PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF A GRADUATE COURSE
(500-600 LEVEL)

EFFECTIVE SESSION Fall 2009

DEPARTMENT ECE

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

1. New course with supporting documents (complete proposal form)  X 7. Change in course attributes
2. Add existing course offered at another campus  X 8. Change in instructional hours
3. Expiration of a course  X 9. Change in course description
4. Change in course number  X 10. Change in course requisites
5. Change in course title  X 11. Change in semesters offered
6. Change in course credit/type  X 12. Transfer from one department to another

PROPOSED:

Subject Abbreviation ECE
Course Number 566
Long Title Embedded Systems
Short Title Embedded Systems

EXISTING:

Subject Abbreviation ECE
Course Number 566
Long Title Embedded Systems
Short Title Embedded Systems

Abbreviated title will be entered by the Office of the Registrar if omitted. (22 CHARACTERS ONLY)

TERMS OFFERED: Check All That Apply:

- Summer
- Fall  X
- Spring

CAMPUS(ES) INVOLVED:

- Calumet
- Cont Ed
- Ft. Wayne
- Indianapolis
- Tech Statewide
- X W. Lafayette

<table>
<thead>
<tr>
<th>CREDIT TYPE</th>
<th>COURSE ATTRIBUTES: Check All That Apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fixed Credit: Cr. Hrs. 3</td>
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<td>2. Variable Credit Range:</td>
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<tr>
<td>Minimum Cr. Hrs. (Check One) To</td>
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<tr>
<td>Maximum Cr. Hrs.</td>
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<td>3. Equivalent Credit: Yes</td>
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<td>4. Thesis Credit: Yes</td>
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<tr>
<td>Instructional Type</td>
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<td>Lecture</td>
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<td>Presentation</td>
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<td>Laboratory</td>
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<td>Lab Prep</td>
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<td>Studio</td>
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<td>Distance</td>
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<td>Research</td>
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<td>Ind. Study</td>
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<td>Pract/Observ</td>
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<td>Minutes Per Mtg 50</td>
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<td>Meetings Per Week 3</td>
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<td>Weeks Offered 16</td>
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<tr>
<td>% of Credit Allocated 100</td>
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<td>Delivery Method (Asyn. Or Syn.)</td>
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<td>Delivery Medium (Audio, Internet, Live, Text-Based, Video)</td>
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| COURSE DESCRIPTION (INCLUDE REQUISITES): Preerequisite: ECE 437 |
| This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits. |

Calumet Department Head Date
Calumet School Dean Date

Fort Wayne Department Head Date
Fort Wayne School Dean Date

Indianapolis Department Head Date
Indianapolis School Dean Date

North Central Department Head Date
North Central Chancellor 10/6/09

West Lafayette Department Head Date
West Lafayette College School Dean 1/24/09

Graduate Area Committee Convener Date
Graduate Dean 2/7/09

Calumet Undergrad Curriculum Committee Date
Fort Wayne Chancellor 10/6/09
Undergraduate Curriculum Committee Date

Date Approved by Graduate Council 10/6/09
Graduate Council Secretary
West Lafayette Registrar 3/19/09

OFFICE OF THE REGISTRAR
INSTRUCTIONS: Please check the items below which describe the purpose of this request.

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5. Change in course title [ ] 11. Change in semesters offered
6. Change in course credit/type [ ] 12. Transfer from one department to another

PROPOSED:

Subject Abbreviation: ECE
Course Number: 568
Long Title: Embedded Systems
Short Title: Embedded Systems

EXISTING:

Subject Abbreviation: ECE
Course Number: 568
Long Title: Embedded Systems
Short Title: Embedded Systems

TERMS OFFERED

Check All That Apply:

- Summer
- Fall [ ]
- Spring [ ]

CAMPUS(ES) INVOLVED

- Calumet
- N. Central
- Cont Ed
- Tech Statewide
- Ft. Wayne
- W. Lafayette
- Indianapolis

Abbreviated title will be entered by the Office of the Registrar if omitted. (22 CHARACTERS ONLY)

CREDIT TYPE

Fixed Credit: Cr. Hrs. _____
Variable Credit Range: Minimum Cr. Hrs. ______ (Check One) To _____ Or _____
Maximum Cr. Hrs. _____
Equivalent Credit: Yes [ ] No [X]
Thesis Credit: Yes [ ] No [X]

COURSE ATTRIBUTES:

- 1. Pass/Not Pass Only
- 2. Satisfactory/Unsatisfactory Only
- 3. Repeatable
- 4. Credit by Examination
- 5. Designator Required
- 6. Special Fees
- 7. Registration Approval Type
- 8. Variable Title
- 9. Remedial
- 10. Honors
- 11. Full Time Privilege
- 12. Off Campus Experience

Instructional Type: Lecture
- Lecture: _____ Per Mg 50 Meetings Per Week 3
- Laboratory: _____
- Presentation: _____
- Studio: _____
- Distance: _____
- Clinic: _____
- Experiential: _____
- Research: _____
- Ind. Study: _____
- Pract/Observ: _____
- Other: _____

% of Credit Allocated: 100

Delivery Method: (Asyn. Or Syn.)

Delivery Medium: (Audio, Internet, Live, Text-Based, Video)

Cross-Listed Courses:

COURSE DESCRIPTION (INCLUDE REQUISITES):

This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits.
The faculty of the School of Electrical and Computer Engineering has approved the following changes in ECE 568. This action is now submitted to the Engineering Faculty with a recommendation for approval.

From: ECE 568 — RISC & DSP Microprocessor System Design
Sem.1 and 2. Class 3, cr. 3. (Offered in alternate years.)
Prerequisite: Department approval required.

Overview of reduced instruction set (RISC) microprocessors and digital signal processing (DSP) microprocessors, with emphasis on incorporating these devices in general purpose and embedded system designs, respectively. The first half of the course emphasizes design considerations for RISC microprocessor based computer systems; a half-semester design project focuses on design principles that could be utilized in a general-purpose computer system (e.g., an engineering workstation). The second half of the course emphasizes design considerations for DSP microprocessor based computer systems; a half-semester design project focuses on analog I/O interfacing techniques and use of these devices for embedded applications (e.g., spectrum analyzer, digital audio equalizer).

To: ECE 568 — Embedded Systems
Sem. 2 of even years. Class 3, cr. 3
Prerequisite: ECE-437 or equivalent

This course provides an introduction to the design of embedded and ubiquitous computing systems including their hardware and software architectures, design methodologies and tools, and communication protocols. The lectures are organized into three parts namely, (a) basic design principles including specification and modeling, hardware components and platforms, software organization, embedded and real-time operating systems, interfacing with external environments using sensors and actuators, and communication in distributed embedded systems, (b) advanced topics such as energy management, safety and reliability, and security, and (c) case-studies of real-world systems from a variety of embedded application domains such as biomedical devices, smart cards and RFID, networked sensors, personal computing devices, home appliances and electronics, mobile robotics, etc. In addition to hands-on programming assignments using off-the-shelf embedded system development kits, the course will feature a comprehensive project where students will design, implement, and evaluate a prototype embedded system.

Reason: The course description and content have been changed to reflect the updated content of the course.

Mark J. T. Smith, Head
School of Electrical & Computer Engineering

APPROVED FOR THE FACULTY OF THE SCHOOLS OF ENGINEERING BY THE ENGINEERING CURRICULUM COMMITTEE

ECC Minutes 4/25
Date 5/11/08
Chairman ECC
Supporting Documentation

ECE 568–Embedded Systems

Required Text: There is no required text book. Assigned readings will be distributed.

Recommended References:

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Principal Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to embedded systems, overview of the design flow</td>
</tr>
<tr>
<td>1</td>
<td>Embedded system specification and modeling</td>
</tr>
<tr>
<td>1</td>
<td>Embedded hardware platforms and peripherals</td>
</tr>
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<td>1</td>
<td>Interfacing to the external world through sensors and actuators</td>
</tr>
<tr>
<td>1</td>
<td>Design and synthesis of ASIC hardware</td>
</tr>
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<td>1</td>
<td>Software organization, scheduling, and execution</td>
</tr>
<tr>
<td>1</td>
<td>Embedded and real-time operating systems</td>
</tr>
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<td>1</td>
<td>Wired communication and bus protocols</td>
</tr>
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<td>1</td>
<td>Basics of wireless communication and embedded networking</td>
</tr>
<tr>
<td>2</td>
<td>Energy management and low-power design</td>
</tr>
<tr>
<td>1</td>
<td>Safety and reliability in embedded systems</td>
</tr>
<tr>
<td>1</td>
<td>Secure embedded system design</td>
</tr>
<tr>
<td>1</td>
<td>Case studies: Low-end systems (medical devices, smart cards, sensors)</td>
</tr>
<tr>
<td>1</td>
<td>Case studies: High-end systems (automobiles, home electronics, robotics)</td>
</tr>
<tr>
<td>Final</td>
<td>Project presentations and demonstrations</td>
</tr>
</tbody>
</table>

Special Information: The final project, done in teams of two or three, will involve the design, implementation, and evaluation of an embedded system. Projects can be hardware based, software based, or even about proving the theoretical properties of a design. A good project should address the following aspects: target applications, related existing solutions, new features and limitations of the design, technological and economic feasibility.

Course Outcomes: A student who successfully fulfills the course requirements will have demonstrated:

1) Design simple embedded systems. [4; a, c, k]
2) Choose effective communication for embedded systems. [3, 4; e, k]
3) Analyze real-time scheduling algorithms. [4; a]
4) Identify design flaws. [3, 4; b, e, k]
**Outcome Assessment Method:** The students will have several opportunities to satisfy the course outcomes including homeworks, programming assignments, exams, and a final project. A student will satisfy each course outcome when his/her score for the corresponding exam/assignment/homework/project question(s) equals or exceeds a value specified as representing minimal competency. If the student fails to meet this level of minimal competency on a specific course outcome, the student will have a second chance to do so by appearing for a retest (either written or through an interview, to be chosen by the instructor). While the retest will not affect the student's score on the original test, it will provide him/her a second opportunity to demonstrate competency on the course material, thus satisfying the course outcome.