Bachelor of Technology Partnership

Course Outline

1. COURSE INFORMATION

Session Offered	Winter 2017	
Course Name	Industrial Networks and Controllers	
Course Code	PROCTECH4IC3	
Date(s) and Time(s) of lectures	Monday: 11:30am – 1:30pm Friday: 11:30am - 12:30pm	
Program Name	Process Automation Technology	
Calendar Description	Corporate and industrial networks, OSI model, Ethernet and TCP/IP, Modbus, Foundation Fieldbus, DevicNet, PROFIBUS, AS-I, propriety buses protocols and interfaces, distributed I/O, drivers and devices and their implementation in PC and PLC based systems	
Instructor(s)	Dr. Tom Wanyama	E-Mail: wanyama@macmaster.ca Office Hours & Location: Monday: 8:30am – 10:30am, ETB206

2. COURSE SPECIFICS

Course Description

Instruction Type

Code	Type	Hours per term
C	Classroom instruction	39
L	Laboratory, workshop or fieldwork	39
T	Tutorial	
DE	Distance education	78
	Total Hours	

Resources

ISBN	Textbook Title & Edition	Author & Publisher
ISBN:978-0-9948503-0-0	A Practical Approach to Industrial System Integration	*Author: Tom Wanyama publisher: Tom Wanyama*

Other Supplies	Source
Lecture Notes	Avenue

Prerequisite(s)	PROCTECH 3MC3, 3PL3, 3SC3 and registration in level IV of Process Automation Technology.
Corequisite(s)	*N/A*
Antirequisite(s)	*N/A*
Course Specific Policies	Attendance: Laboratory attendance is compulsory. A mark of zero will be allocated for missed laboratory experiments. Students shall only attend labs during the time assigned to their lab sections. Make up shall only be allowed if the missed work or lab is covered by MSAF. Late Submissions: Late testes and quizzes and assignments shall not be allowed. Late lab and project reports will result in 10% reduction in the assigned marks for each day the work is late to up to 5 days including weekends and holidays, after which the work will not be accepted. Laboratory Safety Policy: The students must follow the departmental safety policy. The students not following the safety policy will not be allowed to work in the laboratory and will not be allowed to make up such missed labs.

Departmental Policies	Students must maintain a GPA of 3.5/12 to continue in the program. In order to achieve the required learning objectives, on average, B.Tech. students can expect to do at least 3 hours of "out-of-class" work for every scheduled hour in class. "Out-of-class" work includes reading, research, assignments and preparation for tests and examinations. Where group work is indicated in the course outline, such collaborative work is mandatory. The use of cell phones, iPods, laptops and other personal electronic devices are prohibited from the classroom during the class time, unless the instructor makes an explicit exception. Announcements made in class or placed on Avenue are considered to have been communicated to all students including those individuals that are not in class. Instructor has the right to submit work to software to identify plagiarism.	
3. SUB TOPIC(S)		
Week 1	**Industrial Control Systems and Networking** Course introduction, Basic Elements of an Automated System, Levels of Automation, Process Industries vs. Discrete Manufacturing Industries, Continuous Control, DCS Systems, Networking: Process Control, Supervisory Control, enterprise Control	
Week 2	**Introduction to Communication** Communications Process, Interface Standards, Coding, Protocols, Common Communication Protocols	
Week 3	**Introduction to Communication** Communication Channels and Properties, Data Transmission Modes. Encoding Methods, Error Detection	
Week 4	**Networking Fundamentals** Network Communication and Components, Types of Networks, Interoperability and Internetworking, Protocols and Protocol Standards, IEEE/ISO Standards, Network Topologies, Media Access Methods	
Week 5	**Industrial Ethernet & TCP/IP** 10, 100 & Gigabit Ethernet, troubleshooting Ethernet Networks, TCP/IP Introduction, Internet Layer Protocols, Design of Ethernet based Networks, Node Addressing, LAN, Sub-Networks	
Week 6	**Industrial Ethernet & TCP/IP** Topics covered: TCP and UDP, Troubleshooting, Socket programming, Automation Trends, TCP/IP Based Factory Automation, Thin Servers, Network Security	
Mid-term Recess: Monday, February 20 to Sunday, February 26, 2017		
Week 7	**Ethernet IP** Topics covered: ODVA, OSI reference model, EtherNet/IP Terms & Definitions, Design of Ethernet IP Networks, Web Compatible SCADA Systems	
Week 8	**Modbus, Modbus Plus and Modbus TCP** Topics covered: Modbus Overview, Modbus Protocol Structure, Modbus Function Codes, Troubleshooting, Modbus Plus Technical Overview	

Week 9	**CANBUS and DeviceNet** Topics covered: CAN Technical Overview, Application Layers, CANopen, DeviceNet Technical Overview, ODVA,	
Week 10	**AS-I Interface** Topics covered: Reduced IOS reference model, AS-interface, Technical Overview, AS-i Applications, AS-i Consortium, AS-i Troubleshooting	
Week 11	**Profibus** Introduction to Profibus, Profibus-PA (Process Automation), Profibus-DP (Decentralized Periphery), Network design and configuration	
Week 12	**Foundation Fieldbus & HSE** Topics covered: Foundation Fieldbus, FF Wiring and Signalling, FF Intrinsic Safety and Power Delivery, Fault Tolerance and Single-Loop Integrity, FF Protocol, FF Function Blocks, FF Troubleshooting, High Speed Ethernet-HSE	
Week 13	**Proprietary Communication Protocols** Smartwire, IO-Link, OSI reference model, wiring, configuration, Gateways	

Classes end: Thursday, April 6, 2017
Final examination period: Tuesday, April 11 to Thursday, April 27, 2016
All examinations MUST be written during the scheduled examination period.

List of experiments	
Lab 1	TCP/IP Utilities
Lab 2	TCP/IP Networking in Visual Basic Using Sockets
Lab 3	Configuration of Ethernet IP Devices
Lab 4	Ethernet IP Configuration of Communication and Data Access
Lab 5	Open Lab
Lab 6	Lab Test 1
Mid-term Recess: Monday, February 20 to Sunday, February 26, 2017	
Lab 7	Sensor Networks: SmartWire-DT Technology
Lab 8	Control Level Networks: Modbus Serial
Lab 9	Control Level Networks: Modbus TCP
Lab 10	Interoperability: Ethernet IP, Modbus TCP, and Modbus Serial
Lab 11	Open Lab
Lab 12	Lab Test 2

Note that this structure represents a plan and is subject to adjustment term by term.
The instructor and the University reserve the right to modify elements of the course during the term. The University may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes.

4. ASSESSMENT OF LEARNING *including dates*	**Weight**
Assignments and Quizzes	15%
Mid-term test	15%
Labs	30%
Final examination (tests cumulative knowledge)	40%
TOTAL	**100%**

Percentage grades will be converted to letter grades and grade points per the University calendar.

5. LEARNING OUTCOMES

1. Design Industrial Networking architecture
2. Select networking technologies for industrial automation applications
3. Understand the fundamentals of data communications
4. Understand and apply IEEE networking standards
5. Follow I/O bus installation and wiring connections guidelines for setting up industrial networks.
6. Design, configure, and program fieldbus networks
7. Program the communication among industrial automation controllers

6. POLICIES

Anti-Discrimination

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.
http://www.mcmaster.ca/policy/General/HR/Discrimination_Harassment_Sexual_Harassment-Prevention&Response.pdf

Academic Integrity

You are required to exhibit honestly and use ethical behaviour in all aspects if the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act of fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, located at: http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf .

The following illustrates only three forms of academic dishonesty:
1. Plagiarism. E.g. the submission of work that is not own or for which other credit has been obtained
2. Improper collaboration in group work
3. Copying or using unauthorized aids in tests and examinations.

Requests for Relief for Missed Academic Term Work (Assignments, Mid-Terms, etc.)

The McMaster Student Absence Form is an on-line self-reporting tool for **Undergraduate Students** to report absences for:

1) Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:
   - Students may submit a maximum of one academic work missed request per term. It is the responsibility of the student to follow up with instructors immediately (within the 3 day period that is specified in the MSAF) regarding the nature of the accommodation. All work due in that time period however can be covered by one MSAF.
   - MSAF cannot be used to meet religious obligation or celebration of an important religious holiday, for that has already been completed or attempted or to apply for relief for any final examination or its equivalent.
2) For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has not been used previously in that term:
   - Students must visit their Associate Dean's Office (Faculty Office) and provide supporting documentation.

E-Learning Policy

Consistent with the Bachelor of Technology's policy to utilize e-learning as a complement to traditional classroom instruction, students are expected to obtain appropriate passwords and accounts to access Avenue To Learn for this course. Materials will be posted by class for student download. It is expected that students will avail themselves of these materials prior to class. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail account, and program affiliation may become apparent to all other students in the course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about this disclosure please discuss this with the course instructor. Avenue can be accessed via http://avenue.mcmaster.ca.

Communications

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their @mcmaster.ca alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

Turnitin (Optional)

This course will be using a web-based service (Turnitin.com) to reveal plagiarism. Students submit their assignment/work electronically to Turnitin.com where it is checked against the internet, published works and Turnitin's database for similar or identical work. If Turnitin finds similar or identical work that has not been properly cited, a report is sent to the instructor showing the student's work and the original source. The instructor reviews what Turnitin has found and then determines if he/she thinks there is a problem with the work. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to http://www.mcmaster.ca/academicintegrity/turnitin/students/

Protection of Privacy Act (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades and all other personal information at all times. For example, the submission and return of assignments and posting of grades must be done in a manner that ensures confidentiality.
http://www.mcmaster.ca/univsec/fippa/fippa.cfm

Academic Accommodation of Students with Disabilities Policy

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information consult McMaster's policy for Academic Accommodation of Students with Disabilities
http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf

Students must forward a copy of the SAS accommodation to the instructor of each course and to the Program Administrator of the B.Tech. Program immediately upon receipt. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. http://sas.mcmaster.ca

Student Code of Conduct

The Student Code of Conduct (SCC) exists to promote the safety and security of all the students in the McMaster community and to encourage respect for others, their property and the laws of the land. McMaster University is a community which values mutual respect for the rights, responsibilities, dignity and well-being of others. The purpose of the Student Code of Conduct is to outline accepted standards of behavior that are harmonious with the goals and the well-being of the University community, and to define the procedures to be followed when students fail to meet the accepted standards of behavior. All students have the responsibility to familiarize themselves with the University regulations and the conduct expected of them while studying at McMaster University.
http://studentconduct.mcmaster.ca/student_code_of_conduct.html