

**Course Assessment Report
Washtenaw Community College**

Discipline	Course Number	Title
Robotics	101	ROB 101 06/26/2019- Robotics I - I
Division	Department	Faculty Preparer
Advanced Technologies and Public Service Careers	Advanced Manufacturing	Hari Kandasamy
Date of Last Filed Assessment Report		

I. Review previous assessment reports submitted for this course and provide the following information.

1. Was this course previously assessed and if so, when?

No

2. Briefly describe the results of previous assessment report(s).

3.

4. Briefly describe the Action Plan/Intended Changes from the previous report(s), when and how changes were implemented.

5.

II. Assessment Results per Student Learning Outcome

Outcome 1: Identify proper applications for automation.

- Assessment Plan
 - Assessment Tool: departmental exam
 - Assessment Date: Fall 2016
 - Course section(s)/other population: all sections
 - Number students to be assessed: all students
 - How the assessment will be scored: answer key
 - Standard of success to be used for this assessment: 70% of the students will score 70% or higher.

- Who will score and analyze the data: Departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2018, 2017		

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
66	61

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Of the total 66 enrolled students, 61 students were included in this assessment. The five missing students are due to student withdrawal from the course (Fall 2017).

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

For both Fall 2017 and Fall 2018, ROB101 was conducted as two sections (day and evening classes), enabling regular full time students (including WTMC students) and part time students to enroll and complete the course.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A written final exam was used to assess the learning outcome. This learning outcome was assessed by including 12-14 questions on the topic in the written portion of the final exam. Students were provided with different application scenarios and presented with multiple choice questions.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes
 Based on the data compiled, 98% of total students assessed scored either 70% or higher. As ROB101 serves as an introductory course to Robotics, this learning outcome helps students identify proper application of robotics. Based on the outcome, students are able to successfully identify proper application of robotics

in industries. The standard of success, as described in the learning outcome, was met.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Based on the case studies performed during the class on the application of automation in industrial settings, and from lecture discussion on how an application can be realized in factory floor in multiple ways, students were able to identify applications that are suitable for automation. More importantly, students were able to critically think critically about whether a specific application lended itself to be automated.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

Additional case studies modeled after current/live industrial projects will aid in student learning. More project videos can be included in lecture discussion.

Outcome 2: Identify suitable methods of production.

- Assessment Plan
 - Assessment Tool: departmental exam
 - Assessment Date: Fall 2016
 - Course section(s)/other population: all sections
 - Number students to be assessed: all students
 - How the assessment will be scored: answer key
 - Standard of success to be used for this assessment: 70% of the students will score 70% or higher.
 - Who will score and analyze the data: Departmental faculty
1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2017, 2018		

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
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66

61

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Of the total 66 enrolled students, 61 students were included in this assessment. The five missing students are due to student withdrawal from the course (Fall 2017).

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

For both Fall 2017 and Fall 2018, ROB101 was conducted as two sections (day and evening classes), enabling regular full time students (including WTMC students) and part time students to enroll and complete the course.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A written final exam was used to assess the learning outcome. This learning outcome was assessed by including 7-9 questions on the topic in the written portion of the final exam. Students were tested on proper/suitable production methods of a part and presented with multiple choice questions.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

Based on the data compiled, 97% of total students assessed scored either 70% or higher. As ROB101 serves as an introductory course to Robotics, this learning outcome helps students select/identify proper automated production methods. Based on the outcome, students are able to successfully identify production methods suited for given manufacturing requirements and constraints. The standard of success, as described in the learning outcome, was met.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students were able to understand the logical flow of an automated process through multiple examples discussed in class. Students were then able to identify appropriate production method/sequence of an automated manufacturing station.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

To further improve student exposure, an overview of upstream and downstream manufacturing model can be included.

Outcome 3: Recognize limitations and capabilities of industrial robots.

- Assessment Plan
 - Assessment Tool: departmental exam
 - Assessment Date: Fall 2016
 - Course section(s)/other population: all sections
 - Number students to be assessed: all students
 - How the assessment will be scored: answer key
 - Standard of success to be used for this assessment: 70% of the students will score 70% or higher.
 - Who will score and analyze the data: Departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2018, 2017		

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
66	61

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Of the total 66 enrolled students, 61 students were included in this assessment. The five missing students are due to student withdrawal from the course (Fall 2017).

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

For both Fall 2017 and Fall 2018, ROB101 was conducted as two sections (day and evening classes), enabling regular full time students (including WTMC students) and part time students to enroll and complete the course.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A written final exam was used to assess the learning outcome. This learning outcome was assessed by including 17-20 questions on the topic in the written portion of the final exam. Students were tested on the capabilities and limitation of industrial robots through multiple choice questions, TRUE/FALSE statements, and short-answer questions.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

Based on the data compiled, 93% of total students assessed scored either 70% or higher. As ROB101 serves as an introductory course to Robotics, this learning outcome helps students understand the capabilities of an industrial robot, and the limitations of robot motion. Based on the outcome, students are able to successfully identify the hardware and software limitation of robots. The standard of success, as described in the learning outcome was met.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students (with no robotics background) were able to determine the JOG direction of robots in multiple JOG modes. Students were able to determine the safe working space for robots, different interpolation methods (LINEAR and JOINT moves) and their behavior in the physical world.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

Students' success can be improved by continuing to provide additional lab time for students to explore the capabilities of robots by jogging the robot in multiple modes and observing the robot behavior in different situations.

Outcome 4: Recognize the key historical events and timeframe in the development of robotics.

- Assessment Plan
 - Assessment Tool: departmental exam
 - Assessment Date: Fall 2016
 - Course section(s)/other population: all sections
 - Number students to be assessed: all students
 - How the assessment will be scored: answer key
 - Standard of success to be used for this assessment: 70% of the students will score 70% or higher.
 - Who will score and analyze the data: Departmental faculty

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2018, 2017		

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
66	61

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Of the total 66 enrolled students, 61 students were included in this assessment. The five missing students are due to student withdrawal from the course (Fall 2017).

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

For both Fall 2017 and Fall 2018, ROB101 was conducted as two sections (day and evening classes), enabling regular full time students (including WTMC students) and part time students to enroll and complete the course.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A written final exam was used to assess the learning outcome. This learning outcome was assessed by including 3-4 questions on the topic in the written portion of the final exam. Students were tested on the historical milestones and developmental timeline of robotics using multiple choice questions.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

Based on the data compiled, 88% of total students assessed scored either 70% or higher. The standard of success, as described in the learning outcome, was met.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

Students learn the historical timeline of robotics development and are able to understand how modern technologies evolved over time and the reason behind the system architecture of robot controllers.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

Continue to include this module at the beginning of the course.

Outcome 5: Write entry level robot programs.

- Assessment Plan
 - Assessment Tool: Student written robot program.
 - Assessment Date: Fall 2016
 - Course section(s)/other population: All sections.
 - Number students to be assessed: All students enrolled.
 - How the assessment will be scored: Department developed rubric.
 - Standard of success to be used for this assessment: 70% of the students will score a 3 of 5 or higher on all five areas.

- Who will score and analyze the data: Department faculty.

1. Indicate the Semester(s) and year(s) assessment data were collected for this report.

Fall (indicate years below)	Winter (indicate years below)	SP/SU (indicate years below)
2018, 2017		

2. Provide assessment sample size data in the table below.

# of students enrolled	# of students assessed
66	61

3. If the number of students assessed differs from the number of students enrolled, please explain why all enrolled students were not assessed, e.g. absence, withdrawal, or did not complete activity.

Of the total 66 enrolled students, 61 students were included in this assessment. The five missing students are due to student withdrawal from the course (Fall 2017).

4. Describe how students from all populations (day students on campus, DL, MM, evening, extension center sites, etc.) were included in the assessment based on your selection criteria.

For both Fall 2017 and Fall 2018, ROB101 was conducted as two sections (day and evening classes), enabling regular full time students (including WTMC students) and part time students to enroll and complete the course.

5. Describe the process used to assess this outcome. Include a brief description of this tool and how it was scored.

A written final exam and a laboratory final exercise were used to assess the learning outcome. This learning outcome was assessed by including 12-14 questions on the topic in the written portion of the final exam. Students were tested on reading an industrial robot program and completing missing program instructions using multiple choice questions, TRUE/FALSE statements, and short-answer questions.

In addition, students had to complete all laboratory exercises given during the semester. The laboratory exercises were designed to provide students sufficient time and attempts to complete the activity without penalty for multiple attempts. The objective is to make students comfortable programming the robot without hurting them and others in the lab.

The final laboratory activity requires student to write a short program to accomplish the given objective. All students complete the activity to complete the course.

6. Briefly describe assessment results based on data collected for this outcome and tool during the course assessment. Discuss the extent to which students achieved this learning outcome and indicate whether the standard of success was met for this outcome and tool.

Met Standard of Success: Yes

The existing metric of requiring 70% of students to score 3 of 5 or higher is not best suited to assess students' learning (especially in programming). A conservative metric of 70% students scoring above 70% was selected for the written FINAL assessment.

Based on this, 93% of students scored above 70% of possible points in the written assessment. All students also complete a final laboratory assignment to be considered for successful completion of course.

7. Based on your interpretation of the assessment results, describe the areas of strength in student achievement of this learning outcome.

In addition to testing student knowledge (using Bloom's taxonomy) in written finals, each student completed 10 labs over 7.5 weeks' time. Emphasis was placed on completion of lab activities and observing and reasoning the robots' behavior for each activity.

Each lab activity is deemed complete only after the student answers a couple of oral questions presented by instructor (Ex: why did the robot move in linear fashion? why did the robot program fail?) before sign-off.

During the final, students are required to complete a hands-on portion where a student writes a robot program on a teach pendant based on the objective given to them. All students are required to successfully complete the hands-on portion to pass this course.

8. Based on your analysis of student performance, discuss the areas in which student achievement of this learning outcome could be improved. If student met standard of success, you may wish to identify your plans for continuous improvement.

Hands-on learning is critical for thorough understanding of the course material. We plan to continue to emphasize the importance of observation and deliberation of each robot program written by students.

III. Course Summary and Intended Changes Based on Assessment Results

1. Based on the previous report's Intended Change(s) identified in Section I above, please discuss how effective the changes were in improving student learning.

No previous assessment report exists for ROB101 course.

2. Describe your overall impression of how this course is meeting the needs of students. Did the assessment process bring to light anything about student achievement of learning outcomes that surprised you?

Having an introductory course for robotics serves its purpose of helping students understand the safety concerns working with robots, and helps them get comfortable working with robots. This course is a mandatory requirement to continue with other robotics courses.

3. Describe when and how this information, including the action plan, was or will be shared with Departmental Faculty.

We will be sharing the report with other AMT faculty during the Fall 2019 faculty meeting.

4. Intended Change(s)

Intended Change	Description of the change	Rationale	Implementation Date
Course Materials (e.g. textbooks, handouts, on-line ancillaries)	Provide additional case studies/resources such as robotics-relevant industry articles (e.g. source: IEEE Spectrum, RobotReport, AMI ... etc.), using the 'blog' option on the Blackboard course page, case studies, project demo videos.	This will provide students with an exposure to varied applications and provide industry-relevant web resources for lifelong learning.	2019
Course Materials (e.g. textbooks, handouts, on-line ancillaries)	Provide a peer-reviewed (student-level appropriate) article/whitepaper on 'Upstream/Downstream model of an automated manufacturing process'	This will provide students with an overview of upstream and downstream manufacturing models to enhance	2019

	as an additional reading assignment, and conduct a classroom discussion on this topic. The article will be shared using the 'blog' tool on the Blackboard course page.	students' understanding of automated production.	
Course Materials (e.g. textbooks, handouts, on-line ancillaries)	Additional lab practice time.	Additional lab practice time with robots during office hours and on Saturdays provides students with a relaxed, self-paced learning opportunity. Starting Fall 2018, we have offered open-lab time during my office hours and on a few Saturdays for students to practice. We shall continue to do the same moving forward, based on students' needs.	2019

5. Is there anything that you would like to mention that was not already captured?

6.

III. Attached Files

- [ReportData F17 F18 ROB101](#)
- [ROB101 WrittenFinals SampleQs](#)
- [ROB101 HandsOnFinals SampleQs](#)

Faculty/Preparer: Hari Kandasamy **Date:** 07/22/2019
Department Chair: Thomas Penird **Date:** 07/22/2019
Dean: Brandon Tucker **Date:** 07/24/2019
Assessment Committee Chair: Shawn Deron **Date:** 08/29/2019