JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
BIT 2319 ARTIFICIAL INTELLIGENCE

Pre-requisites: *ICS 2105 Data Structures and Algorithms, SMA 2100 Discrete Mathematics*

Course Purpose
This course aims to introduce students to some of the basic theory and practical techniques in artificial intelligence.

Learning Outcomes
Upon successful completion of this course, the student should be able to:

i. Discuss both the achievements of AI and the theory underlying those achievements
ii. Discuss the engineering issues underlying the design of AI systems.
iii. Demonstrate a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.
iv. Contrast basic issues of knowledge representation and blind and heuristic search, as well as of other topics such as minimax, resolution, etc. that play an important role in AI programs.
v. Discuss and evaluate some of the more advanced topics of AI such as Learning, natural language processing, agents and robotics, expert systems, and planning.

Course Description
Introduction to Artificial Intelligence; Definitions, goals of AI, AI approaches, AI techniques, branches of AI, applications of AI. Intelligent agents; Agents and environments, structure of agents. General problem solving; Strategies for space search such as data and goal driven, heuristics, search and control strategies, exhaustive searches, heuristic search techniques.
Knowledge representation issues, predicate logic, rules. Reasoning system; symbolic, statistical, reasoning. Game playing; overview, Mini-Max search procedure, game playing with Mini-Max, Alpha-Beta pruning. Learning; Rote Learning, learning from experience, learning by analogy, learning by induction, learning by discovery, genetic learning algorithms, learning in connectionist models (Neural Networks), Reinforcement learning, Machine Learning applications. Natural Language Processing; Introduction, syntactic processing, semantic and pragmatic analysis. Planning; planning system components, the frame problem, goal stack planning, nonlinear and hierarchical planning, and reactive systems.

Teaching Methodology
Lectures, tutorials, practical computer laboratory classes and guided self study.

Course Schedule

WEEK	TOPIC	OUTLINE
1	Registration	Course introduction
2	**Lecture 1:** Course overview **Lecture 2:** Introduction to Intelligence and AI **Lab 1**	▪ Review of Data Structures and Algorithms ▪ Natural and Artificial Intelligence ▪ History and foundations of Artificial Intelligence (AI) ▪ Branches and current applications
3	**Lecture 3:** Intelligent agents, **Lab 2**.	▪ Intelligent agents and Artificial Intelligence ▪ Types of AI agents, their architectures and their applications
4,5	**Lecture 4:** Search (Blind search algorithms)**, Lab 3** **Lecture 5:** Search (Informed search algorithms)**, Lab 4**	▪ Searching as a problem-solving technique ▪ Review of conventional searching methods including o Breadth-first, depth-first, Uniform cost, Iterative deepening ▪ Heuristic functions and their effect on performance of search algorithms (Best-first, Hill climbing, A*) ▪ Game playing (Game playing heuristics)
6	**Lecture 6:** Knowledge-based agents	▪ Logical problem solving agents ▪ Knowledge representation (KR)
7	**Lecture 7:** KR: Rules,	▪ Production Systems (Rule-based systems)

	Automated reasoning using rules, **Lab 5**	▪ Formal inference o Backward and forward chaining inference strategies
8	**Lecture 8:** KR: Logic **Lab 6**	▪ Propositional logic and First-order logic ▪ Rules of inference
9	**Lecture 9:** Building intelligent agents, **Lab 7** **Lecture 10:** Logic Programming, **Lab 8**	▪ Building intelligent agents capable of acting and reacting in a complex environment using first-order logic and rules ▪ Logic Programming o Introduction to Prolog and/or Jess and/or Clips o Creating ES and interacting with them
10	**Lecture 11:** Knowledge engineering, **Lab 9**	▪ Building knowledge bases and automated theorem provers ▪ Production systems as an example of logical problem solving.
11	**Lecture 12:** Handling Uncertainty **Lecture 13:** Planning agents, **Lab 10**	▪ Truth-maintenance systems and default reasoning ▪ Handling uncertainties ▪ Representation of states, goals and actions.
12	**Lecture 14:** Learning agents, **Lab 11**	▪ Learning from observations and examples. ▪ Function of learning algorithms ▪ Decision trees and the ID3 algorithm. ▪ Connectionism and evolutionary computation
13	**Lecture 16:** Communication and language, **Lab 12** **Lecture 17:** Robotic Systems, **Lab 13**	▪ Natural language and voice recognition ▪ Interpreting natural language, and current applications ▪ Robots in history and applications Perception and action
14	**Lecture 18:** Summary	Revision and Presentations

Course Assessment
30% Continuous Assessment (Tests 10%, Assignment 10%, Practical 10%)
70% End of Semester Examination.

Course Text Books

1. Russell, S. and Norvig, P. (2010). Artificial Intelligence: A Modern Approach. Third edition. Prentice Hall, ISBN-10: 0136042597, ISBN-13: 978-0136042594.
2. Gonzalez, A. J. and Dankel, D. D. (1993). The Engineering of Knowledge-based Systems. Prentice Hall, ISBN-10: 0132769409, ISBN-13: 978-0132769402.
3. Witten, I. H., Frank, E., and Hall, M. A. (2011). Data Mining: Practical Machine Learning Tools and Techniques 3rd Edition, ISBN-10: 0123748569 | ISBN-13: 978-0123748560.

Reference Text Books

1. Durkin, J. (1994). Expert Systems: Design and Development. Prentice Hall, New York, NY, ISBN-10: 0023309709, ISBN-13: 978-0023309700.
2. Puppe, F. (2011). Systematic Introduction to Expert Systems: Knowledge Representations and Problem-Solving Methods, Springer, ISBN-10: 3642779735, ISBN-13: 978-3642779732.
3. Mitchell, T. (1997).Machine Learning, McGraw-Hill, ISBN-10: 0070428077, ISBN-13: 978-0070428072.

Course Journals
1. Machine Learning Journal. Springer. ISSN: 0885-6125.
2. IEEE Transactions on Pattern Analysis and Machine Intelligence. ISSN: 0162-8828.
3. IEEE Transactions on Intelligent Systems. ISSN: 1524-9050.

Reference Journals
1. Thinking & Reasoning journal. ISSN: 1354-6783.
2. Artificial Intelligence. Elsevier. ISSN: 0004-3702.
3. AI Magazine. ISSN: 0738-4602.