

University of Macau
Faculty of Science and Technology
Department of Electrical and Computer Engineering

Part A: Course Outline

Course Title:	Signals and Systems		
Course Code:	ECEB210	Year of Study:	2
Course Mode:	Theoretical with substantial laboratory/ practice content		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	ECEB122		
Prerequisite Knowledge	Circuit Analysis		
Class/Laboratory Schedule:	3-hour lecturer, and 2-hour tutorial and/or laboratory per week		
Duration	One semester	Credit Units	4
Text Books and References:	<p>[1] <i>Signals and Systems</i>, (2nd Edition) by Alan V. Oppenheim, Alan S. Willsky, Prentice Hall International Edition, 1997 [ISBN: 978-0138147570]</p> <p>[2] <i>Continuous and Discrete Signals and Systems</i> (2nd Edition), by Samir S.Soliman, Mandyam D.Srinath, Prentice Hall, 1998. [ISBN: 978-0135184738]</p> <p>[3] <i>信號與系統</i>, 鄭君里, 楊為理, 應啟珩, 高等教育出版社, 2004. [ISBN: 704007981]</p>		
Course Description:	<p>This course introduces the fundamental and contemporary analysis methodologies of both continuous-time and discrete-time signals and systems which play an important role in such diverse areas of science and technology as circuit design, control systems, communications, biomedical engineering, energy generation and distribution systems, speech and video processing and so forth.</p>		
Topics Covered	<p>Basic Continuous-Time (C-T) and Discrete-Time (D-T) Signals and its Transformations. Basic System Properties. Linear Time-Invariant System Analysis: Properties, Convolution Sum and Convolution Integral, Impulse and Step Responses. C-T Fourier Analysis: Fourier Series and Fourier Transform. Time and Frequency Characterization of C-T Signals and Systems: Frequency Response, 1st- and 2nd-Order Systems, Bode Plots, Zero-State System Response. Introduction to Filtering, Modulation and Sampling. Laplace Analysis: Bi- and Uni-lateral Laplace Transform, Pole-Zero Plot and Stability, Transfer Function, Application in Circuit Analysis. Practice includes problem solving, MATLAB and Laboratory Works.</p>		
Course Objectives:	<ol style="list-style-type: none"> 1. Characterize the signal and systems using widely-accepted engineering terminology [a, c, e, h] 2. The use of frequency-domain analysis in the components of the signals as well as the properties of the systems [a, c, e, h] 		

	<p>3. To offer students the signal and system analysis experience through the real measurement laboratory as well as MATLAB simulation works [a, b, c, e, h, k]</p> <p>4. Encourage the students to analysis and explain the physic world of signals and systems using mathematics [a, c, e, h]</p>
<p>Course Assessment:</p>	<p>Quizzes :25%</p> <p>Laboratory Works: 20%</p> <p>Mid-term Exam : 25%</p> <p>Final Exam: 30%</p>
<p>Relationship to Program Objectives and Outcomes</p>	<p>This course primarily contributes to ECE program outcomes that develop students abilities to:</p> <ul style="list-style-type: none"> a. Ability to apply knowledge of mathematics, science and engineering. c. Ability to design a system, component or process to meet desired needs. e. Ability to identify, formulate and solve engineering problems. <p>This course secondarily contributes to ECE program outcomes that develop students abilities to:</p> <ul style="list-style-type: none"> b. Ability to design and conduct simulations and experiments. h. Broad education necessary to understand the impact of engineering solutions in global and societal context. k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice. l. Ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations

	Week no.	Topics	Program Criteria
Course Contents and Relationship to Program Criteria:	1.5	Introduction Introduction why the signals and systems analysis is important in the engineering worlds, and give some examples on engineering problems that can be solved by the topic covered in this course. continuous-time and discrete-time signals are presented with their properties, Singularity Functions, as well as the general property of systems.	ES, DIC
	2.5	Linear Time-Invariant Systems Concepts on Linear Time-Invariant (LTI) system, convolution sum and integral, property of LTI systems, LTI systems described by differential equations	ES, DIC, DE
	3	Fourier Series Analysis Fourier series on discrete and continuous-time periodic signals, convergence of Fourier series, properties of Fourier series, Filters.	ES, DIC, CV
	2	Fourier Transform Analysis Basic concepts of Fourier Transform of continuous-time aperiodic signals, properties of Fourier Transform, Fourier Transform of periodic signals, Fourier Transform and differential equations.	ES, DIC, DE, CV
	1.5	Time and Frequency Characterization of Signals and Systems Brief introduction on the relationship between time- and frequency-domain of signals and systems, magnitude and phase of frequency response, time- and frequency-domain characteristics of filters, 1 st order and 2 nd order systems, Bode-Plots	ES, DIC, DE, CV
	0.5	Sampling Introduction to Sampling Theorem, reconstruction, the effect of aliasing.	ES
	0.5	Communication Systems Different types of Modulation – Amplitude Modulation, Frequency Modulation, Phase Modulation, Demodulation	ES
	2.5	Laplace Transform and Its Application in Circuit Analysis The Laplace Transform analysis, Region of Convergence (ROC), pole-zero plot, geometric evaluation of Fourier transform by pole-zero plot, Properties of Laplace Transforms, Analysis of LTI systems using Laplace Transform, Transfer Function and its block diagram representations, Unilateral Laplace Transform and its application in circuit analysis.	ES, DIC, DE, CV
	Contribution of Course to meet the professional component:	This course educates students with basic skills on the analysis the signals and systems in both time-domain and frequency domain, which is important in many engineering sense that need the classification on different components in the signals as well as understanding the system property. The material on this course find important applications in many engineering aspects, such as telecommunications, control systems, circuit designs, signal processing, etc.	
Course Instructor(s):	Dr. Sai-Weng Sin		
Prepared by:	Dr. Sai-Weng Sin		

Part B: General Course Information and Policies

Instructor: Dr. Sai-Weng Sin Office: R315A

Office Hour:

Dr. Sin: Friday 3:30~5:30 p.m. or by appointment Phone: 8795

E-mail: terryssw@umac.mo

Programme Educational Objectives

1. **Problem Solving:** Graduates have the ability to think in a critical and evaluative manner and to consider a broad perspective, in order to solve technical and nontechnical problems.
2. **Leadership and Communication:** Graduates will provide effective leadership, act in an ethical manner and skills will include the ability to communicate well and to work successfully within diverse groups.
3. **Market Acceptance:** Graduates will have successful careers in the academic environment, industrial and government organizations.
4. **Technical Competence:** Graduates will be technically competent and have a thorough grounding in the fundamentals of math and science in electrical and computer engineering and experience in engineering design. They will be able to use modern engineering techniques, skills, and tools to fulfill societal needs.

Scale: 1 (Highest) to 4 (Lowest)

	Problem Solving	Leadership and Communication	Market Acceptance	Technical Competence
Signals and Systems	1	3	3	1

Remark:

- Objective for “Problem Solving” can be achieved by assignments, quizzes, mid-term exam, final exam and projects.
- Objective for “Leadership and Communication” can be achieved by report writing. However, leadership training is not given by this course.
- Objective for “Market Acceptance” can be achieved by the course subject that is related to broad range fundamental knowledge in electrical engineering.
- Objective for “Technical Competence” can be achieved by using fundamentals of math and science in electrical and electronics engineering and experience in engineering project design.

Program Criteria Policy:

Course VS Program Criteria

Scale: 1 (Highest) to 4 (Lower)

Course	PS	DIC	BS	CS	ES	DE	LA	CV	DM
Signals and Systems		1			2	3		1	

Terms:

Probability and Statistics (PS), Differential and Integral Calculus (DIC), Basic Science (BS), Computer Science (CS), Engineering Science (ES), Differential Equation (DE), Linear Algebra (LA), Complex Variables (CV), Discrete Mathematics (DM)

Relationship of course to Programme Outcomes:

Course VS Course

	Program Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
ECEB210 Signal and Systems	TP	P			T		P					

Outcomes

***T – TEACH; P – PRACTICE; M – MEASURED**

The electrical and electronics engineering program outcomes are:

- Ability to apply knowledge of mathematics, science and engineering.
- Ability to design and conduct experiments.
- Ability to design a system, component or process to meet desired needs.
- Ability to function on multidisciplinary teams.
- Ability to identify, formulate and solve engineering problems.
- Understanding of professional and ethical responsibility.
- Ability to communicate effectively.
- Broad education necessary to understand the impact of engineering solutions in global and societal context.
- Recognition of the need for and an ability to engage in life-long learning.
- Knowledge of contemporary issues.
- Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
- Ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations

Curriculum Detail

ECEB210 Signals and Systems

Timetabled work in hours per week			No of teaching weeks	Total hours	No /Duration of exam papers	Max marks available from:	
Lecturer	Tutor	Practice				Exams	Course
3	1	1	14	70	2/4 hours	45	55

Term: 3th

Hours			Percentage content of					
Lecturer	Lab/tut	Other	Maths	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies
42	3/25	0	40	10	30	20	0	0

Design Elements

% of Design Content	Design Content in Course Work	Design Project	Design Content in Laboratories
20%	0	0	X

Course Assessment Policy:

- Homework assignments will be given to students according to the course progress. 3 Quizzes will then be held to justify the students learning progress is satisfactory or not.
- 1-2 laboratories will be performed during the semester. 2-3 students form one group and group report should be handed up.
- 1 mid-term exam and 1 final exam.

STUDENT DISABILITIES SUPPORT SERVICE

The University of Macau is committed to providing an equal opportunity in education to persons with disabilities. If you are a student with a physical, visual, hearing, speech, learning or psychological impairment(s) which substantially limit your learning and/or activities of daily living, you are encouraged to communicate with your instructors about your impairment(s) and the accommodations you need in your studies. You are also encouraged to contact the Student Disability Support Service of the Student Counselling and Development Section (SCD), which provides appropriate resources and accommodations to allow each student with a disability to have an equal opportunity in education, university life activities and services at the University

of Macau. To learn more about the service, please contact SCD at scd.disability@umac.mo, or 8397 4901 or visit the following website: http://www.umac.mo/sao/scd/sds/aboutus/en/scd_mission.php

學生身心障礙支援服務

澳門大學致力為身心障礙人士提供平等的學習機會，若您在肢體、視力、聽力、語言、學習或心理上的障礙，導致您在學習或日常活動中受到嚴重的限制，我們鼓勵您與老師溝通，讓他/她知道你的狀況，並作出適當的安排。此外，我們也鼓勵您與學生輔導及發展處之學生身心障礙支援服務聯繫，該服務將為有需要的學生提供相應的資源和設施，讓所有學生都能在大學裏享有同等的教育機會、大學生活及服務。如閣下對此服務有任何疑問，歡迎聯絡學生輔導及發展處（電郵：scd.disability@umac.mo；電話：83974901；瀏覽網頁 http://www.umac.mo/sao/scd/sds/aboutus/cn/scd_mission.php）。