COURSE SYLLABUS

ILSE 653 Computer Science Education

Semester A (2022), 3 (3-0-6) credit hours

Course Coordinator

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Instructors

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Course Description

Educational reform that effects the learning and teaching of computer science; computer science curricula; synthesis of learning theories and teaching-learning approaches in promoting the learning of programming, data structure, and algorithm; the use of technology in learning and teaching of computer science; instrument selection for measurement and evaluation; constructing learning and teaching plans in computer science; micro-teaching of a computer-science subject

Course Objectives

Students should be able:

Course Learning Outcome (CLO)	Expected Learning Outcome (ELO)	Sub-ELO
CLO1: To understand the computer science curriculum	ELO 2	sub-ELO 2.1
CLO2: To understand and analyze various instructional methods in computer science	ELO 1 ELO 2	sub-ELO 1.2 sub-ELO 2.2
CLO3: To explain the concept of programming, artificial intelligence, simulation, and microcontroller	ELO 6	sub-ELO 6.1 and 6.4 (Ph.D.)

Course Learning Outcome (CLO)	Expected Learning Outcome (ELO)	Sub-ELO
	ELO 7	sub-ELO 7.2
CLO4: To apply PCK in planning a lesson of a selected topic	ELO 2 ELO 3	sub-ELO 2.2 and 2.3 sub-ELO 3.1 and 3.2
CLO5: Design an instruction to improve students' learning in the selected computer science topic	ELO 1 ELO 2	sub-ELO 1.1 sub-ELO 2.1, 2.2 and 2.3

Venue: Room 303 Institute for Innovative Learning (Online learning is also available for overseas students and in any circumstances where face-to-face meetings are not possible)

Online Link: https://mahidol.webex.com/mahidol/j.php?MTID=mda46de1df6dcda88c6d397e6701528c9

Meeting number: 2643 542 8735

Password: ILSE653

Host key: 624968

Course Outline (Thursday, 13.00-16.00)

Week	Date	Topic	Instructor	Teaching approaches	CLO
1	11 Aug	Introduction to Computer science education	WW	Discussion, Case study	CLO1
2	18 Aug	PCK in Programming I	WW	Discussion, Case study	CLO2 and 3
3	25 Aug	PCK in Programming II	WW	Discussion, Case study	CLO2 and 3
4	1 Sep	PCK in Programming III	WW	Discussion, Case study	CLO4 and 5
5	15 Sep	PCK in Programming IV*	WW	Discussion, Demonstration, Case study	CLO2, 3, 4, and 5
6	22 Sep	PCK in Artificial Intelligence I	WW	Discussion, Case study	CLO2 and 3
7	29 Sep	PCK in Artificial Intelligence II	WW	Discussion, Case study	CLO4 and 5
8	6 Oct	PCK in Artificial Intelligence III*	WW	Discussion, Demonstration, Case study	CLO2, 3, 4, and 5
9	20 Oct	PCK in Simulation I	MP WW	Discussion, Case study	CLO2 and 3
10	27 Oct	PCK in Simulation II	MP WW	Discussion, Case study	CLO4 and 5
11	3 Nov	PCK in Simulation III*	MP WW	Discussion, Demonstration, Case study	CLO2, 3, 4, and 5

Week	Date	Topic	Instructor	Teaching approaches	CLO
12	10 Nov	PCK in Microcontroller I	SN TP	Discussion, Case study	CLO2, 3, 4, and 5
13	17 Nov	PCK in Microcontroller II*	SN TP	Discussion, Case study	CLO2, 3, 4, and 5
14	24 Nov	Planning computer science instruction	MP SN TP WW	Discussion, Case study	CLO2, 3, 4, and 5
15	1 Dec	Rehearsing computer science instruction*	MP SN TP WW	Discussion, Demonstration, Case study	CLO2, 3, 4, and 5

* have an assignment

Readings

Committee on *How People Learn*, National Research Council (U.S.). (2005). *How Students Learn: Science in the Classroom*. (M. S. Donovan & J. D. Bransford, Eds.) National Academies Press.

Course Requirements

For credit registration

- **Class attendance and participation (20%) To evaluate CLO 1**

  Each student is expected to discuss and analyze the concepts presented during the learning activities and oral presentations.

- **Class assignments (80%) To evaluate CLO2, 3, 4, and 5**

  From time to time, there will be assignments such as searching for information to extend the concepts learned in class or applying the concepts to various situations. In Week 5, 8, 11, and 15, each student is assigned to prepare teaching and demonstrate the teaching in the class. Verbal feedback will be provided at the end of the student's presentation.

  Final grades will be determined as follows:

>= 85%	A,
>= 75 and <85%	B^+,
>= 65 and <75%	B,
>= 55 and <65%	C+, and
< 55%	I

  In addition, a student's final grade may be higher than the suggested guideline if the student's score is close enough (<1% gap) to the next higher score. That is, close scores will likely earn the same final grade.

For audit registration

- **Class attendance and participation**

  Attendance 80% and active participation 80%

- **Class assignments**

  In Week 5, 8, 11, and 15, each student is assigned to prepare teaching and demonstrate the teaching in the class (at least one mathematical topic).

Rubric for class participation

	Present (1)	**Attentive (2)**	**Engaging (3)**	**Satisfactory (4)**	**Exemplary (5)**
Active contribution	Show up but never contribute to class discussion	Seldom contribute to class discussion, unless asked	Occasionally contribute to class discussion	Regularly contribute to class discussion	Proactively and regularly contribute to class discussion
Active listening	Lack of attention to the discussed topic	Listen when others discuss and occasionally respond to the discussed topic	Listen when others discuss and sometimes respond to the discussed topic	Appropriately listen when others discuss and consistently respond to the discussed topic	Appropriately listen when others discuss and usefully respond to the discussed topic

Rubric for assignment

	Capstone	Milestones		Benchmark
	4	3	2	1
Decomposition	Breaks a complex problem into clearly described, well-defined, and distinct-but-related subproblems that are easier to solve than the original problem but when combined efficiently solves the original problem.	Breaks a complex problem into clearly described subproblems that are distinct-but-related but lack efficiency, although they solve the original problem.	Breaks a complex problem into subproblems that lack efficiency, fail to have sufficient descriptions, and overlap, although they solve the original problem.	Breaks a complex problem into subproblems that are inefficient, described poorly, overlap or closely related, and fail to completely solve the original problem.
Algorithms	Creates a logical, efficient, and well-described sequence of steps or instructions to solve a problem or achieve a goal.	Create a logical sequence of steps that are well-described (e.g. unambiguous, precise) and solve a problem or achieve a goal but the steps are inefficient e.g. not in an optimal sequence, overlapping, duplicative, or unnecessary.	Create a logical sequence of steps that solve a problem or achieve a goal but the steps are poorly described (e.g. ambiguous, vague	Create a sequence of steps that do not solve a problem or achieve a goal. The step lack efficiency, sufficient descriptions, and are not described or documented.
Abstraction	Create an accurate-but-simplified representation of a process of a group of objects to solve the problem or meet the goal. Selects essential characteristics by filtering out unnecessary information. Can be used to solve other problems or goals.	Create an accurate-but-simplified representation of a process or group of objects to solve the problem or meet the goal. Selects essential characteristics by filtering out unnecessary information. Cannot be used to solve other problem or goals.	Create an accurate-but-simplified representation of a process or group of objects to solve the problem or meet the goal. Fails to select all essential characteristics by filtering out unnecessary information. Cannot be used to solve other problem or goals.	Create a representation of a process or group of objects that is not accurate, not sufficiently simplified or fails to solve the problem or meet the goal.

	Capstone	Milestones		Benchmark
	4	3	2	1
Readability	The code is exceptionally well organized and very easy to follow.	The code is fairly easy to read.	The code is readable only by someone who knows what it is supposed to be doing.	The code is poorly organized and very difficult to read.

Adapted from Computational Thinking Rubric (NSF)

The PLOs and key performance indicators of the Master of Science Program in Science and Technology Education (International Program) in Academic Year 2020.

PLOs	Key Performance Indicators
PLO 1: Display moral and ethical behavior for science and technology educators	1.1 Display moral and ethical behavior that aligns with the code of conduct for science and technology educators 1.2 Follow the ethical code of conduct in educational research
PLO 2: Apply principle in science and technology education to design and implement learning activities in science and/or technology classes appropriately	2.1 Adopt instructional sciences to improve learning in science and technology education 2.2 Design learning activities for science and/or technology classes 2.3 Implement the designed activities to improve learning in science and technology education 2.4 Assess students' learning achievement
PLO 3: Synthesize solutions to learning problems in the field of study	3.1 Analyze learning problems in the field of study 3.2 Apply PLO 2 to synthesize new ways and/or means to solve the learning problems
PLO 4: Conduct science and technology education research by integrating knowledge in the field of study	4.1 Propose a research project in science and technology education predicated on educational research methodology 4.2 Conduct science and technology education research 4.3 Publish an international peer-reviewed research article
PLO 5: Improve innovations in science and technology education consistent to knowledge in the field of study and social contexts	5.1 Display ability to search for existing innovations in science and technology education consistent to knowledge in the field of study 5.2 Analyze strengths and weaknesses of the existing innovation

PLOs	Key Performance Indicators
	5.3 Propose ways and/or means to improve the existing innovation 5.4 Use the improved innovation for others' benefits and/or applicable to social contexts
PLO 6: Evaluate knowledge of oneself	6.1 Classify criteria for self-evaluation 6.2 Reflect oneself against the criteria 6.3 Evaluate oneself validly and reliably
PLO 7: Display the ability to control and improve oneself	7.1 Display the ability to control oneself 7.2 Display the ability to improve oneself
PLO 8: Display leadership quality and ability to effectively collaborate with others	8.1 Display leadership quality to effectively collaborate with others 8.2 Display ability to effectively collaborate with others