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) EGCI 200 คณิตศาสตร์วิศวกรรม

(English) EGCI 200 Engineering Mathematics

2. Number of Credits

4(4-0-8) (Lecture/Lab/Self-study)

3. Curriculum and type of subject

3.1 Curriculum Bachelor of Engineering (Computer Engineering)

3.2 Type of subject Major Course (Core)

4. Responsible faculty member

Vladimir Buntilov

5. Trimester / year of study

5.1 Trimester 2^{nd} / year of study 4^{th} year

5.2 Number of students 5-20 students

6. **Pre-requisite(s)** ICMA 215

7. Co-requisite(s) none

8. Venue of study Mahidol University International College, Salaya campus

9. Date of latest revision January 2012

Section 2 Goals and Objectives

1. Goal

After successful completion of this course, students will be able to:

- Translate a physical or other problem into a mathematical form such as algebraic equation, a differential equation or other mathematical expression
- Solve mathematical models by selecting and applying a suitable mathematical method.
- Interpret the mathematical result in physical or other terms.

2. Objective of development revision

To update the content of the course

Section 3 Course Management

1. Course Description

(Thai) วิชานี้ศึกษาเกี่ยวกับหลักการ วิธีการ และผลลัพธ์ของคณิตศาสตร์วิศวกรรมที่จะนำคณิตศาสตร์ไปใช้ประยุกต์ใช้สำหรับ เนื้อหาในวิชานี้ประกอบด้วย สมการอนุพันธ์เชิงสามัญอันดับที่หนึ่งและสอง การแปลงลาปลาสและการประยุกต์ใช้เพื่อนำไปในการแก้สมการ พีชชคณิตเชิงเส้น ซึ่งประกอบด้วยการดำเนินงานกับแมทริกส์ ดีเทอร์มิแนนต์ ปัญหาไอเกนเวกเตอร์ เมทริกซ์เฉียงเชิงตั้งฉาก และ แคลคูลัสการอนุพันธ์เวกเตอร์

(English) The course provides knowledge of principles, methods and results of engineering mathematics, that is applied mathematics for engineers.. The course covers the following topics: Ordinary Differential Equations of the first and second order; Laplace Transform and its application to solve differential equations; Linear Algebra including operations with matrices, determinants, eigenvalue problem and diagonalization; Vector Differential Calculus.

2. Credit hours / trimester

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

3. Numbers of hours that the lecturer provides individual counseling and guidance

1 hour/week

Section 4 Development of Students' Learning Outcome

1. Expected outcome on students' skill and knowledge

Students shall be able to apply the received knowledge in various academic/industrial fields. In addition students shall possess clear understanding about the physical/engineering processes discussed as demonstrative examples through the lectures.

2. Teaching Methods

- Lectures
- Homework exercises
- Self-study

3. Evaluation methods

1. Morality and Ethics

1.1 ***Expected outcome on morality and ethics:***

○ 1.1.1 To be aware of values and morality, ethics, self-sacrifice and honesty.

● 1.1.2 To process self-discipline, punctuality, self-responsibility and social responsibility

1.1.3 To process leadership and supporter skills and be able to work in a team with integrity and cooperation.

1.1.4 To demonstrate good listening behavior and have respect for the rights and value of others.

1.1.5 To pay respect to the rule of organization and social.

1.1.6 To demonstrate the ability to analyze ethical impacts of computer usage to personals, organizations and social.

1.1.7 To demonstrate good academic ethical behaviors.

1.2 ***Teaching methods:***

Encourage students to study independently using their full potentials. Encourage self-discipline in class.

1.2.1 Lectures
1.2.2 Assignments

1.3 ***Evaluation methods:***

1.3.1 Class attendance, class participation and behavior in class
1.3.2 On-time submission of assignments and their quality
1.3.3 Absence of academic dishonesty

2 Knowledge development

2.1 ***Expected outcome on knowledge development:***

- 2.1.1 To process the knowledge related to principles, theories and practice in the course

2.1.2 To be able to analyze, understand and explain the computer requirements and be able to apply knowledge and skills using the appropriate tools to solve a problem.

2.1.3 To be able analyze, design and install and/or evaluate computer components to meet the requirements of the users

2.1.4 To have the ability to remain current in research, and pursue new knowledge and perform ability to apply the knowledge.

2.1.5 To know, understand and perform eagerness to develop computer knowledge and skills continuously.

2.1.6 To have a breadth knowledge in order to oversee the changes and understand the impact of new technology.

2.1.7 To have a hand-on experience in software development and/or software applications.

- 2.1.8 To demonstrate knowledge integration with other related sciences.

2.2 ***Teaching methods:***

Provide examples from physics and engineering which are described by the mathematical ideas discussed in lectures. Unassisted solving of the problems in homework assignments.

2.2.1 Lectures
2.2.2 Homework assignments
2.2.3 Self study

2.3 ***Evaluation methods:***
2.3.1 Written examination
2.3.2 Quality of homework assignments

3. Intellectual development

3.1 ***Expected outcome on intellectual development:***

- 3.1.1 To have self-dependent and systematic thinking skill.

3.1.2 To have the ability to search, consolidate and evaluate ideas and evidence for

problem solving.

3.1.3 To be able to apply knowledge and experience to analyze and creatively solve problems both in general and in academic contexts.

○ 3.1.4 To be able to apply knowledge and experience to synthesize solution and precautions

3.2 ***Teaching method:***

3.2.1 Systematic problem solving examples and case studies.
3.2.2 Systematic unassisted problem solving in homework assignments.
3.2.3 Self-Study

3.3 ***Evaluation methods:***
3.3.1 Written examination
3.3.2 Homework assignments evaluation

4. Interpersonal relationship and responsibility

4.1 ***Expected outcome on interpersonal relationship and responsibility:***

4.1.1 To perform good communication skills with various groups of people.

4.1.2 To be a constructive team member (in various roles).

4.1.3 To process the knowledge of the course to identify social problems.

● 4.1.4 To demonstrate self and team responsibility.

○ 4.1.5 To have initiative in problem solving.

4.1.6 To take responsibility in a life-long learning.

4.2 ***Teaching methods:***

4.2.1 Homework assignments

4.2.2 Written examination

4.2.3 Group assignment

4.3 ***Evaluation methods:***
4.3.1 Class attendance, class participation and behavior in class
4.3.2 On-time submission of assignments and their quality
4.3.3 Absence of academic dishonesty

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

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

- 5.1.1 To be able to select and apply existing tools for computer related work.

5.1.2 To possess the ability to apply information technology for data gathering, processing, interpreting and presenting information/results.

5.1.3 To have the ability to communicate effectively and select appropriate methods for presentation.

- 5.1.4 To use information technology appropriately.

5.2 ***Teaching methods:***

5.2.1 Lectures and in-class discussion
5.2.2 Homework exercises
5.2.4 Self Study

5.3 ***Evaluation methods:***

5.1.5 Written examination
5.1.6 On-time submission of assignments and their quality

Section 5 Teaching and Evaluation Plans

1. Teaching plan

week	Topics	Hours			Teaching methods/ multimedia	Instructor
		Lecture	Lab	Self-Study		
1	**First order linear ODEs**	4	0	8	Lecture and homework exercises	Vladimir Buntilov
2	**Second order linear ODEs.** Free oscillations.	4	0	8	Lecture and homework exercises	
3	**Second order linear ODEs.** Method of undetermined coefficients, forced oscillations.	4		8	Lecture and homework exercises	

week	Topics	Hours			Teaching methods/ multimedia	Instructor
		Lecture	Lab	Self-Study		
4	**Laplace Transform.** First shifting theorem. Transform of the derivatives. Method of partial fractions.	4	0	8	Lecture and homework exercises	
5	**Laplace Transform.** Solving IVPs. Transform of the unit-step function, delta function. Second shifting theorem	4	0	8	Lecture and homework exercises	
6	**Linear Algebra I.** Operation with matrices. Linear system of equations. Gauss elimination and back-substitution. Row-echelon form. Determinants.	4	0	16	Lecture and homework exercises	
7	**Linear Algebra I.** Rank of a matrix. Linear independence of vectors. Inverse matrix.	4	0	8	Lecture and homework exercises	
8	**Linear algebra II.** Matrix eigenvalue problem. Diagonalization of matrices. Quadratic forms.	4	0	16	Lecture and homework exercises	
9	**Vector differential calculus.** Vectors, vector functions. Derivative of a vector function. Curves in space.	4	0	8	Lecture and homework exercises	

week	Topics	Hours			Teaching methods/ multimedia	Instructor
		Lecture	Lab	Self-Study		
10	**Vector differential calculus.** Gradient of a vector field. Directional derivative. Surface normal vector. Potential of a vector field.	4			Lecture and homework exercises	
11	**Vector differential calculus.** Divergence, curl of a vector field.				Lecture and homework exercises	
	Total	44	0	88		

2. Evaluation Plan

Expected outcomes	Methods / activities	Week	Percentage
1.1.2, 2.1.1, 3.1.1, 4.1.4, 5.1.4	Midterm Examination Final examination	6 12	45% 45%
1.1.2, 2.1.1, 3.1.1, 4.1.4, 5.1.4	Homework exercises	1-11	10%

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Section 6 Teaching Materials and Resources

1. Texts and main documents

Erwin Kreyszig, “Advanced Engineering Mathematics, 9th ed.”, John Willey & Sons, Inc., 2006.

2. Documents and important information

Course syllabus, tentative schedule and course documents:

Website http://sites.google.com/site/buntilov/teaching

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 of students' learning outcome**

   Analysis of students' learning outcomes using scores from class attendance, group activity.

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

   Review the course before trimester starts.

Symbol ● represents main responsibility / Symbol ○ represents minor responsibility / Space represent no responsibility

These symbols will appear in Curriculum Mapping