

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

**Part A: Course Outline**

Course Title:	Telecommunications		
Course Code:	ELEC 361	Year of Study:	3
Course Mode:	Theoretical with substantial laboratory/ practice content		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	ELEC 261		
Prerequisite Knowledge	Signals & Systems + Probability		
Class/Laboratory Schedule:	3-hours lecture, 1.5-hours tutorial/lab work per week		
Duration	One semester	Credit Units	3.5
Text Books and References:	<p>[1] A. B. Carlson and P. B. Crilly, “Communication Systems”, 5<sup>th</sup> Ed. McGraw-Hill@2010</p> <p>[2] J. G. Proakis, “Digital Communications”, 4<sup>th</sup> Ed., McGraw-Hill</p> <p>[3] F. G. Stremler, “Introduction to Communication Systems”, Addison-Wesley</p> <p>[4] A. Bateman, “Digital Communications: design for the Real World”, Prentice-Hall</p> <p>[5] R. E. Ziemer and W. H. Tranter, “Principles of Communications” , Wiley</p>		
Course Description:	<p>Telecommunications has influenced the world since last century. The course is an introduction to <b><u>elementary concepts and principles</u></b> on the selected topics of Telecommunications from <i>an ECE point of view</i>. It provides basic knowledge to analysis and design of a communication system. Several key concepts, such as signal, noise, analog and digital modulation/demodulation are introduced.</p>		
Topics Covered	<ol style="list-style-type: none"> <li>1. Introduction of communications</li> <li>2. Signals: its spectra, transmission and filtering</li> <li>3. Linear and angle continuous wave (CW) modulations</li> <li>4. Sampling &amp; pulse modulation + Multiplexing techniques</li> <li>5. Noise in communication systems</li> <li>6. Analog communication systems</li> <li>7. Digital communication systems</li> <li>8. Channel coding and digital modulation</li> </ol>		
Course Objectives:	<ol style="list-style-type: none"> <li>1. To introduce to students the theory and applications of telecommunication systems [a, e, k]</li> <li>2. To prepare students to know the main components of communication systems and their corresponding characteristics/functions [a, b, e]</li> </ol>		
Course Assessment:	<p>Assignments: 15%, Simulation Projects and Experiments: 15%</p>		

	Mid-term Exam. : 20% Final Exam. : 50%																					
Relationship to Program Objectives and Outcomes	<p>This course primarily contributes to ECE program outcomes that develop students abilities to:</p> <ul style="list-style-type: none"> <li>a. Ability to apply knowledge of mathematics, science and engineering.</li> <li>c. Ability to design a system, component or process to meet desired needs.</li> <li>e. Ability to identify, formulate and solve engineering problems.</li> </ul> <p>.</p> <p>This course secondarily contributes to ECE program outcomes that develop students abilities to:</p> <ul style="list-style-type: none"> <li>b. Ability to design and conduct experiments.</li> <li>k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.</li> <li>d. Ability to function on multidisciplinary teams.</li> </ul>																					
Course Contents and Relationship to Program Criteria:	<table border="1"> <thead> <tr> <th>Week no.</th> <th>Topics</th> <th>Program Criteria</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><b>Introduction</b> Overview of communications</td> <td>ES, BS,</td> </tr> <tr> <td>3</td> <td><b>Signals: its spectra, transmission and filtering</b> Fourier transform, time and frequency relations, signal distortion in transmission, correlation and spectral density</td> <td>DIC, ES, CS, PS</td> </tr> <tr> <td>4</td> <td><b>Linear and angle CW modulation + Analog communication systems</b> Bandpass signal &amp; systems, various AM and FM techniques, frequency conversion, super-heterodyne techniques</td> <td>ES, CS, DE</td> </tr> <tr> <td>2</td> <td><b>Sampling and pulse modulation + Multiplexing techniques</b> Sampling theory, quantization, FDMA, TDMA, CDMA, SDMA</td> <td>ES, CS,</td> </tr> <tr> <td>1</td> <td><b>Noise in Communication systems</b> Random variables, System noise calculations</td> <td>ES, CV, PS</td> </tr> <tr> <td>3</td> <td><b>Digital communications + Channel coding + Digital modulation</b> Error detection and correction, linear block codes, convolutional codes, ASK, PSK, FSK, QAM</td> <td>LA, CV, PS</td> </tr> </tbody> </table>	Week no.	Topics	Program Criteria	1	<b>Introduction</b> Overview of communications	ES, BS,	3	<b>Signals: its spectra, transmission and filtering</b> Fourier transform, time and frequency relations, signal distortion in transmission, correlation and spectral density	DIC, ES, CS, PS	4	<b>Linear and angle CW modulation + Analog communication systems</b> Bandpass signal & systems, various AM and FM techniques, frequency conversion, super-heterodyne techniques	ES, CS, DE	2	<b>Sampling and pulse modulation + Multiplexing techniques</b> Sampling theory, quantization, FDMA, TDMA, CDMA, SDMA	ES, CS,	1	<b>Noise in Communication systems</b> Random variables, System noise calculations	ES, CV, PS	3	<b>Digital communications + Channel coding + Digital modulation</b> Error detection and correction, linear block codes, convolutional codes, ASK, PSK, FSK, QAM	LA, CV, PS
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Contribution of Course to meet the professional component:	This course prepares students to work professionally in the area of Telecommunications related fields. Students should be able to apply knowledge of mathematics and engineering, and identify formulas to solve engineering problems.																					
Course Instructor(s):	Dr. Ma, Shaodan, et al.																					
Prepared by:	Dr. Ma, Shaodan																					

## **Part B: General Course Information and Policies**

Instructor: Dr. Ma, Shaodan

Office: B1-A703

Office Hour: Monday 2:00-4:00 p.m. or by appointment Phone: 8470

E-mail: [shaodanma@umac.mo](mailto:shaodanma@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 possess the abilities 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)

	<b>Problem Solving</b>	<b>Leadership and Communication</b>	<b>Market Acceptance</b>	<b>Technical Competence</b>
Telecommunications	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 and presentation. However, leadership training is not given by this course.
- Objective for “Market Acceptance” can be achieved by the course subject that is related to telecommunication systems.
- 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: 1 (Highest) to 4 (Lowest)

Course	PS	DIC	BS	CS	ES	DE	LA	CV	DM
Telecommunications	1	2	2	3	1	4	2	2	

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
Telecommunications	H	S	H	S	H	N	S	S	N	S	H	S

The electrical and computer engineering program outcomes are:

- a. Ability to apply knowledge of mathematics, science and engineering.
- b. Ability to design and conduct experiments.
- c. Ability to design a system, component or process to meet desired needs.
- d. Ability to function on multidisciplinary teams.
- e. Ability to identify, formulate and solve engineering problems.
- f. Understanding of professional and ethical responsibility.
- g. Ability to communicate effectively.
- h. Broad education necessary to understand the impact of engineering solutions in global and societal context.
- i. Recognition of the need for and an ability to engage in life-long learning.
- j. Knowledge of contemporary issues.
- 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

## Curriculum Detail

### ELEC 361 Telecommunications

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	0.5	1	14	63	2/4 hours	70	30

**Term:** 5<sup>th</sup>

Hours			Percentage content of					
Lecture	Lab/tut	Other	Maths	Basic Science	Engineering Science	Engineering Design and Synthesis	Complementary Studies	Computer Studies
42	14/7	0	20	10	30	30	0	10

### Design Elements

% of Design Content	Design Content in Course Work	Design Project	Design Content in Laboratories
35%	X	0	X

### Course Assessment Policy:

- Assignments will be given to students according to the course progress. No late submission of homework is accepted. Zero mark will be given when homework is copied.
- A number of pop quizzes may be held during the semester.
- Some experiments will be performed during the semester. Two students form one group and group report should be handed in.
- Commercial software shall be used in simulations.
- One mid-term exam and one final exam will be performed with 1.5 hours and 2.5 hours respectively.