COME372 –Antennas & Propagation I

Curricular Area	**Electrical Engineering/ Communication Section**	
Type of Course	Mandatory – Major	
Catalogue Description	Review of Maxwell's equations. Plane wave in material media. Polarization. Pointing vector. Reflection and transmission of waves. Normal and oblique incidence. Propagation of electromagnetic waves in the atmosphere. High frequency transmission lines. Matching techniques. Smith chart. Rectangular and cylindrical waveguides. Cavity resonators. Antennas parameters, radiation potentials. linear antennas (elementary dipole, short dipole, linear dipole), antenna arrays, loop antenna, traveling wave antenna, helical antenna, Yagi antenna.	
Prerequisites by Courses	POWE 271: Electromagnetic Fundamentals	
Prerequisites by Topics	Maxwell's Equations, Potential Functions, Time-Harmonic Fields	
Instructors	Dr. Hamza Issa Office: Faculty of engineering - Debbieh Email: h.issa@bau.edu.lb Phone: BAU Debbieh ext: 3403	
Office Hours	M: 14:00-16:00, T: 10:00-11:00, W: 15:00-16:00, F: 10:00-12:00	
Load	4 credits; 4 Lecture-sessions/week – 50 min per session. Monday and Wednesday 08h00-10h00. Room: B225	
Textbook	• David K. Cheng, "Fields and Waves Electromagnetics", Addison Wesley, 2nd edition, 1989. • C. A. Balanis, "Antenna Theory, Analysis & Design", John Wiley & Sons, 3rd edition, 1996.	
Topics	*Subjects covered*	*50 min. lectures* (weeks)
	Wave equation	4 (1,2)
	Plane waves in material media	4 (2,3)
	Polarization	4 (3)
	Reflection and transmission of waves	4 (4,5)
	Propagation of electromagnetic waves	4 (5,6)
	Test 1 Transmission lines (types, equivalent circuit, primary parameters, secondary parameters, standing wave ratio, matching, Smith chart)	4 (7,8,9)
	Transmission lines (Smith Chart and matching technique)	(10)
	Transmission lines (Smith Chart and matching technique) Two-parallel wire, coaxial (geometry, characteristic impedance, propagation constant)	4 (10)

	Test 2, Rectangular waveguides (high power transmission, cutoff frequencies, propagating modes)	4 (11, 12)
	Circular waveguides and cavity resonators	4 (12)
	Radiation potentials and antennas parameters	4 (13)
	Antenna parameters	4 (13)
	Test 3, Dipoles antennas	4 (14)
	Antenna arrays	4 (14, 15)
	Loop traveling wave, helical antennas and Yagi antenna	4 (15)
	Total	60

At the end of this course, the students should be able to:

Learning Outcomes **Correlation with**	**Program Outcomes**	**Program Objectives**
Explain the physical meaning of Maxwell's equations and obtain the wave equation from these relations	A	1, 2
Determine the principal parameters of electromagnetic wave (impedance, velocity and propagation constant) in different media	A, D	1, 2
Explain the concept of wave polarization and identify the different types	A, D	1, 2
Identify the different propagation media (dielectric lossless, lossy or perfect conductor)	A, C, D	1, 2
Determine the reflection and transmission coefficients between two media in case of normal and oblique incidence	A, D	1, 2
Explain the propagation phenomena in the atmosphere according to the signal frequency	A, C	1, 2
Distinguish the different types of transmission lines according to the used frequency and applications	A, D	1, 2
Describe the equivalent circuit of a transmission line and determine the primary parameters as well as the secondary ones (R, L, G and C) (α, β and Zc)	A, D	1, 2
Determine the power reflection and transmission coefficients, standing wave ratio for transmission lines circuits	A, D	1, 2
Explain and analyze the different matching technique using Smith chart	A, D	1, 2
Simulate high frequency transmission line circuits using modern appropriate software tools	E, G, I	1, 2, 3
Describe the geometry and determine the characteristic impedance and the propagation constant of two parallel wire and coaxial line	A, D	1, 2
Identify the waveguides as high power transmission lines in microwave frequency ranges, determine the cutoff frequencies of the	A, D	1, 2

propagating modes according to the guide dimensions		
Explain and analyze the propagation phenomena in rectangular and circular waveguides as well as for cavity resonators	A, D	1, 2
Apply appropriate theories, principles, and concepts relevant to antennas	A, D	1, 2
Name major types of antennas and their applications	D, E	1, 2
Identify different antennas parameters and explain the physical meaning of each one	D, E	1, 2
Identify, formulate and evaluate engineering problems in high frequency communication systems	D, E, I	1, 2
Illustrate the principle of antenna arrays	A, D, E	1, 2
Design uniform antenna arrays for a specified radiation pattern	D, E, I	1, 2, 3, 5
Recognize the operation of dipole, loop, traveling wave, Yagi and helical antennas	D, E	1, 2, 5
Cultivate a professional attitude and develop skills relation to communication, teamwork, project planning and management, and responsibility for individual learning	A, C	4

Learning Outcomes Assessment Tools	**Exams**	**HW s**	**Lab Reports**	**Project**	**Course Survey**
Maxwell's equations and wave equation	☒	☒			☒
impedance, velocity and propagation constant	☒	☒			☒
Wave polarization	☒	☒			☒
Dielectric lossless, Lossy or Perfect conductor	☒	☒			☒
Reflection and Transmission	☒	☒			☒
Explain the propagation phenomena in the atmosphere according to the signal frequency	☒	☒			☒
Distinguish the different types of transmission lines according to the used frequency and applications	☒	☒			☒
transmission line primary parameters and secondary ones	☒	☒			☒
Determine the power reflection and transmission coefficients, standing wave ratio for transmission lines circuits	☒	☒			☒
Smith chart	☒	☒			☒
Two parallel wire and coaxial line	☒	☒			☒
Operation of dipole	☒	☒			☒
Different types of Antennas	☒	☒			☒
Cultivate a professional attitude and develop skills relation to communication, teamwork, project planning and management, and responsibility for individual learning					

Assessment:

3-1 Assessment type

Assessment Methods	Assessment skills	Average weight
Closed-book examinations	knowledge base and intellectual qualities	90%
Assignments submissions (problem set)	intellectual qualities and professional skills	10%
Total	Total	100%

3-2 Assessment Schedule and Weighing

Assessment:	Dates	Weighing
Quiz 1+ Drop quizzes + Assignments	1st– 7th Week Quiz 1: 23/04/2016	12.5%+12.5%+5% =30%
Quiz 2+ Drop quizzes + Assignments	8th – 12th Week Quiz 2: 27/04/2016	7.5%+7.5%+5% =20%
Quiz 3+ Assignments	11th Week – 15th week Quiz 3 18/05/2016	5%+2.5%+2.5% =10%
Final Exam	TBS	40%
Total		100%

Vacations

Date	Remarks	Substitution
07,09/04/2015	Easter vacation	Extending other lectures

Attendance:

As set by BAU regulations, and specified in Student Manual, students who miss more than 20% of the sessions of any course excluding the first week of the semester will be withdrawn from the course with and will get a grade of "WF". The first attendance warning is issued after 10% absence. The second sued when the absence percentage becomes 15%. The course is withdrawn when the percentage reaches 20%. The "WF" grade is not taken into account in the calculation of the SGPA.

Course Coordinator	Dr. Hamza Issa

January 2016