Mathematics for Electrical Engineering

Course Name	Course type (credit/hours)	Required course(3/3)	Course code	C009
	Target students Division/major/grade	Electrical and Computer Engineering/Sophomore	Opening semester	2021 1ST SEMESTER
	Class time and classroom	Tue C(WH228)Fri C(WH228)	English Grade	A(100%English)
Reference to this course	Prerequisite courses			
	Related basic courses			
	Recommended concurrent courses			
	Related advanced courses			

Instructor	Name (title/division)	Sangsin Na(Professor, Electrical and Computer Engineering)				
	Office Room Number	원천관 406	Office phone Number	2366	e-mail	
	Office hours		Homepage address			
Teaching Assistant	Name (title/division)					
	Office Room Number		Office phone Number		e-mail	

1. Introduction

The course focuses on the following topics, which arise in signals and systems in electrical engineering.

(1) Complex numbers and functions of a complex variable, phasor, impedance, rational functions of a complex variable from signals and systems

(2) Fourier series and Fourier transform, spectrum, transfer function and frequency response function of linear time-invariant systems

(3) Introductions to partial differential equations, wave equations, diffusion equations

2. Course Objectives

The objectives of the course are to understand and apply theories of rational functions of a complex variable, the Fourier series and transforms and partial differential equations to analyze and design electrical signals and systems. In order to accomplish these objectives, the following skills are emphasized:
(1) ability to operate on complex numbers and rational functions of a complex variable
(2) ability to formulate and apply the Fourier series and Fourier transform to find the spectrum and the frequency response function
(3) ability to solve one-dimensional diffusion equations, two-dimensional Laplace equations, and one-dimensional wave equations
(4) ability to use the Matlab to analyze and design filters

3. Class types and activities

(1) The course will be delivered mainly in the form of lectures.
(2) Under the Covid19 circumstances, lecturea are expected to be recorded online (100%) plus real-time online Q&A sessions.
(3) The Q&A sessions will be either during the school-scheduled class hours or will be announced later when the class settles down.
(4) The Q&A sessions are optional, meaning that you do not have to attend them, but you are encouraged to, especially when you have questions.

4. Teaching Method

- [V] lecture
- [ ] discussion and debate
- [ ] team project(presentation and case studies)
- [ ] experiments(role-playing,etc)
- [ ] designing and production
- [ ] on-site learning(on-site training)
- [ ] others

5. Support Systems in Use

- [V] AjouBb
- [ ] automatic recording system
- [ ] web-based assignment
- [ ] cyber lecture
- [ ] online content
- [ ] class behavior analyazing system
- [ ] others

6. Teaching Tools

- [ ] PBL(Problem Based Learning)
- [ ] CBL(Case Based Learning)
- [ ] TBL(Team Based Learning)
- [ ] UR(Undergraduate Research)
- [ ] FL(Flipped Learning)
- [ ] DSAL(Data Science Active Learning)
- [ ] others

7. Knowledge and ability required for taking this course

Knowledge assumed for the course is the following.

(1) Math 1: differentiation and integration of functions of one variable

(2) Math 2: differentiation and integartion of functions of multivariables

(3) Engineering Math A: differential equations of constant coefficients, the Laplace tranform method

(4) Mathlab basic programming

8. Method of Evaluation

Evaluation Item	The Number of Times	Evaluation Proportion	Remarks
Attendance			
midterm exam	1	25%	Midterm: 25% (School Schedule) [100 points toward the total score]
final exam	1	25%	Final Exam: Tuesday, June 15, 6:30--8:30 or 9:00~11:00 pm [100 points toward the total score]
quiz	~10	50%	Quizzes and assignments during class hours or 9:00~9:40 pm [200 points toward the total score]
presentation			
discussion			
homework			
etc			
study hours	6 hours weekly		

9. Textbook and supplementary material

Main/Sub	Title (Web-site)	Writer	Publisher	Publication year
Main	Advanced Engineering Mathematics, 10th ed	Erwin Kreyszig	Wiley & Sons	2011
Ref.	Any circuit analysis book, e.g., your Circuit Analysis textbook, such as Introduction to Electric Circuits	Dorf		
Ref.	Elements of Electromagnetics	Matthew Sadiku		
Ref.	Any Book About Matlab			

10. Class system and Class shedule

(1) Complex numbers and functions of a complex variable

complex number operations -> ration functions of one complex variable -> sinusoids, phasor and impedance -> analysis of circuit in sinusoial steady state -> transfer functions, poles and zeros -> filter analysis

(2) The Fourier analysis

the Fourier series -> Fourier transform -> the Fourier spectrum of signals -> Fourier analysis of linear time-invariant systems

(3) Partial differential equations

introduction to partial differential equations -> two-dimensional Laplace equations -> one-dimensional diffusion equations -> one-dimensional wave equations

< Class Schedule >

* language : K-korean, E-English

Weeks	Topics	language	Instructor	Teaching Method	Evaluation Method	Matter to be prepared
1	13.1,13.2: complex numbers and plane, polar form	E	Sangsin Na	강의		
2	phasor, impedance, circuits in sinusoidal steady state	E	Sangsin Na	강의		
3	digital filters, z-transform,	E	Sangsin Na	강의		
4	roots, analog filters	E	Sangsin Na	강의		
5	6.6, 11.9: convolution, Dirac delta function	E	Sangsin Na	강의		
6	11.1, 11.2: Fourier series, periodic expansions	E	Sangsin Na	강의		
7	Orthonormal bases, applications of Fourier series	E	Sangsin Na	강의		
8	midterm week		Sangsin Na	중간고사		
9	11.7, 11.9: Fourier transform	E	Sangsin Na	강의		
10	Fourier transform applications	E	Sangsin Na	강의		
11	12.1,12.3: basic concepts of PDE, Separation of variables	E	Sangsin Na	강의		
12	12.6: Two-dimensional Laplace equations	E	Sangsin Na	강의		
13	12.6: Two-dimensional Laplace equations	E	Sangsin Na	강의		
14	12.6 : One-dimensional diffusion equations	E	Sangsin Na	강의		
15	12.3: One-dimensional wave equations	E	Sangsin Na	강의		
16	final exam week		Sangsin Na	기말고사		

11. Other items of notification

Letter grades will be determined as follows.

(1) The school grade policy B applies to the course. International students are exempt from the policy.
Covid19 may affect the policy: in 2020, the grade policy 3 was introduced, which allowed assigning A and A+ up to 50% of the class.

(2) Assuming that the grade distribution complies with the school grade policy, based on the total of 400 points
your score >= 360 A+ (90/100)
>= 320 A0 (80/100)
>= 280 B+ (70/100)
>= 240 B0 (60/100)
>= 200 C+ (50/100)
>= 160 C0 (40/100)
>= 120 D+ (30/100)
>= 100 D0 (25/100)