Republic of the Philippines
BATANGAS STATE UNIVERSITY
The National Engineering University
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**College of Informatics and Computing Sciences**

# CURRICULUM

## Master of Science in Computer Science (MSCS)

Academic Year: 2020-2021
Reference CMOs: CMO No. 7, Series of 2010 and CMO No. 15, s.2019

### Program Description

Designed to broaden and upgrade the knowledge and skills of CS practitioners. The program aims to provide both breadth and in-depth knowledge in the concepts and techniques related to the design, implementation and application of computer systems

The MSCS curriculum is based from the Policies and Standards (PS) for the graduate program of the Information Technology Education issued by the Commission on Higher Education (CHED) and is benchmarked from the curriculum of leading international academic institutions offering this program.

### Program Educational Objectives

1. Engaged in professional development or post-graduate education to pursue flexible career paths adapting to innovative technological changes in computer science and related fields;
2. Demonstrated professionalism and a sense of societal and ethical responsibility in computer science practice, development and in all their endeavors; and
3. Articulated their expertise in making technical contributions to design, develop, and solve problems in their practice of computer science which meet the desired needs of the society.

### Student Outcomes

1. Ability to apply computer science principles and practices.
2. Ability to apply suitable software engineering principles and practices to develop and maintain stable, secure, scalable, and maintainable software.
3. Ability to produce effective solutions to complex computer science problems.
4. Ability to recommend appropriate computer science solutions based on organizational needs and an evaluation of alternatives.
5. Ability to identify and discuss professional, individual, organizational, societal, and regulatory implications of information systems and technology.
6. Ability to select technologies, policies, and procedures to assure the confidentiality, integrity, and availability of information and CS systems.

| Curriculum | Total Units |
|---|---|
| a. CS CORE COURSES | 12 |
| b. CS SPECIALIZATION COURSES | 18 |
| c. THESIS | 6 |
| | **36** |

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**PROGRAM DURATION**

CS CORE COURSES (12 units)

- Advanced Data Structures and Algorithms
- Advanced Computer Organization and Operating Systems
- Theory of Programming Languages
- Theory of Computation

CS SPECIALIZATION COURSES (18 units)

- Specialization 1 – Intelligence Systems
- Specialization 2 – Theoretical Computer Science
- Specialization 3 – Computational Science
- Specialization 4 – Data Science
- Specialization 5 – Advanced Data Security
- Specialization 6 – Machine Learning

THESIS (6 units)

- Thesis 1
- Thesis 2

**COURSE DESCRIPTION**

| | |
|---|---|
| ***MSCS111*** | **Advanced Data Structures and Algorithms** |
| Course Description | This course covers the design, analysis and proofs of correctness of algorithms. It also discusses algorithms for advanced data structures, set manipulation and searching, graphs and geometric problems. In terms of analysis techniques, it includes asymptotic worst case and average case, as well as amortized analysis. The development of a probability model is covered for average case analysis. NP – completeness will also be discussed. |
| Credit | 3 units |
| ***MSCS112*** | **Advanced Computer Organization and Advanced Operating System** |
| Course Description | This course covers the advance topic in the theory, design and implementation of operating systems. It will also cover selected areas such as performance of operating systems for multiprocessors systems and operating systems research. |
| Credit | 3 units |
| ***MSCS113*** | **Theory of Computation** |
| Course Description | This course covers formal languages which include topics on regular languages, regular expressions, finite-state machines, context-free languages, grammars, and pushdown machines. It also convers computability with topics on primitive recursive functions, partial recursive functions, recursive languages, recursively enumerable languages, and Turing machines. Computational complexity: space and time complexity, complexity classes (such as P, NP, PSpace, L, and NL), and complete problems |
| Credit | 3 units |
| ***MSCS114*** | **Theory of Programming Languages** |

| | |
|---|---|
| Course Description | This covers a survey of programming languages paradigms with focus on issues in the design, implementation, and applications of programming languages. Syntactic ans semantic specifications will also be covered. |
| Credit | 3 units |
| ***MSCS311*** | **Thesis 1** |
| Course Description | This course will require student to propose a Thesis that will introduce either a new application, technology, or process that can be used as a tool to solve an organizational or societal problem. |
| Credit | 3 units |
| ***MSCS312*** | **Thesis 2** |
| Course Description | In this course the student will present the final output (system and documentation) of his/her thesis to the faculty of MSCS. |
| Credit | 3 units |

**SPECIALIZATIONS**

| | |
|---|---|
| ***MSCS211*** | **Intelligence Systems** |
| Course Description | This course introduces students to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty, learning from experience and following problem solving strategies found in nature. |
| Credit | 3 units |
| ***MSCS212*** | **Theoretical Computer Science** |
| Course Description | This class teaches you about basic concepts in theoretical computer science -- such as NP-completeness -- and what they imply for solving tough algorithmic problems. CS covers a wide variety of topics including algorithms, data structures, computational complexity, parallel and distributed computation, probabilistic computation, quantum computation, automata theory, information theory, cryptography, program semantics and verification, machine learning, computational biology, computational economics, computational geometry, and computational number theory and algebra. Work in this field is often distinguished by its emphasis on mathematical technique and rigor. |
| Credit | 3 units |
| ***MSCS213*** | **Computational Science** |
| Course Description | Big scientific data sets are growing exponentially both in size and complexity. Extracting meaningful information from this data requires not only programming skills, but also understanding the analysis work-flows and mathematical models and visualization tools that help to condense large amounts of information into a comprehensible story. Computational science is the scientific investigation of problems through modeling, simulation and analysis of physical processes on a computer. Computational science is now considered by most scientists to be on par with the development of scientific theory and the use of experimentation in order to understand more about our world. Computational science is not the same as |

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|---|---|
| | computer science. Rather, it is an interdisciplinary blend of scientific models, applied mathematics, computational techniques, and practices. |
| Credit | 3 units |
| ***MITS111*** | **Data Science** |
| Course Description | This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used. |
| Credit | 3 units |
| ***MSCS215*** | **Advanced Data Security** |
| Course Description | This course explores the basic components and design principles of advanced broadband networks (wireline and wireless) and how they enable essential services such as mobility, secure data storage, processing and transmission. This course will also introduce the student to emerging issues facing organizations considering implementing cloud computing services and mobility to enable worker productivity. Students will also be exposed to the basic pillars of network security (IA) and protecting individual privacy. |
| Credit | 3 units |
| ***MSCS216*** | **Machine Learning** |
| Course Description | This course covers include: Algorithmic models of learning. Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs from experience. Bayesian, maximum a posteriori, and minimum description length frameworks. Parameter estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers. Computational learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting. |
| Credit | 3 units |

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**STUDENT OUTCOMES MAPPING**

| COURSE CODE | COURSE DESCRIPTION | STUDENT OUTCOMES | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| MSCS111 | Advanced Data Structures and Algorithms | X | | X | | | |
| MSCS112 | Advanced Computer Organization and Operating Systems | X | | X | | | |
| MSCS113 | Theory of Programming Languages | X | | | X | | |
| MSCS114 | Theory of Computation | X | | X | | | |
| MSCS211 | Intelligence Systems | X | | X | | | |
| MSCS212 | Theoretical Computer Science | X | | X | | | |
| MSCS213 | Computational Science | | | | X | | |
| MITS111 | Data Science | X | | X | | | |
| MSCS215 | Advanced Data Security | | | | X | X | X |
| MSCS216 | Machine Learning | X | | X | | | |
| MSCS311 | Thesis 1 | X | X | X | X | X | X |
| MSCS312 | Thesis 2 | X | X | X | X | X | X |

**PROGAM OF STUDY**

| **FIRST YEAR** *First Semester* | | |
|---|---|---|
| **COURSE CODE** | **DESCRIPTIVE TITLE** | **UNITS** |
| MSCS111 | Advanced Data Structures and Algorithms | 3 |
| MSCS112 | Advanced Computer Organization and Operating Systems | 3 |
| MSCS113 | Theory of Programming Languages | 3 |
| Total | | 9 |
| **FIRST YEAR** *Second Semester* | | |
| **COURSE CODE** | **DESCRIPTIVE TITLE** | **UNITS** |
| MSCS114 | Theory of Computation | 3 |
| MITS111 | Data Science | 3 |
| MSCS211 | Intelligence Systems | 3 |
| Total | | 9 |
| **FIRST YEAR** *Midterm* | | |
| **COURSE CODE** | **DESCRIPTIVE TITLE** | **UNITS** |
| MSCS212 | Theoretical Computer Science | 3 |
| MSCS213 | Computational Science | 3 |
| Total | | 6 |
| **SECOND YEAR** *First Semester* | | |
| **COURSE CODE** | **DESCRIPTIVE TITLE** | **UNITS** |
| MSCS215 | Advanced Data Security | 3 |
| MSCS216 | Machine Learning | 3 |
| MSCS311 | Thesis 1 | 3 |
| Total | | 9 |
| **SECOND YEAR** *Second Semester* | | |
| **COURSE CODE** | **DESCRIPTIVE TITLE** | **UNITS** |
| MSCS312 | Thesis 2 | 3 |
| Total | | 3 |