Course Title: COSC 4362: Artificial Intelligence

Semester Credit Hours: 3 (3,0)

I.   **Course Overview**

The course presents an overview of artificial intelligence and its methods for solving problems. Basic algorithms for finding solutions to problems or adaptively improving responses to situations are discussed. Expert systems, genetic algorithms, and intelligent agents are among the areas that are explored.

II.   **PMU Competencies and Learning Outcomes**

Students of COSC 4362: Artificial Intelligence develop skills necessary for understanding the design of artificial intelligence applications so as to appreciate the strengths and limitations of artificial intelligence approaches to problem solving. This course makes extensive use of the PMU technology infrastructure to provide communication between faculty and students. The course is primarily a lecture-based course with the student required to complete significant projects outside of class time. The course includes individual as well as group projects and provides opportunities for the presentation and defense of designed solutions. The course encourages the development of professional communication skills and provides opportunities for collaborative project development.

III.   **Detailed Course Description**

This course examines artificial intelligence as a tool for solving problems. The course looks at the major categories (application domains) of artificial intelligence (AI), including vision, natural language, planning and others with a view to identifying characteristics that mark domains as potential areas of interest. An overview of search algorithms is presented with an emphasis on heuristic driven search, including the A* algorithm and game trees. The course discusses approaches to knowledge representation, including those based on predicate calculus and non-symbolic representations like neural networks. It introduces the concepts of expert systems, intelligent agents and genetic algorithms.

IV.   **Requirements Fulfilled**

COSC 4362: Artificial Intelligence satisfies three hours of the requirements for the degree in computer science. It is required of all students pursuing a degree program in computer science within the College of Information Technology. This course may be used as an elective in the Information Technology and Computer engineering degree programs. This course should be taken in the senior year.

V.   **Required Prerequisites**
- COSC 3421: Data Structures
- COSC 3351: Algorithms

VI. Learning Outcomes

In this course, students learn:

- To develop an understanding of various basic concepts and constructs underlying the artificial intelligence.

- To earn experience in designing and testing AI solutions to programming problems.

- To become familiar with a variety of common AI developmental tools

- To be able to discuss the strengths and limitations of different AI paradigms in solving programming problems.

- To develop improved communication and collaborative skills.

VII. Assessment Strategy

The course grade involves an assessment of student performance on examinations that focus on the understanding of various concepts and constructs underlying Artificial Intelligence, and the communication of those concepts and the characteristics of designed solutions to AI problems to an audience. Course grades are based on:

- Weekly assigned homework to motivate students to do the work and earn credit accordingly.
- Weekly, in-class presentations by students related to independent literature research on aspects of the course material and classroom discussion and critique of the presentation.
- Four written reports summarizing literature related to aspects of the course.
- Two in-class examinations to assess the student's accumulative mastery of content covered prior to the time of the examination.
- Three programming assignments testing students understanding of the major concepts introduced during the course.
- A comprehensive final examination to assess the student's accumulative mastery of course material.

The final grade is based on 10% credit for the homework, 10% for the presentations and participation in classroom discussion, 20% for written reports, 20% on in-class examinations, 30% on programming assignments and 10% for the final examination.

Students are required to maintain a journal of thoughts and commentaries during the course. The journal contains daily entries including the identification of areas of interest and concern, notes on the preparation of presentation and comments and analysis of classmate's presentations. The journal is reviewed weekly by the instructor to provide feedback to the students.

Final grades and the student and instructor observations from reflective notebooks are included in the student's portfolio for use in the final assessment capstone course. The intent is to document the student's maturation as he proceeds through the curriculum.

VIII. Course Format

A. Instruction

This course is primarily a lecture/discussion course. Students are expected to attend three hours of lecture/discussion per week. At least once per week students should be prepared to make presentation summarizing an aspect of the AI literature selected by the instructor and to take part in a discussion based on that presentation. Once a week students should have at least 30 minutes of collaborative problem solving activity. Students should expect to incorporate a significant independent experimentation with AI development tools.

B. Web supplement

Course home page (the university's Web tool, WebCT or Blackboard) should contain the following:

- Course syllabus
- Course assignments
- Sample solutions to examinations (after being graded and returned)
- Sample solutions to programming assignments (after being graded and returned)
- Course calendar (an active utility)
- Course e-mail (an active utility)
- Course discussion list (an active utility)
- Student course performance (an active utility)

Classroom Hours (3 hours per week)   **Class:** 3
                                                Lab: 0

IX. Topics to Be Covered

A. Overview
   1. Definition of terms
   2. Major divisions of AI
B. Searching for solutions
   1. Data tree search algorithms
   2. Heuristics
   3. A* algorithms
   4. Game trees
C. Knowledge representations
   1. Symbolic vs. non-symbolic predicate calculus
   2. Forward and backward chaining

D. Systems
   1. Expert systems
   2. Genetic classifier systems
E. Machine learning
   1. Non-symbolic representations
   2. Genetic algorithms
   3. Neural networks
   4. Reinforcement learning methods
F. Planning vs. reacting
   1. Intelligent agents
   2. Robotics

X. Laboratory Exercises

This course does not require a separate laboratory.

XI. Technology Component

This course makes use of the university's wireless access infrastructure. The course relies on the university and the students having access to professional grade application development environments for the students to use. The course has a laboratory component that would be best implemented in university provided laboratory space.

XII. Special Projects / Activities

Students are required to keep a "reflective notebook" in which, after each class, they enter their own assessments of what they learned, and what questions remain from the class. From each exercise set, each student selects one problem, which the student thinks best reflects the way the topic is used in a technical context. A detailed solution to the problem is included in the student's reflective notebook.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Luger, G.F. *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*. _____: Pearson Addison Wesley, 2002. ISBN: 0-201-64866-0.

B. Alternative Textbooks

Norvig, P. *Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp*. _____: Morgan Kaufmann, 1991. ISBN: 1-558-60191-0

C. Supplemental Print Materials

None.

D. Supplemental Online Materials

1. PDProlog Interpreter:
   http://www-2.cs.cmu.edu/afs/cs/project/ai-repository/ai/lang/prolog/impl/prolog/pdprolog/0.html

2. Xlisp:
   http://www.aracnet.com/~tomalmy/xlisp.html

3. CLIPS (public domain expert system):
   http://www.ghgcorp.com/clips/OtherWeb.html