PENNSTATE

SENATE COMMITTEE ON CURRICULAR AFFAIRS

NEW COURSE Proposal Form

Principal Faculty Member/s Proposing Program: Vittaldas Prabhu, Associate Professor of Industrial Engineering

College/s: Engineering

Department or Instructional Area: Harold & Inge Marcus Department of Industrial & Manufacturing Engineering

Type of Proposal: ■ Add ☐ Change ☐ Drop

Type of Review Requested: ■ Full ☐ Expedited (see *Guide to Curricular Procedures* for definition of a full or expedited review)

Current Course Designation: Abbreviation: ____ ____ ____ ____ ____ (max 5 spaces) Number: _____

Current Course Title: _____

Proposed Course Designation: Abbreviation: I E (max 5 spaces) Number: 567

Proposed Course Title: Distributed Systems and Control

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Complete for special categories of UNDERGRADUATE (001-499) course proposal (check, if appropriate):

General Education
_____ Writing/Speaking (GWS)
_____ Quantification (GQ)
_____ Health and Physical Activity (GHA)
_____ Natural Sciences (GN)
_____ Arts (GA)
_____ Humanities (GH)
_____ Social and Behavioral Sciences (GS)

Bachelor of Arts Course: _____ Arts _____ Humanities _____ Social/Behavioral Sciences _____ Other Cultures

Honors **(H)** or Honors/Writing **(M)** or Honors/US; IL **(U)** or Honors/1st-Year Seminar **(T)**: _____

United States Cultures **(US)** Permanent _____ International Cultures **(IL)** Permanent _____ or both US and IL _____

Writing-Intensive **(W)** Permanent _____ One-Semester **(W)** _____

Submitted by: Richard J. Koubek, Professor and Head, Harold & Inge Marcus Department of Industrial & Manufacturing Engineering — Date: 3/04/05

Reviewed by: Robert G. Melton, College Representative, Graduate Council Subcommittee on New and Revised Programs and Courses — Date: 4/20/05

Approved by: John M. Mason, Jr., Associate Dean for Graduate Studies, Research & Outreach, College of Engineering — Date: 04/20/05

Graduate School office use only:

Reviewed by: **Dean of the Graduate School** — Date

Recommended by: **Graduate School Subcommittee** — Date

After securing signatures, submit the following to the Curriculum Coordinator, University Faculty Senate, 101 Kern Graduate Building: (1) FULL REVIEW UNDERGRADUATE proposals, 1 copy of this form and 25 copies of supporting documentation; (2) FULL REVIEW GRADUATE proposals, 1 copy of this form and 15 copies of supporting documentation; (3) EXPEDITED REVIEW PROPOSALS, 1 copy of this form and 4 copies of supporting documentation.

SO:12/14/04 ogsro (tkr) 01/05

Supporting Documentation Required for NEW Courses

I E 567, Distributed Systems and Control

A. Heading (as it would appear in the appropriate University *Bulletin*)

1.	Abbreviation	**I E**
2.	Number	**567**
3.	Title	**Distributed systems and Control**
4.	Abbreviated Title (18 bytes or less)	**DIST SYS CONTROL**
5.	Credits	**3**
6.	Description (20 words or less)	**Advances in distributed control and decision-making in enterprises and supply chains with emphasis on computing, algorithms, and dynamics.**
7.	Prerequisite(s)	**Familiarity with high-level programming.**

B. Course Outline. The course outline should include the following:

1. A brief outline of the course content.

- The objective of this course is to study current research and engineering challenges in distributed systems and control in the context of manufacturing and service enterprises, and supply chains. Emphasis will be placed on understanding the dynamics and computational aspects of decision making and control algorithms in integrated enterprises. Assignments and projects in this course will include designing, programming, and integrating distributed control systems.

2. A listing of the major topics to be covered with an approximate length of time allotted for their discussion.

1. **Communication Architectures for Distributed Control.** Introduction to issues such as determinism, response times, bandwidth, and scalability will be studied. Ethernet and related high-speed communication networks will be studied from a distributed systems perspective. **(3 weeks)**
2. **Distributed Computing for Real-Time Decision Making.** High performance computing architectures suitable for real-time control at the plant and enterprise levels such as symmetric multi-processors, clusters, and reconfigurable computing will be studied. **(3 weeks)**
3. **Distributed Control Algorithms.** Distributed arrival time control for discrete-event timing control will be introduced. Mathematical techniques for modeling real-time dynamics of such systems will be reviewed. Techniques from discontinuous differential equation theory, nonlinear control theory will be used for analysis and synthesis of such systems. Algorithms for a variety of distributed control applications will be studied such as adaptive machine capacity control, production scheduling, maintenance scheduling, inventory control, and supply chain control. **(6 weeks)**
4. **Open Architecture Information Systems for Control.** Current open standards for distributed systems such as web services and related standards for integrating distributed enterprises will be studied. **(2 weeks)**

3. A succinct stand-alone course description (400 words maximum) to be made available to students and faculty on the World Wide Web. This single description must encompass all course sections at all locations over a period of time and, therefore, must focus on the common and durable aspects of the course. If the course is offered in multiple relatively stable formats, each may be described. The description should include the course objectives; relationship to courses and programs of study (but generally without course numbers); and, when possible, evaluation methods, special facilities, and frequency of offering and enrollment.

- Recently several new open architecture standards have emerged for control and information systems in industrial enterprises. These standards have been largely driven by industry to reduce the cost of integrating and configuring manufacturing systems, allowing a new breed of distributed enterprises to be engineered. This course deals with the multidisciplinary aspects of controls, computing, and communication in this rapidly evolving area. The objective of this course is to study current research and engineering challenges in distributed systems and control in the context of manufacturing and service enterprises, and supply chains. Emphasis will be placed on understanding the dynamics and computational aspects of decision making and control algorithms in integrated enterprises. Assignments and projects in this course will include designing, programming, and integrating distributed control systems.

  Evaluation will be based on programming and lab assignments, literature review and class presentation, a semester project, and class participation.

  This course will be offered every third semester with a maximum enrollment of 18.

4. The name(s) of the faculty member(s) responsible for the development of the course.

- Dr. Vittaldas Prabhu, Associate Professor of Industrial Engineering