COURSE SYLLABUS

COURSE TITLE: C- 215 Robot System Operations 1

INSTRUCTOR: Jacob Bradshaw

OFFICE LOCATION/HOURS: Bock, Rm 230

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COURSE DESCRIPTION:

Students will be introduced to the basic theory, operation, and programming of industrial robots. Through the use of lecture, hands-on laboratory activities, Fanuc RoboGuide software and simulation, and teach pendant programming, students will complete hands-on labs with APTMFG CSM trainer. Students will also be exposed to virtual simulations, projects, and critical thinking assignments to help prepare for the silver and gold SACA C- 215 Robot System Operations 1 certification exam. Students will also prepare to take the NOCTI Fanuc Handling Pro & Tool Programming certification.

PREREQUISITES: None

REQUIRED TEXT: None

LEARNING OUTCOMES: Upon completion of this course, the student should be able to:

1. Identify safety hazards and apply safe working practices when working with automated equipment.
2. Demonstrate ability to set up and jog a 6-axis robot.
3. Demonstrate an ability to appropriately start, operate, and shut down an industrial robotic cell.
4. Demonstrate an ability to effectively define tool center points (TCP).
5. Develop an understanding of the various coordinate systems used in robotic programming applications.
6. Demonstrate ability to backup and restore individual files and programs.
7. Demonstrate an ability to recover robot operation from common faults and errors.
8. Demonstrate an ability to monitor, force, and simulate robot inputs and outputs.
9. Create and execute MACRO's commands within a robotic application.
10. Demonstrate an ability to create programs with a subroutine structure.
11. Demonstrate an ability to modify programmed positions.
12. Demonstrate ability to read and interpret technical documents pertaining to the robotic cell.
13. Demonstrate ability to use various types of software applicable (RoboGuide) to the course.
14. Assess readiness to take the SACA C-215 Robot System Operations I Certification exam.
15. Assess readiness to take the Fanuc Handling Tool Operations & Programming I Certification exam.

COURSE REQUIREMENTS: Internet connection, min 2GB USB drive, notebook, writing device, safety glasses

ATTENDANCE/PARTICIPATION: Students are expected to attend all class and laboratory sessions. Absences may be permitted for reasonable causes, including but not limited to, illness, disabling injury, death or serious illness in the immediate family. Participation in University-sponsored activities shall also constitute a reasonable cause for absence from class. Written documentation of the reason for absence may be required and, in the case of University-sponsored events, such documentation will be provided by the University sponsor. It is the student's responsibility to discuss pending absences (field trips, athletic competitions, etc.) with his/her professor prior to the missed class period. The faculty member may require the student to complete any work due prior to the absence.

GRADING/EVALUATION:

SACA Silver Online Exam = Minimum Passing Score (80%)
SACA Gold In-Person Hands-On Practical Exam = Minimum Passing Score (100%)
FANUC Handling Tool Operations Exam = Minimum Passing Score (80%) (47 questions; you must achieve an 80% or higher to be certified; 100 points for certification, 0 points if not certified)

OTHER POLICIES:

Trine University industrial partnerships will dictate course start and completion date. Trine University has the right to amend any current or future policies pertaining to the TCTT, Trine Center for Technical Training.

Proper clothing is required when working with a robotic application. No jewelry, no loose hair, no open toed shoes, sandals or flip flops is permitted when working within a robotic cell. This is strictly enforced.

ACADEMIC MISCONDUCT:

The University prohibits all forms of academic misconduct. Academic misconduct refers to dishonesty in examinations (cheating), presenting the ideas or the writing of someone else as one's own (plagiarism) or knowingly furnishing false information to the University by forgery, alteration, or misuse of University documents, records, or identification. Academic dishonesty includes, but is not limited to, the following examples: permitting another student to plagiarize or cheat from one's own work, submitting an academic exercise (written work, printing, design, computer program) that has been prepared totally or in part by another, acquiring improper knowledge of the contents of an exam, using unauthorized material during an exam, submitting the same paper in two different courses without knowledge and consent of professors, or submitting a forged grade change slip or computer tampering. The faculty member has the authority to grant a failing grade in cases of academic misconduct as well as referring the case to Student Life.

PLAGIARISM:

You are expected to submit your own work and to identify any portion of work that has been borrowed from others in any form. An ignorant act of plagiarism on final versions and minor projects, such as attributing or citing inadequately, will be considered a failure to master an essential course skill and will result in an F for that assignment. A deliberate act of plagiarism, such as having someone else do your work, or submitting someone else's work as your own (e.g., from the Internet, fraternity file, etc., including homework and in-class exercises), will at least result in an F for that assignment and could result in an F for the course.

ELECTRONIC DEVICES:

Use of electronic devices including smart watches and cell phones is prohibited during exams or quizzes unless directly allowed by the instructor.

ADDITIONAL INFORMATION:

Course Curriculum: "Skill" is equivalent to hands-on lab.

Week 1

1. Introduction to Robotics
    - Objective 1 - Define Safety
    - Objective 2 – Describe AUTO/T1/T2 switch speeds
    - Objective 3 – Define DCS password settings.
    - Objective 4 – Define startup screen navigation.
    - Objective 5 - Define the basics of operation menu display.
    - Objective 6 – Define jogging the 6-axis robot.
    - Skill 1 – Manually jog/move robot with different speeds.
        - Self-Review 1
        - Quiz

Week 2

2. Basic Programming I
    - Objective 1 – Define gripper setup.
    - Objective 2 - Describe UFrame 2 setup points.
    - Objective 3 - Describe the orientation origin point and its location marks.
    - Skill 1 - Perform a location evaluation for origin points.
    - Objective 4 - Describe the X and Y-direction points of the right-hand rule.
    - Skill 2 - Power up and define UFrame points.
    - Objective 5 – Reference electrical drawing layout for the robotic cell.
    - Objective 6 – Reference mechanical drawing of the robotic gripper.
    - Objective 7 – Review all relevant technical material.
        - Self-Review 1
        - Quiz

Week 3

3. Basic Programming II
    - Objective 1 - Describe the operation of the UTOOL/TCP setup.
    - Skill 1 – Perform a TCP.
    - Objective 2 - Describe how to setup a payload.
    - Objective 3 - Describe how to setup a DCS, DCS Tool Model, DCS Safezone.
    - Skill 3 – Perform a DCS Setup.
    - Objective 4 - Describe how to monitor and setup digital inputs and outputs.
    - Objective 5 – Describe how to setup a Macro function.
    - Objective 6 – Describe TP function key hint screen.
    - Objective 7 – Describe how to powerup and home / reference a program.
    - Skill 4 – Set up a macro to control an output then home a robot.
        - Self-Review 1
        - Quiz

Week 4

4. iRVision Programming
    - Objective 1 - Describe how to adjust a camera and its lighting position.
    - Skill 1 – Manually adjust a vision camera from its frame.
    - Objective 2 – Describe how to calibrate a camera for production use.
    - Skill 2 – Demonstrate a camera application verifying a part.
    - Objective 3 - Describe how to add camera adjustments to TP programming.
    - Skill 3 - Adjust a program utilizing iRVision.
        - Self-Review 1
        - Quiz

Week 5

5. Robotic File Systems
    - Objective 1 - Describe how to connect to the robotic cell through ethernet communication.
    - Objective 2 - Describe the operation and navigation of the robot software (RoboGuide).
    - Objective 3 - Describe the operation of a PC connected and used for programming a robot.
    - Skill 1 - Operate a robot using RoboGuide.
    - Objective 4 - Describe how to file transfer as a backup to an USB.
    - Skill 2 – Perform a file backup using the TP and the PC.
    - Objective 5 - Describe how to use the RoboGuide simulator.
    - Skill 3 – Create a robotic simulation of a realistic robotic system.
    - Objective 6 – Describe how to navigate to a numeric register and a position register.
    - Objective 7 – Describe how to show a list of programs through the TP.
    - Objective 8 – Describe how to navigate to the menu utility setup for HTML screens.
    - Skill 4 – Perform a navigational setup through the TP
        - Self-Review 1
        - Quiz

Week 6

6. Pick and Place Module and Station Sequencing
    - Objective 1 - Describe How to Adjust a Shock Absorber
    - Skill 1 - Adjust a Shock Absorber
    - Objective 2 - Describe a Sequence of Operation of a Powered Parts Feeder
    - Skill 2 - Design a PLC Program That Sequences a Powered Parts Feeder
    - Objective 3 - Describe a Sequence of Operation of a 2-Axis, Pick and Place Manipulator
    - Skill 3 - Design a PLC Program That Sequences a 2-Axis, Pick and Place Pneumatic Manipulator
    - Objective 4 - Describe a Sequence of Operation of a Pick and Place Feeding Station
    - Skill 4 - Design a PLC Program That Sequences a Pick and Place Feeding Station
    - Objective 5 - Describe the Operation of a Pick and Place Feeding Station with Manual/Auto/Reset Functions
    - Skill 5 - Design a PLC Program That Provides Manual/Auto/Reset Functions for a Pick and Place Feeding Station
        - Self-Review 1
        - Quiz

Week 7

7. SACA TEST STUDY GUIDE – ROBOTIC PROGRAMMING 1
    1. SACA SILVER EXAM (Online Proctored Exam)
    2. SACA GOLD EXAM (Hands-On Proctored

Week 8

8. FANUC NOCTI MATERIAL HANDLING PROGRAMMING – ROBOTIC PROGRAMMING 1