored workcells and run the simulation.
18. Create and utilize robot back-up from a simulated robot workcell.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software
RobotStudio. ABB, 2019 or latest ed.

Equipment/Facilities

Computer workstations/lab
Data projector/computer

Reviewer	Action	Date
Faculty Preparer:		
Hari Kandasamy	*Faculty Preparer*	*Aug 23, 2019*

Department Chair/Area Director:		
Thomas Penird	*Recommend Approval*	*Aug 27, 2019*
Dean:		
Brandon Tucker	*Recommend Approval*	*Aug 29, 2019*
Curriculum Committee Chair:		
Lisa Veasey	*Recommend Approval*	*Sep 24, 2019*
Assessment Committee Chair:		
Shawn Deron	*Recommend Approval*	*Oct 10, 2019*
Vice President for Instruction:		
Kimberly Hurns	*Approve*	*Oct 14, 2019*

WASHTENAW COMMUNITY COLLEGE
COURSE-SYLLABUS APPROVAL FORM (CSAF)

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SECTION I. COURSE SUBMISSION INFORMATION

1. Course: (Enter proposed discipline, number & title here. If changing the number or title of an existing course, give old number or title in box 4 below.)

Discipline/No: ROB-222 **Title:** Robotics Simulation

Division Code: TEC Department Code: INTD Effective Term: ~~200109~~ W02

☐ Do not publish in Time Schedule
☐ Do not publish in College Catalog

2. Type of Approval: (applies to both new courses and changes)

☒ Full Approval
☐ Conditional Approval

☒ This proposal previously received conditional approval for the Term: 200109

3. Reason for Submission: This Course is being submitted for: (check all that apply)

☒ New Course Approval (Skip the rest of Section I and go directly to Section II.)
☐ Five-year Syllabus Review ☐ No changes to course
☐ Major Change(s)
☐ Minor Change(s) (If not due for review, submit sections I, II, and revised parts of Section III.)
☐ Reactivation of Inactive Course
☐ Inactivation (Submit Sections I and II only.)

4. Change Information: (Check all that apply. Make proposed changes in Section III, Course Syllabus.)

Minor Changes

☐ Course Discipline/Number (was _____)
☐ Course Title (was _____)
☒ Course Description
☐ Capacity (was: ____)
☒ Pre or Corequisites
☐ Course Objectives
☐ Distribution of Contact Hours (contact hours were: lect: _____ lab _____ clin _____ exp _____)
☐ Distance Learning - minor (Attach Preliminary Approval Form for Distance Learning & the Section Handout.)
☐ Other _____

Major Changes (Major changes will be reviewed by Curriculum Committee.)

☐ Credit hours (credits were: _____)
☐ Core Elements: (Elements to be added: _____)
(Elements to be removed: _____)
☐ Grading
☐ Course Objectives affecting core elements
☐ Total Contact Hours (total contact hours were: _____)
☐ Honors (Attach Honors Section Approval Form.)
☐ Distance Learning - major (Attach Preliminary Approval Form for Distance Learning & the Student Handout for the Distance Section.)
☐ Other _____

5. Rationale for changes:

SECTION II. COURSE REVIEW INFORMATION AND SIGNATURES

1. Department Review (To be completed by department chair; if recommendation is no, initial and return to preparer with rationale attached.)

Will significant new resources be required? ☒ yes ☐ no (If yes, explain Purchase PC version of the IGRIP simulation software)
Have departments that may be affected by this course been consulted? ☐ yes ☒ no (Explain none affected)
Does the department support approval of this course? ☒ yes ☐ no

Print: Gary Schultz (Faculty/Preparer) Signature: Gary L Schultz Date: 4/26/01

Print: Gary Schultz (Department Chair) Signature: Gary L Schultz Date: 4/26/01

2. Division Review (To be completed by division dean; if recommendation is no, initial and return with rationale attached.)

Will significant new resources be required? ☒ yes ☐ no (If yes, have they been secured? ☒ yes ☐ no)
Is this a curricular priority for your division? ☒ yes ☐ no (Comment _____)
What is your estimate of projected enrollment? 40

Recommendation ☒ Yes ☐ No — Roger R. Burkey (Division Dean's Signature) — Date: 4/26/01

3. Curriculum Committee Review (Attach additional comments if necessary.)

Recommendation ☒ Yes ☐ No — Ruth A. Hartner (Curriculum Committee Chair's Signature) — Date: 6.12.01

4. Vice President for Instruction and Student Services Approval (Attach additional comments if necessary.)

Approval ☒ Yes ☐ No — (Vice President's Signature) — Date: 7/5

Log File 7/10/01 JLV ACS Code 1.35 Catalog File Date 7/10/01 JLV Access Date 7/10/01 JLV

Core Elements Approved _____ New Syllabus Date 200105

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SECTION III. COURSE SYLLABUS — **For help screens, select a field and press F1.**

A. COURSE DETAILS (discipline # and title will automatically be entered in 1 and 2 below upon saving or previewing)

1. **Course Discipline & No.:** ROB-222 **2. Course Title:** Robotics Simulation (TM)

3. **Course Description:** This course provides an introduction to Robotic Simulation using the IGRIP software. Students will learn how to build computer simulated models of robotic workcells. Programming and running these simulations is also included. "Hands on" use of the software is an integral part of the course. This course should be taken the same semester as ROB 223. Robotics III.

4. **Credit Hours:** 2
   If Variable credit, Give Range: _____ to _____
   If repeatable for credit, how many times? _____

5. **Class Capacity:** 20
   (If nonstandard, attach Class Capacity Exception form.)

6. **Course Options:**
   - ☐ Distance learning (Attach preliminary distance approval form and Section Handout.)
   - ☐ Honors (Complete Part G.)
   - ☐ P/NP Grading (Attach rationale.)

7. **Contact Hours per Semester in:**
   - Lecture: 15
   - Lab: 30
   - Clinical: _____
   - Experiential: _____
   - **Total Contact Hrs:** 45

8. **Prerequisite(s):**
   ~~none~~ College Level Entrance Scores

9. **Corequisite(s):** (limit to 2)
   ROB 223

10. **a. Course Purpose:**
    - ☒ Program Specialty
    - ☐ Program Support
    - ☒ Nonprogram Specialty
    - ☐ Transfer
    - ☐ Enrichment
    - ☐ Basic Skills

b. Is this course a requirement for a program?
- ☒ Yes (specify the program(s) below) Robotics APROB
- ☐ No

c. Indicate schools to which you want Curriculum Services to send syllabus:
(If transfer is approved, attach documentation.)
- ☐ EMU
- ☐ UM
- ☐ Other _____

B. MAJOR INSTRUCTIONAL UNITS A major instructional unit is a grouping of topics that naturally relate to one another. List in order the major instructional units. Add additional numbers as needed.

1. Retrieving and running workcells
2. Retrieving and positioning devices
3. Paths and Tag Points
4. GSL Programming
5. Interfacing with I/O's
6. Intermediate GSL Programming
7. Final workcell development

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D. INSTRUCTIONAL OBJECTIVES AND CORE ELEMENTS SUPPORTED

DIRECTIONS: (These Units should match those listed in Section B.)Use student outcome based language. (Example: The student will develop and support a thesis in an essay.) If the objective is being used to directly support a core element, write the core element number in the box to the right. If needed, additional information on how the core element is to be met and/or assessed for accomplishment can be included under the objective. If desired you may add a section of "overall course objectives" which are not associated with a specific unit. This may be particularly helpful for addressing core elements.

Unit Objectives	Core Elements
Unit #1 Retrieving and running workcells	
# 1 Students will be able to retrieve previously stored workcells and run the simulation.	
# 2 Students will be able to activate and use crash detection.	
# 3 Students will be able to cruise the workcell and view the simulation from various angles.	
Unit #2 Retrieving and positioning devices	
# 1 Students will be able to describe the difference between workcells and devices.	
# 2 Students will be able to retrieve and position devices in relation to each other.	
# 3 Students will be able to translate devices to new postions.	
Unit #3 Paths and Tag points	
# 1 Students will be able to describe the difference between Tool and World reference frames.	
# 2 Students will be able to store tag points in various frames of reference.	
# 3 Students will be able to describe the difference between slew, joint interpolated and linear interpolated motion.	
Unit #4 GSL Programming	
# 1 Students will be able to write basic GSL programs to create robot motion.	
# 2 Students will be able to include counters, gotos and if...then programming contructs.	

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Unit #5 Interfacing devices using Inputs and Outputs.

1 Students will be able to create "hand shaking" interface between two devices.

2 Students will be able to prevent crashes when two robots are working in the same area.

Unit #6 Intermediate GSL programming

1 Students will be able to incorporate while...do, and for...to...end programming constructs.

2 Students will be able to include the use of sub programs.

Unit #7 Final workcell development

1 Students will be able to build a simple device in the CAD world.

2 Students will be able to incorporate the device into a work cell.

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E. INSTRUCTIONAL METHODS AND EVALUATION

1. Instructional Methods: (Check the appropriate boxes and describe as needed.)

- ☒ Lecture/Discussion
- ☐ Clinical Instruction
- ☐ Self-Paced Learning
- ☐ Internet Instruction
- ☒ Computer Simulations
- ☐ On-Site Work Experience
- ☐ Other
- ☐ Field Trips
- ☒ Team Assignments
- ☐ Telecourse
- ☐ Video Seminar
- ☒ Laboratory Assignments
- ☐ Interactive TV

2. Evaluation Criteria:

- ☒ Attendance
- ☐ Class Discussion
- ☐ Papers
- ☐ Portfolio
- ☒ Projects
- ☐ Reports
- ☐ Clinical/Work
- ☐ Other
- ☒ Quizzes
- ☐ Tests
- ☐ Midterm
- ☒ Final Exam
- ☐ Home Work
- ☐ Presentations
- ☐ Performances

3. Attendance Requirements: (For Certification or nonevaluative purposes.)

F. EQUIPMENT, FACILITIES, TEXTS, MATERIALS, AND SUPPLIES

1. Special Equipment/Facilities : (Check the appropriate boxes and describe as needed.)

- ☐ Lab equipment
- ☐ LRC Reserves
- ☒ Computers TI-139 w/ IGRIP software
- ☐ CD ROM
- ☐ Field Trips
- ☐ Other
- ☐ Testing Center
- ☐ Student Competitions
- ☐ Off-Campus Sites
- ☐ Student Tutors
- ☐ Distance Learning Classroom

2. Texts: (Please indicate if no text is required.)

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Title: No Text Required
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Title: _____
Author: _____ Copyright Yr: _____
Publisher: _____ Est. Cost: _____

Other Texts: _____

3. Supplies and/or Uniforms Student will have to Own or Acquire for Course:
(e.g. calculators, uniforms, tools, and software, etc., excluding pen, pencil, paper, or textbooks.)

Descriptions	Cost Estimates
Calculator	$20
2) 3 1/2" HD floppy discs or Zip discs	$5

4. Reference Materials Students Will Use:
(e.g. journals, books, manuals, maps, LRC reserves, etc.)

5. Audio/Visual and Computer Materials Students Will Use:
(e.g. films, video tapes, slides, audio tapes, software, CDs, etc.)

Title	Source
IGRIP simulation software	TI-139 (college supplied)