Course Specification

Name of Institution	Mahidol University
Campus/faculty/department	Salaya campus
	Mahidol University International College
	Science Division

Section 1 General Information

1. Course code and course title

Thai	ICCS 314	วิธีเชิงตัวเลข
English	ICCS 314	Numerical Methods

2. Number of credit 4 (4-0-8)
(lecture 4 hours – self study 8 hours/ week)

3. Curriculum and type of subject

3.1 Curriculum	offered in international curriculum
3.2 Type of subject	Major Required course, Computer Science

4. Responsible faculty member Full-time faculty members, Mahidol University International College, Mahidol University

5. Trimester / year of study

5.1 Trimester	2 / Third, Fourth year
5.2 Number of students	_____ students

6. Pre-requisites ICCS 101 Introduction to Computer Programming

7. Co-requisites -

8. Venue of study Mahidol University, Salaya campus

Section 2 Goals and Objectives

1. Goals

To let the students having knowledge in relation to fundamental principles of computer programs; basic three programming constructs, namely sequence, conditions, and iterations; logic of programs in the problem solving process; object-oriented programming fundamentals.

2. Objectives of development/revision

The objective of this course is to equip student with the knowledge of how to identify

the type of problems that require numerical techniques for their solutions and accurately approximate the solutions of some problems that cannot be solved exactly. This course combines the knowledge of mathematic and computer programming to solve the mathematical problems. The student will be introduced to the theory and applications of numerical approximation techniques.

Section 3 Course Management

1. Course descriptions

การแนะนำวิธีการใช้คอมพิวเตอร์เพื่อคำนวณหาคำตอบของปัญหาทางวิทยาศาสตร์ ผลเฉลยเชิงตัวเลขของสมการไม่เชิงเส้น ระบบสมการเชิงเส้น การประมาณค่าในช่วง การประมาณค่าของฟังก์ชันการหาอนุพันธ์ ปริพันธ์เชิงตัวเลข ผลเฉลยเชิงตัวเลขสำหรับสมการเชิงอนุพันธ์

Students will learn about basic of numerical analysis for computer science, error analysis, solving of equations in one variable, methods for solving system of linear equations, polynomial approximation and numerical methods of differentiation and integration. Practical applications are included.

2. Credit hours / trimester

Lecture	Additional class	Laboratory / field trip/ internship	Self study
44 hours (4 hour x 11 weeks)	-	-	88 hours (8 hours x 11 weeks)

3. Number of hours that the lecture provides individual counseling and guidance

1 hour / week

Section 4 Development of Students' Learning Outcome

1. Expected outcome on students' skill and knowledge

Students will be able to apply the knowledge from lectures and with the ideas received from analysis and synthesis to set up solutions/ precautions to benefit individuals;

2. Teaching methods

Course organized using lecture, assignments, and quizzes.

3. Evaluation methods

1. Morality and Ethics

1.1 Expected outcome on morality and ethics

- ● (1) To posses morality and ethics
- ● (2) To have self-discipline, honesty, kindness, self- responsible and social responsibility
- ● (3) To demonstrate academic ethical behavior
- ● (4) To respect others' rights and be a good listener
- ● (5) To respect rules and regulations
- ○ (6) To have good attitude toward professors/career
- (7) To demonstrate Leadership, team player

1.2 Teaching methods

Learning Centered Education : Emphasis on knowledge development, important skills in career development and living, encourage students to use their full potentials

(1) Lecture

(2) Assignments

(3) Quizzes

1.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

2. Knowledge development

2.1 Expected outcome on knowledge development

- ● (1) To posses basic knowledge, theories and concepts towards the understanding of self, society, surrounding in order to be well-rounded person
- ● (2) To process the knowledge related to principles, theories and practice in the course
- ● (3) To integrate the knowledge to other related subjects
- ○ (4) To remain current in research and new knowledge

2.2 Teaching methods

Learning Centered Education : Emphasis on knowledge development, important skills in career development and living, encourage students to use their full potentials

(1) Lecture

(2) Assignments

(3) Quizzes

2.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

3. Intellectual development

3.1 Expected outcome on intellectual development

- (1) To have systematic and analytical thinking
- (2) To be able to search, consolidate and evaluate ideas and evidence for problem solving
- (3) To be able to apply knowledge and experience to analyze and creatively solve problems both in general and academic

3.2 Teaching methods

(1) Lecture

(2) Assignments

(3) Quizzes

3.3 Evaluation methods

(1) Written examination

(2) Assignments

(3) Quizzes

4. Interpersonal relationship and responsibility

4.1 Expected outcome on Interpersonal relationship and responsibility

- (1) To posses good interpersonal relationship skills (self esteem and dignity) and have respect for the rights and value of others

(2) To possess leadership and initiative in problem solving

(3) To be constructive team member (in various roles) and be responsible for assignment tasks, professional and society

4.2 Teaching methods

(1) Lecture

(2) Assignments

(3) Quizzes

4.3 Evaluation methods

(1) Written examination

(2) Assignments

(3) Quizzes

5. Mathematical analytical thinking, communication skills, and information technology skills

5.1 Expected outcome on mathematical analytical thinking, communication skills, and information technology skills

● (1) To be able to select and apply appropriate statistical and mathematical methods to research problems

○ (2) To be able to apply information technology for data gathering, processing, interpreting and presenting information/results

(3) To have the ability to communicate effectively and select appropriate methods of presentation

5.2 Teaching methods

(1) Lecture

(2) Assignments

(3) Quizzes

5.3 Evaluation methods

(1) Written examination

(2) Assignments

(3) Quizzes

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Hours	Teaching methods/ multimedia	Instructor
1	Taylor Series and Plotting	**4**	**Lecture**	
2	Root Finding	**4**	**Lecture**	
3	Finding Derivative and polynomial interpolation.	**4**	**Lecture**	
4	Integration	**4**	**Lecture**	
5	System of Linear Equations	**4**	**Lecture**	
6	Least Square Fitting	**4**	**Lecture**	
7	Gradient Descent	**4**	**Lecture**	
8	Ordinary Differential Equation	**4**	**Lecture**	
9	Partial Differential Equation	**4**	**Lecture**	
10	Monte Carlo Methods	**4**	**Lecture**	
11	Special Topics I	**4**	**Lecture**	
12	Special Topics II	**4**	**Lecture**	

2. Evaluation plan

Expected outcomes	Methods / activities	Percentage
1. (1) to (5)	Attendance	10
2. (1) to (5)	Homework	25
3. (1) to (5)	Project	35

4. (1) to (5)	Examination	35

Section 6 Teaching Materials and Resources

1. Texts and main documents

(1) Atkinson K., Elementary Numerical Method Analysis, Second Edition, John Wiley & Sons, New York, 1993

(2) Gerald, Wheatley, Applied Numerical Method Analysis, sixed Edition, Addison-Wesley

(3) Hosking, Joe, Joyce, Turner, First Steps in Numerical Analysis, Second Edition, Arnold, London, 1996

(4) Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, fourth Edition, McGraw-Hill, 2003

2. Documents and important information

3. Documents and recommended information

Section 7 Evaluation and Improvement of Course Management

1. Strategies for effective course evaluation by students

1.1 Evaluation of peers by students

1.2 Student evaluation

1.2.1 Course content

1.2.2 Course management

1.2.3 Suggestions

1.2.4 Overall opinion

2. Evaluation strategies in teaching methods

2.1 Student evaluation

2.2 Presentation

3. **Improvement of teaching methods**

   Workshop on course improvement with the participation of all lecturers in this course

4. **Evaluation of students' learning outcome**

   Analysis of students' learning outcomes using scores from class attendance, group activity and presentation of project and poster presentation

5. **Review and improvement for better outcome**

   Meeting of lecturers to review the course before semester starts and before each period of

   teaching