APPLICATION FOR NEW COURSE

1. General Information.

a. Submitted by the College of: Engineering Today's Date: 11/3/09

b. Department/Division: Electrical and Computer Engineering

c. Contact person name: Lawrence Holloway Email: Holloway@engr.uky.edu Phone: 859-323-8523

d. Requested Effective Date: ☒ Semester following approval OR ☐ Specific Term/Year[1] : _____

2. Designation and Description of Proposed Course.

a. Prefix and Number: EE575

b. Full Title: Industrial Control

c. Transcript Title (if full title is more than 40 characters): _____

d. To be Cross-Listed[2] with (Prefix and Number): _____

e. Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

3 Lecture _____ Laboratory[1] _____ Recitation _____ Discussion _____ Indep. Study

_____ Clinical _____ Colloquium _____ Practicum _____ Research _____ Residency

_____ Seminar _____ Studio _____ Other – Please explain: _____

f. Identify a grading system: ☒ Letter (A, B, C, etc.) ☐ Pass/Fail

g. Number of credits: 3

h. Is this course repeatable for additional credit? YES ☐ NO ☒

If YES: Maximum number of credit hours: _____

If YES: Will this course allow multiple registrations during the same semester? YES ☐ NO ☐

i. Course Description for Bulletin: "EE575 -- Industrial Controls: Control technologies for industrial and process control systems, including sensors, actuators, PLCs, and hydraulic and pneumatic control elements."

j. Prerequisites, if any: Engineering standing or graduate standing

k. Will this course also be offered through Distance Learning? YES[4] ☐ NO ☒

l. Supplementary teaching component, if any: ☐ Community-Based Experience ☐ Service Learning ☐ Both

3. Will this course be taught off campus? YES ☐ NO ☒

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[1] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

[2] The chair of the cross-listing department must sign off on the Signature Routing Log.

[3] In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. Laboratory meeting, generally, represents at least two hours per week for a semester for one credit hour. (from *SR 5.2.1*)

[4] You must *also* submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

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4. Frequency of Course Offering.

a. Course will be offered (check all that apply): ☐ Fall ☒ Spring ☐ Summer

b. Will the course be offered every year? YES ☒ NO ☐

If NO, explain: _____

5. Are facilities and personnel necessary for the proposed new course available? YES ☒ NO ☐

If NO, explain: _____

6. What enrollment (per section per semester) may reasonably be expected? 15

7. Anticipated Student Demand.

a. Will this course serve students primarily within the degree program? YES ☒ NO ☐

b. Will it be of interest to a significant number of students outside the degree pgm? YES ☒ NO ☐

If YES, explain: Students from Mechanical Engineering, Chemical Engineering, or Biosystems Engineering who are interested in industrial control methods may be interested in this course.

8. Check the category most applicable to this course:

☐ Traditional – Offered in Corresponding Departments at Universities Elsewhere

☒ Relatively New – Now Being Widely Established

☐ Not Yet Found in Many (or Any) Other Universities

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program? YES ☐ NO ☒

If YES, name the proposed new program: _____

b. Will this course be a new requirement[5] for ANY program? YES ☐ NO ☒

If YES[5], list affected programs: _____

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500? YES ☒ NO ☐

If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in ***10.b***. You must include: (i) identification of additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See *SR 3.1.4*.)

b. ☒ The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from ***10.a*** above) are attached.

[5] In order to change a program, a program change form must also be submitted.

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Signature Routing Log

General Information:

Course Prefix and Number: EE575

Proposal Contact Person Name: Larry Holloway Phone: 323-8523 Email: holloway@engr.uky.edu

INSTRUCTIONS:

Identify the groups or individuals reviewing the proposal; note the date of approval; offer a contact person for each entry; and obtain signature of person authorized to report approval.

Internal College Approvals and Course Cross-listing Approvals:

Reviewing Group	Date Approved	Contact Person (name/phone/email)	Signature
Dept. of Electrical and Computer Engineering	11/23/2009	Larry Holloway / 323-8523 / holloway@engr.uky.edu	Larry Holloway
College of Engineering	03/26/10	RICHARD J. SWEIGARD 7-1864/rsweigar@engr.uky.edu	Richard J. Sweigard
	/ /		
	/ /		
	/ /		

External-to-College Approvals:

Council	Date Approved	Signature	Approval of Revision[6]
Undergraduate Council	4/27/2010	Sharon Gill Digitally signed by Sharon Gill DN: cn=Sharon Gill, o=Undergraduate Education, ou=Undergraduate Council, email=sgill@uky.edu, c=US Date: 2010.04.28 17:44:01 -04'00'	
Graduate Council		2010.07.09 14:16:54 -04'00'	
Health Care Colleges Council			
Senate Council Approval		University Senate Approval	

Comments:

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[6] Councils use this space to indicate approval of revisions made subsequent to that council's approval, if deemed necessary by the revising council.

EE599-003 (Proposed course number: EE575)
Industrial Controls
Spring 2010

Time and Location: 2-3:15pm, M/W, RGAN207. (Several classes will be taught in the computer labs, and some classes will meet in CRMS 215E Lab).

Instructor:

Dr. Larry Holloway
Office: 453 F.P.Anderson Tower
Office Hours: Tuesdays, 10-11:30
(appointments can also be scheduled through Brenda McMurry, 257-1834)
Office Phone: 323-8523
Email: Holloway@engr.uky.edu

Dr. Bruce Walcott
Office: CRMS220L
Email: Walcott@engr.uky.edu
(appointments can also be made through Vicki Cooper, 257-6262 ext 221, or vlcoop1@uky.edu)
Office Phone: 257-1182

Overview:

Students completing this course will have an understanding of sensing, actuation, and control methods that are appropriate for application in industry for control of processes and systems. The course will cover control of continuous state systems via Sampled Data Control and PID Control, and will also cover discrete control methods (primarily as implemented using Programmable Logic Controllers/PLCs). The class will include lectures, projects, and demonstrations. There will be numerous assignments implementing controls on Allen Bradley and Siemens PLCs using equipment simulations and automation equipment. There will also be a segment on application of digital control.

Prerequisites: The student should have Engineering Standing or graduate standing. This course is suitable for any engineering major, and may be of particular interest to students in Electrical, Chemical, Manufacturing, or Mechanical Engineering.

Learning Outcomes

Upon completion of this course, students will be able to:

- Understand sample data control.
- Understand and design PID control.

- Develop and implement discrete control programs for non-sequential control
- Develop and implement discrete control programs for sequential control
- Understand IEC1131-3 and IEC61131-3 standards for programming industrial automation systems
- Understand and design basic Pneumatic/Hydraulic controls and relay controls
- Describe industrial sensing and actuation technologies
- Understand characteristics of various industrial communications methods

Texts:

This class does not have a required text. However, the following text is highly recommended as a background reference for this class, and students are encouraged to have it.

- *Programmable Logic Controllers, Fourth Edition* (Paperback) by W. Bolton. Newnes (Elsevier), 2006.

A copy of this text will be on course reserve in the library. Since we will be using this text through portions of the course, you may choose also to have your own. Additional reference texts are listed at the end of the syllabus.

Software and Labs

The class will use the PLC simulator LOGIX-PRO (www.thelearningpit.com) for projects on discrete control logic. The simulator is for Allen Bradley / Rockwell PLCs. The course will also be doing programming and demonstrations on the Amatrol Mechatronics System, which uses a Siemens PLC.

Grading

The grade in this class will consist of the following:

- (200 pts.) Homeworks and programs: There will be a homework assignment or program approximately once per week. Larger assignments will be weighted more than smaller assignments.
- (350 pts.) Tests: There will be 2 tests, each worth 100 points, and a final exam worth 150 points. Tests are tentatively scheduled for February 18 and April 15.
- For Graduate Students: (100 pts.) Presentations: As per university policy, courses that include both undergraduate and graduate students must have assignments or grading policies that are different for undergraduates and graduates. All graduate students in the course will be expected to give a presentation on a topic relevant to the class. These might be done individually or as a small team. The intent of the presentations is to teach other students about additional material.

Grading Scale:

90% -100%: A
80% - 89%: B
70% - 79%: C
60% - 69%: D for undergraduates, E for graduate students
Less than 60%: E

Undergraduate students will be provided with a Midterm Evaluation (by the midterm date) of course performance based on criteria in syllabus.

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, email address jkarnes@email.uky.edu) for coordination of campus disability services available to students with disabilities.

Outline of classes:

1. Introductory class – syllabus, structure, and overview of topic
2. Sample data control
3. PID Control
4. Sensor technologies and actuator technologies
5. Basic pneumatic and hydraulic control
6. PLC intro, architecture
7. PLC – Ladder logic and intro to programming non sequential logic
8. PLC – internal relays and sequencing (sequencers, shift registers, cascade method)
9. PLC – timers and counters
10. IEC61131-3
11. Safe design
12. Industrial communications

Potential Projects:

1. Simple logic implementation (Garage Door Control, Automated Filling System) in LogixPro())
2. Sequence Issues. (Traffic Control Simulation or Batch Mixing System in LogixPro)

3. BCD inputs or encoders: (Dual Compressor Control Simulator or elevator in LogixPro)
4. Complicated: Bottle Line Simulator (in LogixPro)
5. Control of Mechatronics System

Additional reference material (beyond the recommended Bolton book mentioned earlier.):

- The Control Systems Engineer (CSE) Licensing Exam outline on www.isa.org. (The exam is much broader than what is covered in the class.) Several study guides and reference texts are available directly for purchase from ISA.
- Industrial automation : circuit design and components. David W. Pessen. Wiley, 1989. An older text, but presents theory/methodologies behind industrial automation control design, including for hardware methods, PLCs, Pnuematics, etc. (on reserve in the library).
- *Industrial Automation and Process Control*, by Jon Stenerson. Prentice Hall 2003. (Seems primarily written for technical college level. Several chapters still have useful information, but not deep on theory or method.)
- *From Plant Data to Process Control: Ideas for process identification and PID design.* Liuping Wang and William R. Cluett. Taylor and Francis, 2000. This book seems to focus on the use of Laguerre Models and Frequency Sampling Filters for process identification.
- Programmable controllers using Allen-Bradley SLC 500 and ControlLogix. Robert Filer, George Leinonen. Prentice Hall 2002. (on reserve in the library)
- Modelling control systems using IEC 61499 : applying function blocks to distributed systems. Robert Lewis. Institute of Electrical Engineers, 2001. (on reserve in the library).
- IEC 61131-3: programming industrial automation systems : concepts and programming languages, requirements for programming systems, aids to decision-making tools. Karl-Heinz John, Michael Tiegelkamp. Springer 2001.
- Handbook of industrial automation. edited by Richard L. Shell, Ernest L. Hall. MarcelDekker 2000 (on permanent reserve in the library, not the course reserve.)