

COURSE OUTLINE

SCHOOL: School of Engineering Technology and Applied Science

DEPARTMENT: Advanced Manufacturing and Automation Technology (AM)

PROGRAM: Automation and Robotics Technician / Technology

COURSE TITLE: Robotic Applications

COURSE CODE: ROBO 247

TOTAL COURSE HOURS: 60 (15weeks X 4 hours)

PRE-REQUISITES/CO-REQUISITES: ROBO 237 (Robotic Devices)

**COURSE ELIGIBILITY FOR PRIOR LEARNING
ASSESSMENT AND RECOGNITION (PLAR):** Yes

ORIGINATED BY: Donald Wang

REVISED BY: Tito R. Khandaker

DATE: January, 2009

APPROVED BY:

Chairperson/Dean

Semester: 2009 Winter

Students should keep all course outlines for each course taken at Centennial College. These may be used to apply for transfer of credit to other educational institutions. A fee may be charged for additional or replacement copies.

COURSE DESCRIPTION:

Building on fundamentals learned in Robo-237, the learner will acquire new programming skills and apply them to industrial robot applications in the laboratory. Topics include robot electrical safety circuits, programming ABB Robots with the input signals and output devices. The learner will also acquire knowledge of the ABB Robot color sorting program, ABB Robot calibration procedure, ABB TCP procedure, automation sensors, work cell support systems, robot and system integration.

COURSE LEARNING OUTCOMES:

Upon successful completion, the student will be able to:

1. Design and write the color sorting application of ABB Robots.
2. Design and write the program the ABB Robots with input signals and output devices.
3. Integrate basic automation sensors, and basic work cell support systems into automation and robotic systems.
4. Use the ABB Robot calibration and TCP procedures.
5. Identify the processes of the CIM systems.
6. Document laboratory assignments in a technical format.

ESSENTIAL EMPLOYABILITY SKILLS (EES):

This course supports the student's ability to:

- apply a systematic approach to solve problems.
- use a variety of thinking skills to anticipate and solve problems.
- locate, select, organize, and document information using appropriate technology and information systems.
- interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.
- use a variety of computer hardware and software, and other technological tools appropriate and necessary to the performance of tasks.

PRIOR LEARNING ASSESSMENT & RECOGNITION PROCESS (ES):

This course is eligible for PLAR through the Registrar and SETAS offices. Assessment of portfolio and/or testing may be discussed with faculty.

EVALUATION & GRADING SYSTEM:

An overall 50% success rate is required.

| | |
|---------------------------------------|-------|
| Test #1 | 12.5% |
| Test #2 | 12.5% |
| Final Exam | 35% |
| Lab test | 10% |
| Lab attendance and "team" assignments | 30% |

Note: The **lab test** is marked on a pass or fail basis. A pass is given 10% and a fail is given 0%. There are no part marks for this portion of the overall grade.

STUDENT ACCOMMODATION:

All students have the right to study in an environment that is free from discrimination and/or harassment. It is College Policy to provide accommodation based on grounds defined in the *Ontario Human Rights Code*. Accommodation may include changes or modifications to standard practices.

Students with disabilities who require academic accommodations must register with the Centre for Student with Disabilities. Please see the Centre for Students with Disabilities for details.

Students requiring accommodation based on human rights grounds should talk with their professors as early as possible. Details are available on the Centennial College website (www.centennialcollege.ca).

If students are unable to write an examination due to a medical problem or unforeseen family problems, they should immediately contact their professor or program Chair for advice. In exceptional and well documented circumstances (e.g. unexpected family problems, serious illness, or death of a close family member), students should be able to write a make-up examination to replace an examination missed.

TEXT AND OTHER INSTRUCTIONAL/LEARNING MATERIALS:

Introduction to Robotics in CIM Systems

Handouts: ABB Robotics

Manual from library: ABB user's guide, manual no. 3HAC 0930-1 for BaseWare

OS 3.0

USE OF DICTIONARIES

Dictionaries (paper) are allowed for test or examinations, but electronic dictionary devices are not permitted.

POLICY STATEMENTS

College Policies

The following statements are selected from Centennial College policies approved by the Board of Governors.

Student Responsibilities

Students are expected to know the contents of the course outline and to discuss with the professor any areas where clarification is required.

Students should keep all course outlines for each course taken at Centennial College. These may be used to apply for transfer of credit to other educational institutions. A fee may be charged for additional or replacement copies.

Other Policies

Students should familiarize themselves with all College Policies that cover students' rights, responsibilities, and the Academic Appeal process. For further information, consult the Academic Matters Section in the full-time and Continuing Education calendars. The Academic Appeal Application form is available from any Enrolment Services Office.

Proof of Student Status

Students must produce official photo identification at any time during the semester when requested to do so by any professor. (The official piece is the Centennial Student Card.) Continuing Education students do not have Centennial Student Cards, and so they may use other forms of photo identification, such as a driver's license, health card, or other government-issued photo identification.

Final Examinations

When writing a test or examination, students must put their official photo-ID cards in full view for review by the invigilator. Students who do not have official photo-ID will be permitted to write the examination with a substitute photo-ID, but they will be required to produce photo-ID at the program or department office within 24 hours or the next business day following the examination, or else the examination results will be void.

More Final Examination Policies are available at <http://my.centennialcollege.ca>.

Academic Progression Policy for Diploma and Certificate Programs:

College Academic Standings will be applied. Please see Academic Policies and Procedures, Full-Time Calendar.

Faculty Consultation

Professors are available to see students outside of class time. Students can contact professors via voice mail, email, or through their program or department office. Information regarding how to contact teachers will be provided at the beginning of the course and is also available in the program or department office.

Human Rights Statement

It is the policy of the College that all programs will strive for a learning, teaching, and working environment that promotes inclusion, understanding, and respect for all students and employees, consistent with the *Ontario Human Rights Code* and Centennial College's *Statement of Diversity*.

| Week | Topic/Content | Readings | Instructional Objectives | Instructional Strategies/ Tests and Assignments |
|------|---|-----------------|--|--|
| 1 | Course outline overview, review test and lab requirements | NA | Provide clear directive for course. Set instructor standards | NA |
| 2 | a) Color sorting application b) ABB Robot I/O module | NA | a) Overview of the ABB instructions (ROBO237) and the color sorting application b) Using the ABB software, write the ABB Robot color sorting subroutine with the subroutine programming method. (Use the TPReadFK instruction) c) Introduce the ABB Robot I/O interface module and addressing method | Overheads/Group work No Lab Define Teams |
| 3 | ABB Robot's inputs and outputs module | ABB handouts | Introduce the ABB Robot I/O interface modules and addressing method, continued. | Overheads/Group work Lab #1 I/O Hardware – Identify I/O signals using the I/O Window and draw the I/O module with devices and sensors. |
| 4 | Introduce the ABB Robot PPNP application Automation sensors | Rehg's text | a) Examine an ABB I/O interface PPNP program and the interface between robots and PLC's. b) Introduce different types of industry sensors c) Examine WAITDI instructions | Overheads/Class notes Lab #2 I/O interface program |
| 5 | a) Robot and system integration b) Introduce other robotic applications c) Test#1 Preview | J. Regh's text | Examine the CIM method of robot and system integration Examine other robotic applications Overview of notes from week #1 to #7 for the preparation of the Test#1 | Overheads/Class notes Lab #3 ABB Robot and the pneumatic PNP Unit |
| 6 | Test #1 | NA | NA | Open labs |
| 7 | a) ABB calibration procedure b) Test#1 Review | NA | Examine the ABB calibration procedures | Handouts/ overheads Lab #4, ABB Robot's color sorting application |

| Week | Topic/Content | Readings | Instructional Objectives | Instructional Strategies/ Tests and Assignments |
|------|---|-----------------------------------|---|--|
| 8 | Network between ABB Robot and PLC systems | ABB handouts | Examine the WHILE DO instruction. Robot interface with sensors, pneumatic system, and operator's interface buttons | Overheads/ Sample worksheet/Group work Overheads/Group work Lab #5 While Do Loop program |
| 9 | a) ABB TCP procedure b) ABB Robots - Industrial Robot Program c) Test#2 Preview | NA | Examine the TPReadNum instruction Introduce the ABB new numerical data and other new instructions. Overview of notes from week #7 to #9 for the preparation of the Test#2 | Calibration procedure DEMO Make up of Labs #1 to #5 |
| 10 | Test #2 | N/A | N/A | Open Labs |
| 11 | a) ABB Robot - Industrial Robot program, continued. ABB Robot Emergency stop electrical circuits and applications–part b) ABB Robot Emergency Stop electrical circuits and applications – part 2 c) Work-cell support systems – part 1 d) Test#2 Review | ABB handout J. Rehg's text | Examine the ABB Robot application with the new instructions and introduction of ABB Robot envelope. Introduce the Run Chain Circuit and applications of the ABB Robots Introduce the Run Chain Circuit and applications of the ABB Robots, continued. Introduce material handling, part feeding, and inspection system | Overheads/Class Notes/Sample Program Lab #6 TCP procedure Lab#7 TP ReadNum and Industrial Robot application. |
| 12 | a) Work-cell support systems – part 2 b) CIM systems and different robotic case studies c) Review for lab test | J. Rehg's text | Introduce material handling, part feeding, and inspection system, continued. Examine the CIM systems and samples of different robotic applications. Review for the lab test rules and procedures. Overview of the lab test. | Overheads/Class notes/ group work Lab # 8 Run chain circuit and applications |

| Week | Topic/Content | <i>Readings</i> | Instructional Objectives | Instructional Strategies/ Tests and Assignments |
|-------------|--|------------------------|--|--|
| 13 | a) CIM systems and different robotic case studies b) Introduce other robotic applications | J. Rehg's text | Examine the CIM systems and samples of different robotic applications, continued. Examine other robotic applications. | Overheads/ class notes Extra help Open labs |
| 14 | Review for the final exam | NA | Overview of notes from week #1 to #14 | Overheads/ class notes Lab tests |
| 15 | Final exam | NA | NA | Final Exam - No Lab |