EXPERIMENTAL and TOPICS COURSE REQUEST FORM

Submission Information

Date Submitted: 1/1/07

Prepared by: Prof. Sudhoff

Area: ES

If an Experimental Course Request…

☐ 1st offering; ☐ 2nd offering; ☐ 3rd offering

Semester/year of prior offerings:

☐ Check if a permanent number is also being requested.

Basic Course Description

Course Number: ECE 630

Course Title: Engineering Analysis and Design Using Genetic Algorithms

Credit: 1 **Class:** **Lab:**

Projected Term(s) Offered: Summer 07
(Enter N/A if a Topics Course Request)

Prerequisite(s):

Co-requisite(s):

Prerequisites by Topic: Familiarity with Matlab

Co-requisites by Topic:

Course Description: The motivation for genetic algorithms as an engineering tool is to improve designs and reduce engineering time. This is done by utilizing a genetic algorithm to perform design optimizations and engineering trade off studies, so that the engineer can focus on the fundamental issues of the underlying physics and operation of the design and on determining what is truly desired in the design. In addition to engineering design, genetic algorithms can also be used to solve engineering support tasks such as parameter identification of existing components and systems.

This short course has three key thrusts. The first is to provide the participant with a sound background in the operation of genetic algorithms. The second is to familiarize the participant with at least one software package for their use. The third is to show the participant how to cast problems so that they may be solved using this powerful technique Thus, at the end of the course, the participants will have both the knowledge and the tools needed to immediately apply genetic algorithms to their problems.

The first thrust of the course is to provide a general background in genetic algorithms. This will begin with a discussion of evolution and genetics from a biological point of view. Next, we will review the original canonical GA first proposed by Holland in the 1960s, and finally conclude with a detailed discussion of modern genetic algorithms.

In the second thrust of the course, participants will be trained in the use one of the MATLAB based toolboxes for using genetic algorithms (GOSET). This will set the stage for numerical demonstrations in the later part of the course, and provide participants with tools to use after they complete the course.

The final thrust of the course will focus on how to cast engineering analysis and design problems so that they may be solved using genetic algorithms. In this part of the course, a variety of parameter identification problems will be considered. Examples will include induction motor parameter identification and obtaining a transfer function from measured frequency response data. Next, design problems will be considered. These problems will include a multi-objective inductor design. The short course will conclude with a review of a host of design examples in the literature.

At the conclusion of the course, the participants will have both the knowledge and software tools necessary to utilize genetic algorithms for engineering analysis and design problems.

Required Text: GOSET User's Manual (Provided)

Recommended References:

James F. Crow, Genetic Notes: An Introduction to Genetics, 8th Edition

Course Outline

(The course outline should reflect the principal topics covered and the approximate time spent on each topic.—It should not be a day-by-day schedule of lectures. The latter is information best provided in the course syllabus.)

Lectures	*Principal Topics*
2	Biological Genetics and Evolution
1	The Canonical Genetic Algorithm
1	The Schema Theorem
2	Real Coded Genetic Algorithms
1	Genetic Optimization System Engineering Tool
2	Examples in Single Objective Optimization
3	Multi-Objective Optimization
2	Examples in Multi-Objective Optimization
1	Swarm Optimization

Special Information: This course will run during the summer, as part of an experiment with EPE. In particular, the course offering will be run for EPE credit, and the lectures will also be used for a non-credit short course.

ABET Required Information for ECE-595 Courses

Indicating the nature of the Engineering Design Content (if any) and the associated Engineering Design Considerations, along with Course Outcomes and the Assessment Method for Course Outcomes, are **only required for dual level (500 level) courses.**

*Course Outcomes***…**Use the **exact wording** included in the template to introduce the set of outcomes. Each listed outcome is to be followed by a set of numbers and a set of letters enclosed in parentheses that indicate respectively the Program Attributes and Program Outcomes that are being met. The BSEE and BSCmpE Program Attributes and Objectives are listed on-line at the URL, https://engineering.purdue.edu/ECE/Academics/Undergraduates/ProgramObjectivesandOutcomes

Assessment Method…A student who receives a passing grade must have satisfied all of the course outcomes to some minimum degree. By awarding the student a passing grade, the instructor confims that all of the outcomes have been satisfied. Outcomes based on material covered only during the final week or two of the course should be avoided.

Engineering Design Content: Check all of the following items that apply.

☐ Establishment of objectives and criteria; ☐ Synthesis; ☐ Analysis;

☐ Construction; ☐ Testing; ☐ Evaluation.

Engineering Design Considerations: Check all of the following items that apply.

☐ Economic; ☐ Environmental; ☐ Ethical; ☐ Health/Safety; ☐ Manufacturability;

☐ Political; ☐ Social; ☐ Sustainability

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

1)
2)
3)
4)
5)
6)
7)

Outcome Assessment Method:

Supplemental Information

(1) Please justify the chosen level (500 or 600) of the course.

Although the level of the course is graspable by a strong undergraduate, the desired target audience should have the maturity of a graduate student.

(2) What is the expected course enrollment?

6-12 On Campus

(3) If the enrollment is to be limited, note the desired limit.

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(4) Do you expect to need TA support? ☐ Yes ☒ No If yes, please justify.

(5) If you are not using a published textbook, please indicate if class notes will be used, whether the notes are available at this time, and how the notes are to be distributed to the class.

Notes are available at this time.

(6) Please justify the intended frequency of the course offering in terms of the faculty available to teach the course, the expected number of students who will enroll in the course, other courses for which this course provides prerequisite information, etc.

This is a summer course, which also supports some EPE initiatives. If the course is run again, it will probably remain a summer activity.

(7) Please list other courses in your Area, within ECE, and outside ECE that are related to this course and describe the relationship. In particular, note and describe any overlap.

There is no overlap in ES; there is a minor overlap with ECE 580.

(8) Will the introduction of this course require changes in your Area course offerings? Will this course affect the enrollment in other courses offered by your Area?

No.

(9) Have you identified students (in your Area and in other Areas) who are likely to take this course? Please elaborate.

This course should be of general interest to the graduate student community.

(10) Are you requesting joint listing for this course with another ECE area or with another school/department? If so, note the area/school/department and the status of the joint request.

No.

(11) Summarize the content of the required Area discussion of the course and how you responded to any constructive criticism of the course.

No discussion. Everyone said 'ok'.

(12) Please record the result of the Area vote for this course proposal.

4 For 0 Against 0 Abstain