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

Part A: Course Outline

Course Title	Applied Electronics III		
Course Code	ELEC321	Year of Study:	3
Course Mode	Theoretical with substantial laboratory/ practice content		
Compulsory/Elective	Compulsory		
Course Prerequisites	ELEC223		
Prerequisite Knowledge	Circuit Analysis, fundamental electronics circuits		
Class/Laboratory Schedule	3-hours lecture, 1.2-hours tutorial and 0.8-hour experiment per week		
Duration	One semester	Credit Units	3.5
Text Books and References	[1] A. S. Sedra and K. C. Smith, *Microelectronics Circuits*, 5th Edition, Oxford University Press, 2004. [2] N. R. Malik, *Electronic Circuit Analysis*, Simulation and Design, Prentice-Hall, 1995. [3] S. Franco, *Design with Operational Amplifiers and Analog Integrated Circuits*, McGraw-Hill, 1988. [4] R. C. Dorf and J. A. Svoboda, *Introduction to Electric Circuit*, 3rd Edition, John Wiley & Sons, 1996. [5] P. R. Gray and R. G. Meyer, *Analysis and Design of Analog Integrated Circuits*, 3rd Edition, John Wiley & Sons, 1993. [6] D. A. Johns, K. Martin, *Analog Integrated Circuit Design*, John Wiley & Sons, Inc., 1997.		
Course Description	Part 1 of this course discusses the feedback configuration; its analysis is first presented after conventional feedback structure overview, and then some simple stability applications follow. After, this course goes to the introduction of an important class of circuitry – active filters in Part 2. Part 3 of this course is devoted to some advanced analog circuits with the special emphasis on oscillator. Finally, the output stages and power amplifiers will be discussed in Part 4. Besides, some experiments are provided to help students to have a thorough grasp of the above discussion.		
Topics Covered	1. Feedback network 2. Filters and tuned amplifiers 3. Signal generators and waveform-shaping circuits 4. Output stages and power amplifiers		
Course Objectives	1. To introduce to students the different configurations of feedback systems and their analysis in analog circuits. [a, b, c, e, k] 2. To provide the student insight of fundamental knowledge about active filters and tuned amplifiers. Filter classification and their corresponding specifications are also introduced. [a, b, c, e, k] 3. To study the analog signal generation technique. Requirements for oscillators are discussed and different circuit configurations are also studied. [a, e, k]		

<table>
<tr><td></td><td>4. To study and compare the performance of output stages with different topologies. [a, b, e, k]</td></tr>
<tr><td>Course Assessment</td><td>Quiz: 15%
Experiments: 30%
Mid-term Exam. : 25%
Final Exam. : 30%</td></tr>
<tr><td>Relationship to Program Objectives and Outcomes</td><td>This course primarily contributes to EEE program outcomes that develop students' abilities to:
a. Ability to apply knowledge of mathematics, science and engineering.
e. Ability to identify, formulate and solve engineering problems.
k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

This course secondarily contributes to EEE program outcomes that develop students' abilities to:
b. Ability to design and conduct experiments.
c. Ability to design a system, component or process to meet desired needs.</td></tr>
<tr><td>Course Contents and Relationship to Program Criteria</td><td>
<table>
<tr><th>Week no.</th><th>Topics</th><th>Program Criteria</th></tr>
<tr><td>4</td><td>Feedback
Network parameters; Feedback classification; A-circuit and ß-circuit; Stability.</td><td>BS, ES, CS</td></tr>
<tr><td>4</td><td>Filters and Tuned Amplifiers
Filter specification; Frequency response; Butterworth and Chebyshev filters; Magnitude-squared function; Second-order filter function; Inductor replacement; Biquad using Two-Integrator-Loop structure; Single-Amplifier Biquad; Switched-Capacitor Filter.</td><td>ES, CS</td></tr>
<tr><td>3</td><td>Signal Generators and Waveform-Shaping Circuits
Phase/Magnitude conditions; Wien-Bridge oscillator; LC-tuned oscillator; Derivation of oscillating frequency and condition of oscillation.</td><td>BS, ES, CS</td></tr>
<tr><td>3</td><td>Output Stages and Power Amplifiers
Power Amplifier vs. Signal Amplifier; Power calculation; Class A, Class B and Class AB amplifiers; Power conversion efficiency; Cross over distortion elimination; Compound devices for output stage; Darlington Circuit.</td><td>ES</td></tr>
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<tr><td>Contribution of Course to meet the professional component</td><td>This course provides fundamental knowledge in electronic aspects. Different types of circuitries/components are introduced as so to complete the theory on analog circuit design.</td></tr>
<tr><td>Course Instructor(s)</td><td>Prof. Tam Kam Weng</td></tr>
<tr><td>Prepared by</td><td>Prof. Tam Kam Weng</td></tr>
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Part B: General Course Information and Policies

Instructor: Prof. Tam Kam Weng Office: N323
Office Hour: By appointment Ext.: 4373
E-mail: kentam@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 electronics 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**
Applied Electronics III	1	3	2	1

Remark:

- Objective for "Problem Solving" can be achieved by assignments, quizzes, mid-term exam and final exam.
- Objective for "Leadership and Communication" can be achieved by experiments. However, leadership training is not given by this course.
- Objective for "Market Acceptance" can be achieved as this course provides fundamental knowledge in electronics.
- 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 and computer simulation.

Program Criteria Policy:

Course VS Program Criteria
Scale: 5 (Highest) to 1 (Lower)

Course	PS	DIC	BS	CS	ES	DE	LA	CV	DM
Applied Electronics III			3	2	5				

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)

Program Outcome Policy:

Course VS Course Outcomes

(H= Highly Related, S = Supportive, N = None)

Course	a	b	c	d	e	f	g	h	i	j	k	l
Applied Electronics III	H	S	S	N	H	N	N	N	N	N	H	N

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solution in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an 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

Curriculum Detail

ELEC321 Applied Electronics III

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	1.2	0.8	14	70	2/5 hours	100	100

Term: 5th

Hours			Percentage content of					
Lecturer	Lab/tut	Other	Maths	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementa Studies	Computer Studies
42	12/16	0	20	10	30	30	0	10

Design Elements

% of Design Content	Design Content in Course Work	Design Project	Design Content in Laboratories
30%	X	0	X

Course Assessment Policy:

Course notes, tutorial notes, tips of weekly study and class news are posted on the course web according to the course progress. Assignments will be given to students according to the course progress, and, selected assignments' answers will be posted onto course web accordingly in addition to the weekly tutorial classes;

- 4 quizzes will be given and only the best 3 are counted;
- 3 experiments will be performed. 2 students form a group and individual reports should be submitted.
- A 2-hours mid-term exam and a 3-hours final exam will be required respectively.