Title (Units): **COMP 7060 Advanced Topics in Intelligent Systems (3,3,0)**

Course Aims: Through a systematic training, students will be able to conduct independent intelligent systems research and develop theoretical or practical solutions in some selected domains, such as learning, planning, self-organization, soft-computing, adaptive computation, evolutionary computation, and intelligent agents.

Prerequisite: Research Postgraduate Student Standing

Learning Outcomes (LOs):
Upon successful completion of this course, students should be able to:

No.	Learning Outcomes (LOs)
	Knowledge
1	Explain the fundamental concepts and characteristics in some selected domains, such as learning, planning, self-organization, soft-computing, adaptive computation, evolutionary computation, and intelligent agents
2	Explain the advantages and limitations of various methods developed for the selected domains
3	Describe the applicability, design and implementation considerations of related techniques in tackling different types of application problems
4	Describe the recent research development in the selected domains
	Professional Skill
5	Formulate some application scenarios or problems based on related intelligent systems models and algorithms
6	Implement self-organization, learning, reasoning, and adaptation algorithms

Calendar Description: This course deals with the advanced topics in intelligent systems. Through a systematic training, students will be able to conduct independent intelligent systems research and develop theoretical or practical solutions in some selected domains, such as learning, planning, self-organization, soft-computing, adaptive computation, evolutionary computation, and intelligent agents.

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous assessment	50%	Continuous assessments will provide opportunities to students for demonstrating their understanding of both fundamental concepts and relevant computing algorithms/techniques via developing an intelligent system, implementing some specific algorithms, or conducting a literature review on some selected domains.
2	Examination	50%	The final examination will be designed to check all learning outcomes, in which the students will analyze and discuss certain intelligent systems development issues, as well as to work out solutions in various problem scenarios.

Assessment Rubrics:

Criteria	Excellent (A)	Good (B)	Satisfactory (C)	Fail (F)
Formulate problems based on intelligent systems models and algorithms and implement them	Compare, contrast and design appropriate intelligent systems to solve problems; Identify appropriate occasions or contexts for their use.	Formulate some selected classical problems and implement intelligent systems to solve them.	Formulate classical problems and solve them using some existing intelligent system tools.	Unable to perform problem formulation and implementation.
Describe the key fundamental concepts and characteristics of	Describe the features and the derivation of various key	Describe the features and the derivation of various key different intelligent system	Describe the features of various key different intelligent system models and algorithms.	Unable to clearly identify key fundamental concepts and characteristics of

different intelligent system models and algorithms -- indicating their purposes, strengths and limitations	different intelligent system models and algorithms; Explain how they work in the context of some selected applications.	models and algorithms; Explain how they work using simple toy examples.		different intelligent system models and algorithms

Learning Outcomes and Weighting:

Content	LO No.
I-XI Selected Domains in Intelligent Systems	1-6

References:

Yoav Shoham and Kevin Leyton-Brown. Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations (1st Edition), Cambridge University Press, 2008

Steven Johnson, Emergence: The Connected Lives of Ants, Brains, Cities, and Software, Simon & Schuster, 2001.

Jiming Liu, Xiaolong Jin, and Kwok Ching Tsui, Autonomy Oriented Computing: From Problem Solving to Complex Systems Modeling, Kluwer Academic Publishing / Springer, 2005.

Ning Zhong, Jiming Liu and Yiyu Yao (editors), Web Intelligence, Springer, 2003.

Jiming Liu, Autonomous Agents and Multi-Agent Systems: Explorations in Learning, Self-Organization, and Adaptive Computation, World Scientific Publishing, 2001.

Mitchel Resnick, Turtles, Termites and Traffic Jams: Explorations in Massively Parallel Microworlds (Complex Adaptive Systems series), MIT Press, 1994.

Gerhard Weiss (Editor), Multiagent Systems (2nd Edition), MIT Press, 2013.

Kenneth A. De Jong, Evolutionary Computation: A Unified Approach, MIT Press**,** 2016.

(Note: Additional reading materials such as research papers and chapters will be provided.)

Course Content in Outline:

Topic

Some of the following topics will be covered:

I. Agent Learning

II Artificial Life and Autonomy-Oriented Computation

III. Autonomous Agents and Multi-Agent Systems

IV. Behavior Engineering

V. Constraint Satisfaction and Satisfiability

VI. Evolutionary Computation

VII. Planning and Optimization

VIII. Real-World Problem-Solving

IX. Self-Adaptation and Adaptive Computation

X. Self-Organization and Self-Organized Criticality

XI. Soft-Computing and Uncertainty Management