**Course Syllabus**

**Course:** ENGT 213 – Robotic Fundamentals

**Section #:** 01

**Semester:** Spring 2013

**Course Credits:** 2Lecture, 2 Lab, 3 Credit Hours

**Developer:** John Daum 217-875-7211 X447

**Dev/Rev Date:** Spring 05

**PCS #: IAI #:** (if applicable)

**Class Data:**

Section: 01

Time: 9:00-11:50 AM—M ,W

Room: E152

**Instructor Information:**

Name: John Daum

Phone: 217-875-7211 ext 447

Office: E152A

Email: [jdaum@richland.edu](mailto:jdaum@richland.edu)

**Office Hours**:

Mon, Wed : 11 to 12:30 ; 2:15 to 2:45 Tues, Thur: 12 to 12:30

And By Appointment

**Course Description:**

ENGT 213 Robotic Fundamentals is a hands-on introduction to industrial robot systems including hardware, software, and system integration. Topics include operation, programming, troubleshooting, proper application, system integration, profitability analysis, and safety issues. The course covers an overview of current robotics industry, terminology, mechanical components, power sources, end effectors, robot controllers, and system sensors. A variety of robotic systems are studied, including servo and non-servo systems. Programming is done both on the PC and “teach" pendants. Robots will be integrated with CNC machines, programmable logic controllers and electrical controls to create a flexible manufacturing system (FMS).

This course has been modified in content and delivery to meet the critical objectives for the INAM grant program.

Applicable toward graduation where program structure permits:

* Certificate or Degree – All certificates, A.A.S., A.L.S
* Group Requirement – Not Applicable
* Area of Concentration – Not Applicable

**Course Prerequisite:**

ENGT 104 or ENGT 210

**Course Outcomes :**

The student will be able to perform or demonstrate the following skills at the end of the course.

**Course Objectives/Outcomes:** The student will be able to perform or demonstrate the following skills at the end of the course.

|  |
| --- |
| **Course Outcomes:** |
| 1. Demonstrate knowledge of basic OSHA requirements, general shop safety, and machine tool safety procedures |
| 1. Demonstrate entry-level skills to setup and operate machine tools |
| 1. Operate, troubleshoot, and program a robotic system. |
| 1. Utilize robotic terminology |
| 1. Apply workplace safety concepts to robotic applications |
| 1. Apply business economics to the use of a robot |
| 1. Program a servo robot |
| 1. Identify robots by various classification systems. |
| 1. Identify and explain various end effectors. |
| 1. Utilize teach pendant to teach and modify points |
| 1. Utilize off-line software to write and edit a robotics program |
| 1. Upload and download robot programs using off line computer systems |
| 1. Operate and maintain robotic electrical controls. |
| 1. Operate and maintain robotic fluid power components |
| 1. Operate and maintain robotic mechanical systems |
| 1. Integrate robot controller with inputs and outputs |
| 1. Integrate robot with a CNC machine |
| 1. Utilize a robot system for palletizing |
| 1. Identify attributes that determine a successful robotic systems integration. |
| 1. Utilize manufacturer data sheets to identify commercial robot characteristics. |
| 1. Trouble shoot robot application failures |
| 1. Demonstrate use of basic math skills to facilitate technical metal cutting competences |
| 1. Use basic communication skills (reading, writing, speaking, and listening) to understand technical manuals and written work instructions while interacting well in a team/group environment |
| **RCC Cross-Disciplinary Outcomes:** |
| 1. The degree-seeking student will be able to communicate effectively (read, write, speak and listen). |
| 1. The degree-seeking student will think critically and creatively |
| 1. The degree-seeking student will manage technology and evaluate information in various research and applied contexts. |
| 1. The degree-seeking student will act professionally and responsibly |

**Text: (On Line Reference Only )**

Mitsubishi Robot Operators Manual , Mitsubishi Company

Mitsubishi Robot Training Manual , Mitsubishi Company

**Topical Outline:**

|  |  |
| --- | --- |
| Week 1 | Robotic overview |
| Week 1 | Economics of Robotics |
| Week 2 | Teach Pendant Operation |
| Week 3 | Inputs and Outputs |
| Week 4 | Basic Robot Program structure |
| Week 5 | Offline programming software |
| Week 6 | Subroutine programming |
| Week 7 | Application requirements |
| Week 8 | Robotic mechanical systems |
| Week 9 | Robotic electrical systems |
| Week 10 | Robotic fluid power systems |
| Week 11 | Robotic palletizing |
| Week 12 | Programming troubleshooting |
| Week 13 | PLC integration |
| Week 14 | Robot system integration |
| Week 15 | Projects Due |
| Week 16 | Final |

**Methods of Delivery:**

This course utilizes competency based learning which requires the student to perform tasks designed to demonstrate the ability to meet course requirements. The course incorporates lecture, discussion, group activities, individual activities, assigned reading, problem solving, critical thinking, and structured competency-based laboratory experiences.

**Grading Policy:**

Grades will be compiled from the following weighted scale:

Hands on Labs 30%

Tests and quizzes 40%

Teach Pendant

Basic Operator Controls

Basic Programming Commands

Advanced Programming Commands

Robot Terminology and Systems Integration

Final Project (Palletizing) 10%

Presentation assignment 10%

Class participation, attendance, and teamwork 10%

Grades will be determined by a composite score of unit exams, comprehensive final examination, group activities, written projects, and student project assignments. Please note that speed and efficiency will be an attribute measured during testing. Homework is mandatory and will be graded. Late work will be marked down one letter grade and will not be accepted after the next class period. **This includes unapproved absences on test days!!**

**Methods of Evaluation:**

This course incorporates discussion, problem solving, reading and writing, student questions, cooperative group activities, and lectures. Students are strongly encouraged to come to class prepared to ask questions and participate in the learning process in the classroom

Letter grades and lab scores will be based upon the following attributes listed below:

Accuracy, speed, overall quality, attention to detail, conformance to requirements, teamwork, dependability, proper use and care of tools and equipment, clean-up of equipment, troubleshooting and minimizing mistakes, following instructions, ability to perform increasingly higher level tasks.

Grading criteria of lab work is detailed as follows:

" **A** "Always executes skills without supervision, can explain and show others. Exceeds all requirements and expectations, with no rework, in an efficient, timely manner. Able to solve most problems independently and takes on higher level tasks. Deliverables are excellent. Helps others.

" **B** " Frequently executes skills without supervision. Meets all requirements, with limited rework, working at a reasonable pace. Able to solve most problems with limited input from others. Does not need help. Deliverables are good. Can take on some higher level tasks.

" **C** " Usually executes skills without supervision. Meets all requirements, with occasional rework, using maximum time allotted. Not able to solve problems without limited help from others. Deliverables are acceptable. Not ready for higher level tasks.

" **D** " Infrequently executes skills without supervision. Inconsistent in ability to perform required tasks. Is in constant need of help. Normally needs others to help complete work. Can not solve problems without significant help from others. Can not complete tasks in a timely manner. Deliverables are messy. Unable to do more than the minimum.

" **F** " Did not perform the required work. Unacceptable attendance and class participation. Unable to execute skills without supervision. Use help from others to complete work. Can not solve troubleshooting problems. Deliverables are not complete. Does not complete tasks in a timely manner.

**Important Course Content Information:**

**Lab Assignments:**

* Lab assignments will be completed sequentially.
* Deliverables include a title page, copy of the program, flow chart, and set up sheet that will be stapled and turned in. This material must be neat and well presented.
* The robot program will be operated upon request by instructor.
* The student will be expected to perform all essential elements of each project without substantial assistance.
* Students are encouraged to work and help each other. However, each student must demonstrate individual proficiency on each project.

It is **not acceptable** to copy other students work or programs.

**Presentation:**

A formal 15 minute presentation will be made as assigned during the semester. Each student will be assigned a robotic topic to present to the class. The presentation should include PowerPoint or other multimedia systems. Discussion of the assigned topic should be based on internet research, recent publications or news events concerning the use of robotics in today’s manufacturing environment. The topic and rough outline will be reviewed and approved by the instructor prior to start of research. The presentation should include library and internet research, actual observations, and overheads. The goal of this project is to broaden the class perspective of real world applications of robotic technologies. A copy of the referenced articles will be handed in.

**Field Trip:**

A field trip will be utilized to study real world examples. A report will be due one week after the visit. The topic will be assigned after the visit. The report should be a minimum of two typed pages of concise discussion, applying material studied to actual observations. The paper must be typed using word processor software, double-spaced, with 12 pt font. Due to scheduling conflicts, field trips and lab time cannot be made up. Since field trips cannot be made up, missing a field trip will drop your final grade by one letter!

**Supplies:**

The following items are required:

1. Calculator
2. Safety Glasses
3. USB Flash Drive (2 GB)
4. Shop coat (optional)
5. Ruler with metric (millimeters)
6. 3-ring notebook
7. Pencils
8. Graph paper
9. Loose leaf lined paper
10. Highlighter

**Attendance:**

*Regular attendance is necessary for satisfactory completion of a course. Richland faculty will take roll at each class meeting at least through midterm. If a student is absent for one week plus one day (or less, if specified by the instructor in the course outline), his/her name may be sent to the Registrar’s Office. Students with unsatisfactory attendance will be sent a “stopped attending” letter. At midterm the College will administratively drop any student who has failed to meet the attendance standard as certified by the instructor. This report will be used to determine certain financial aid awards. A student who fails to attend the first two classes of a course may also be dropped from the class.*

Each unexcused missed class may result in a 2% deduction in the attendance grade. Five or more unexcused absences may result in an administrative drop. **Student must notify instructor prior to class for approval of absence**. No tests/quizzes may be made up without prior approval. **Students wishing to drop class must complete written drop request form, which includes instructor’s signature, or a grade of “F” will result.**

**Instructor Absence:**

In the unlikely event that the instructor is unable to attend class, a note will be posted in the classroom by the department assistant stating such. In case of instructor delay, students should practice good time management skills by working on course material until the instructor arrives. In no case will the class be cancelled without an official notice from the department assistant. The instructor will make every attempt to contact students ahead of time if class is cancelled due to illness.

It is the student’s responsibility to keep their registration contact phone number up to date.

**Safety Warning:**

**LAB EQUIPMENT UTILIZES HIGH PRESSURE COMPONENTS, HIGH VOLTAGE POWER SOURCES, ROTATING SHAFTS, AND FLYING CHIPS. WEAR SAFETY GLASSES WHEN OPERATING ANY LAB EQUIPMENT. FAMILIARIZE YOURSELF WITH ALL OPERATING INSTRUCTIONS AND SAFETY REQUIREMENTS PRIOR TO OPERATING EQUIPMENT!!!!!ASK FOR ASSISTANCE IF YOU ARE UNCERTAIN ABOUT THE OPERATION OF ANY MACHINE OR PROCESS. BE AWARE OF OTHER STUDENT’S ACTIVITIES!!**

**Student Responsibility for Insurance:**

The College provides no medical, long-term disability or life insurance for students, and as such, the student assume full responsibility for any medical or loss of time expenses. , if any should occur during the period of this event, including but not limited to classroom, field trips, and travel outside of the classroom.

**National/ State/ Local Skill Standards:**

* Illinois Skill standards for Manufacturing are not published at this time.
* Illinois Skill standards for Machining are incorporated when applicable.
* NIMS - National Institute for Metalworking Skills are incorporated when applicable

**Classroom Procedures:**

Students will conform to the RCC Student Conduct policies included in the College Course Catalog. Violations of these rules will result in a reduction of your class participation grade and possible removal from class:

* Students are expected to be prepared and ready to perform at the best of their abilities.
* Students are expected to be on time!
* Cell phones and pagers must be turned off before entering the class room.
* Food and beverages are not allowed in the classroom.
* The student is to be courteous to others and respect their right to have an opportunity to learn.
* The student will conduct him/herself in a professional manner at all times.
* Students “suspected” of being under the influence of alcohol or illegal drugs will be asked to leave the classroom.

**ADDITIONAL HELP:**

BE SURE TO GET HELP BEFORE IT IS TOO LATE!

Office hours will be announced. The student is encouraged to get additional help when the material is not comprehended. Robotics is a cumulative subject; therefore, getting behind is a difficult situation for the student.

**STUDY GROUPS**

The student is encouraged to study with other students. A study group of 2 to 4 persons is an excellent opportunity to ASSIST in the learning of technology. Each student in the study group should be responsible for the understanding of all of the material.

**Online Resources Available:**  Additional study resources are available on World Wide Websites: I encourage you to explore the many internet resources as a source of study assistance.

**Human Relations Policy:**

* This course incorporates concepts regarding all races, creeds, sexes, and ethnic groupings, and the belief that they must learn to live together.

**RCC Core Values:** The following core values will guide the class:

* Commitment - We are dedicated to meeting the needs of the communities we serve.
* Respect - We recognize the expertise of all members of the College community and encourage individual contributions.
* Excellence - We strive to develop and pursue higher standards.
* Accountability - We assume and demonstrate responsibility for our actions.
* Diversity/Inclusiveness - We believe that our similarities and differences are opportunities for establishing a common bond and strengthening the College.

**RCC Academic Integrity Policy:**

Each student is expected to be honest in his/her class work or in the submission of information to the College. The College regards dishonesty in classroom and laboratories and on assignments and examinations and the submission of false and misleading information to the College as a serious offense. A student who cheats, plagiarizes, or furnishes false, misleading information to the College is subject to disciplinary action up to and including failure of a class or suspension/expulsion from the College.

**Cross-Disciplinary Outcomes**

1. The degree-seeking student will be able to communicate effectively (read, write, speak and listen).
2. The degree-seeking student will think critically and creatively.
3. The degree-seeking student will manage technology and evaluate information in various research and applied contexts.
4. The degree-seeking student will act professionally and responsibly.

**Core Abilities/SCANS:**

1. Reading
2. Mathematics
3. Teamwork

Participate as a team member – contribute to group effort

1. Responsibility
2. Problem Solving
3. Information

Acquire and evaluate information

Organize and maintain information

Interpret and communicate information

**my.richland.edu**

Richland uses my.richland.edu as the information portal for students. Users can access a wide variety of web-based services, including online registration, academic information, Richland e-mail, the Angel Learning Management System, and the LRC research databases. Academic information available includes current semester schedule, unofficial transcripts, grade point average projection, financial aid information review, online payment services, and degree auditing to determine degree completion progress. Student grades are posted only on the my.richland.edu website. Grades will not be mailed to students unless requested.

Students with a “hold” placed on their records due to a financial obligation to the College or other unmet requirement will be unable to view academic records.

**RCC Student Support Services**

**College Telephone Number: 217-875-7211**

**Academic Success Center**

**Accommodations,** Room C148, Ext. 379

Responsibilities: Services for students with documented disabilities, including advisement, counseling, adaptive equipment and materials, instructional aids, tutors, note takers, interpreters, and testing accommodations.

**Testing,** Room S116, Ext. 238

Responsibilities: Placement testing in English, mathematics, reading, health courses; make-up testing as arranged by instructor; testing for online courses.

**Tutoring,** Room S118, Ext. 419

Responsibilities: Tutoring on walk-in or appointment basis, study groups, computers.

**Enrollment Services**

**Advising and Registration**, Room C129, ext 267

Responsibilities: Advisement, registration, general student services

**Financial Aid and Veteran Affair’s,** Room N136, ext 274

Responsibilities: federal and state aid, veteran and entitlement benefits, scholarships

**Student Records**, Room C129, Ext. 257

Responsibilities: grades, transcripts, graduation.

**Learning Resources Center (Library)**, Room C152, Ext. 303

Responsibilities: Manages print and electronic resources for students, faculty, and the broader College community. Offers research assistance, information literacy sessions, course reserves, and individual and group study areas.

**Online Learning Support**, [ochelp@richland.edu](mailto:ochelp@richland.edu) Room W143, Ext. 376

Responsibilities: Assists students with navigation in an online course, access and navigation in the student information system, and technical questions regarding personal computer system requirements and troubleshooting. Assistance is also given to students in hybrid and technology enhanced courses. Staff provide technical support through e-mail, telephone, and walk-in service. The best way for students to contact the Online Help Desk is to use the Tech Request Support Form at <http://www.richland.edu/online/support> or e-mail at [ochelp@richland.edu](mailto:ochelp@richland.edu). The Request goes directly to the Help Desk e-mail as well, and this e-mail is checked regularly.

**Open Computer Labs**

Students may use computers in the Learning Resources Center and in the Academic Success Center.

**Perkins Program**: Room E185, Ext. 223

**Message from Leslie DeVore,** Carl Perkins Federal Grant Administrator:

*The Perkins program is a federally-funded program designed to assist students in helping them become academically successful. For a student to be eligible for the Perkins Program they must be enrolled in an occupational program.*

*If a student is enrolled in an occupational area, they are automatically enrolled in the Perkins Program. Students may call the Perkins Program Coordinator for more information 875-7211, Ext. 223 or stop by E185.*

*All students should apply for financial aid (forms can be obtained from Student Development and Services on the first floor). Funding for the Carl Perkins Program is based on the number of students requesting financial aid.*

**Student and Career Development**

**Career Services**, Room C129, Ext. 307, 205

Responsibilities: Career assessments, job placement information and transfer information and assistance

**Counseling Services**, Room C129, Ext. 252

Responsibilities: Academic advising, personal counseling.

**Transfer Center**, Room C129, Ext. 222

Responsibilities: Transfer information, college visits, and campus representatives on campus

**Veteran Services**, Room C129, Ext. 307, 205

Responsibilities: assist veterans with comprehensive college services

**Student Engagement**

**Student Success**, Room C131, Ext. 314

Responsibilities: Passport workshops, academic success strategies and workshops, Success.net, (assist with identifying academic need early), and work with probation and suspension students.

**Student Support Services/TRiO Program,** Room C143, Ext. 440.

Responsibilities: Program designed for first-generation college students, offering academic and personal support.

Schedule subject to change:

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Date** | **Topics** | **Homework/Tests:** |
| **1** | Jan 14 | Robotic overview. Lab Procedures Economics of Robotics |  |
| **2** | Jan 21 | Teach Pendant Operation, Machine Operation |  |
|  | Jan 21 | MLK Holiday College closed |  |
| **3** | Jan 28 | Basic Robot Program and Position file structure | Project 1(Move to sensors) |
| **4** | Feb 4 | Offline programming software | Project 2 |
| **5** | Feb 11 | Movement commands | Project 3 |
| **6** | Feb 18 | Movement commands | **Teach Pendant Test 1** |
|  | Feb 18 | Presidents Day Holiday College closed | Project 4 |
| **7** | Feb 25 | Robotic mechanical systems | Project 5 |
| **8** | Mar 4 | Inputs and Outputs, PLC integration | **Basic Programming Commands Test 2** |
| **9** | Mar 11 | Spring Break |  |
| **10** | Mar 18 | Robot system integration, Application requirements | Project 6 |
| **11** | Mar 25 | Subroutine programming | **Robot Terminology Test 3** |
|  | Mar 29 | Spring Holiday |  |
| **12** | Apr 1 | Robotic electrical systems |  |
| **13** | Apr 8 | Robotic fluid power systems | **Advanced Programming Test 4** |
| **14** | Apr 15 | Robotic palletizing, |  |
| **15** | Apr 22 | Plant tour, Programming troubleshooting | **Systems Integration and sensors Test 5** |
| **16** | Apr 29 | Projects | Project Due |
| **17** | May 6 | **Last Day to Drop Friday May 10** |  |
| **18** | May 14 | Final Wed May 15 | Comprehensive Final |
|  |  |  |  |

INAM Grant:

“This workforce solution was funded by a grant awarded by the U.S. Department of Labor’s Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timelines, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use, by an organization and/or personal use by an individual for  non-commercial purposes, is permissible. All other uses require the prior authorization of the copyright holder.”

CIM Lab House Keeping Rules:

1. Follow all Safety rules (see separate sheet)
2. Report all worn or damaged tools to the instructor
3. Check out new tools with the instructor. Do not remove from inventory without removal.
4. Check out raw material with the instructor. Do not remove from inventory without approval.
5. Report malfunctioning or damaged equipment.
6. Clean up area before leaving the lab for the day, unless another student accepts responsibility to clean it up.
7. Return all tools to the tool box when done using.
8. Turn off the air and shut down machines if no one else is in line.
9. Do not put fingerprints on the computer screens or Plexiglas covers.
10. Do not wear dirty or oily shoes in the lab. Bring a change of shoes if necessary.
11. Keep the lab door closed for noise and HVAC control.
12. Wash hands after eating oily or salty foods.
13. Drinks must be in a spill proof container.
14. Wash hands BEFORE and AFTER using equipment and Keyboards
15. Ask instructor or lab facilitator for access to tools or for assistance with machines.

**Violations of these rules indicate poor workplace skills and will result in a reduction of your class participation grade.**

CIM Lab Safety Rules:

Notice: **LAB EQUIPMENT UTILIZES HIGH PRESSURE COMPONENTS, HIGH VOLTAGE POWER SOURCES, ROTATING SHAFTS, AND FLYING CHIPS**

1. **Students are expected to follow all OSHA and common workplace rules.**
2. **Students will be drug and alcohol free.**
3. **Wear safety glasses when operating any lab equipment.**
4. **Do not reach into operating machines.**
5. **Follow lock out, tag out procedures when working on a machine.**
6. **Dress appropriately. Remove all jewelry, rings, watched, roll up sleeves, and tuck in shirt tales.**
7. **Protect your hearing from load noises.**
8. **Familiarize yourself with all operating instructions and safety requirements prior to operating equipment**
9. **Ask for assistance if you are uncertain about the operation of any machine or process**
10. **Be aware of other student’s activities! You are responsible for your fellow students!**
11. **Students are not allowed to use equipment without supervision.**
12. **Protect your back when lifting or bending. Follow best ergonomic practices.**
13. **Protect your shoulders and wrists when using a keyboard. Follow best ergonomic practices.**
14. **The College provides no medical, long-term disability, or life insurance for the student, and as such, the student assumes full responsibility for any medical or loss of time expenses, if any should occur during the period of this event.**

**Violations of these rules indicate poor workplace skills and will result in a reduction of your class participation grade. Severe safety violations may result in dismissal from class.**