52. Course Specification of Communication Systems

I. Course Identification and General Information:

1.	Course Title:	Communication Systems				
2.	Course Code & Number:	CNE429				
3.	Credit hours:	C.H				Total
		Th.	Tu.	Pr.	Tr.	
		2	-	2	-	3
4.	Study level/ semester at which this course is offered:	Fifth year / Second semester				
5.	Pre –requisite (if any):	Digital Communications (CNE323)				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	Communication Engineering and Networks				
8.	Language of teaching the course:	English				
9.	Location of teaching the course:	Electrical Engineering Department				
10.	Prepared By:	Asst. Prof. Dr. Ali Nagi Nosary				
11.	Date of Approval					

II. Course Description:

This course consists of three main parts. The first part examines satellite telecommunication systems with an emphasis on modern systems. Topics include a historical perspective, orbital mechanics and constellations, choice of orbital parameters, propagation considerations, link budgets, interference issues and other obstacles. It also explains Earth stations optimization in addition to modulation, multiplexing and multiple-access techniques.

The second part provides an overview on radars including physical principles, system components, the processing chain and typical applications, target detection and the radar equation. Moreover, it covers main radar concepts such as ambiguities, Doppler shift, and radar cross section. Many types of radar systems will be introduced including FMCW radars, Pulsed radars, Antennas and phased arrays, and imaging radars (SAR).

The third part provides an overview on TV systems.

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	III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a1	Define both Satellite communication systems and radar systems regarding design, components, and parameters.	A2
b1	Design a simple satellite communication system or a basic radar system.	B1
c1	Design link power budget for satellites.	C2
c2	Install satellite's small earth stations for services such as VSAT.	C3
d1	Conduct a good researches of modern types of communication systems after being familiar with the principles of basic communication systems.	D5

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Define both Satellite communication systems and radar systems regarding design, components, and parameters.	▪ Lectures ▪ Cooperative Learning ▪ Practical Training ▪ Interactive Class Discussion	▪ Homework, ▪ Project, ▪ Mid and Final Exams

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Design a simple satellite communication system or a basic radar system.	▪ Lectures ▪ Cooperative Learning ▪ Practical Training ▪ Interactive Class Discussion	▪ Homework, ▪ Project, ▪ Mid and Final Exams

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© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Design link power budget for satellites.	▪ Lectures ▪ Cooperative Learning ▪ Practical Training ▪ Interactive Class Discussion	▪ Homework, ▪ Project, ▪ Mid and Final Exams
c2- Install satellite's small earth stations for services such as VSAT.	▪ Practical Training	▪ Training Report

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Conduct a good research of modern types of communication systems after being familiar with the principles of basic communication systems.	▪ Lectures ▪ Cooperative Learning ▪ Practical Training ▪ Class Discussion ▪ Project	▪ Project

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Satellite communication	a1, b1, c1, d1	▪ Introduction ▪ Basics ▪ Applications of Satellites ▪ Frequency Allocation of Satellites ▪ Types of Orbits	1	2

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2.	Orbits and lunching methods	a1, b1, c1, d1	▪ Introduction ▪ Kepler‟s Laws ▪ Orbital Elements	1	2
3.	Geostationary orbit	a1, b1, c1, d1	▪ Introduction ▪ Antenna Look Angles ▪ Sun Transit Orbit	1	2
4.	Space segment	a1, b1, c1, d1	▪ Introduction ▪ The Power Supply ▪ Attitude Control ▪ Station Keeping ▪ Thermal Control ▪ TT&C Subsystem ▪ Transponders ▪ The Antenna Subsystem	1	2
5.	Earth segment	a1, b1, c1, d1	▪ Introduction ▪ Receive-Only Home TV Systems ▪ Transmit-Receive Earth Stations	1	2
6.	Satellite Systems	a1, b1, c1, d1	▪ Thuraya ▪ Iridium ▪ GPS	1	2
8.	Introduction to Radar systems	a1, b1, d1	▪ Introduction ▪ Radar Applications ▪ Basic Principles ▪ Modulation Types ▪ Radar Generic System ▪ Radar Antennas ▪ Basic Radar Types ▪ Pulse Transmission ▪ Continuous Wave	1	2
9.	Radar Fundamentals	a1, b1, d1	▪ Range, Range Resolution ▪ Doppler Frequency ▪ Coherence	2	4

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			▪ Radar Equation ▪ Radar Cross Section (RCS)		
10.	Tracking Radar	a1, b1, d1	▪ Tracking with radar ▪ Mono-pulse tracking ▪ Conical scan and sequential lobing ▪ Tracking accuracy limitations ▪ Low angle tracking ▪ Tracking in range ▪ Comparison of trackers	2	4
10.	TV. Systems	a1, b1, d1	▪ Introduction ▪ TV signals ▪ Signal Values ▪ Signal Domain, Standardization ▪ Timing and synchronization ▪ TV audio ▪ Coding ▪ Multiplex and signaling	3	6
Number of Weeks /and Units Per Semester				**14**	**28**

B – Tutorial Aspect:				
Order	**Topics**	**Number of Weeks**	**Contact hours**	**Learning Outcomes**
1.	Frequency Allocation of Satellites and Types of Orbits	1	2	a1, b1, c1, d1
2.	Orbiting and lunching	1	2	a1, b1, c1, d1
3.	Geostationary orbit and Antenna Look Angles	1	2	a1, b1, c1, d1
4.	Space segment related problems	1	2	a1, b1, c1, d1
5.	Earth Segment	1	2	a1, b1, c1, d1
6.	Satellite Systems	1	2	a1, b1, c1, d1
6.	Basic Principles of radar, Modulation Types, Radar Generic System, Radar Antennas, and Pulse Transmission	1	2	a1, b1, d1
7.	Range, Range Resolution, Doppler Frequency, Coherence, Radar Equation and Radar Cross Section (RCS)	2	4	a1, b1, d1
8.	Radar tracking	2	4	a1, b1, d1
9.	TV signals	1	2	a1, b1, d1
10.	TV coding	1	2	a1, b1, d1
11.	TV multiplexing	1	2	a1, b1, d1
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course:

- Lectures
- Cooperative Learning
- Practical Training
- Class Discussion
- Project

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VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Problems Sheet #1	a1, b1, c1	2	1.5
2.	Problems Sheet #2	a1, b1, c1	4	1.5
3.	Problems Sheet #3	a1, b1, c1	6	1.5
4.	Problems Sheet #4	a1, b1, c1	8	1.5
5.	Training Report	a1, b1, c.2,	10	16.5
	Total			**22.5**

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Midterm Exam	7th	22.5	15%	a1, b1, c1
2.	Assignments and Report	12th	22.5	15%	a1, b1, c1, c.2
3.	Project	12th	15	10%	a1, d1
4.	Final Exam	16th	90	60%	a1, b1, c1
	Total		**150**	**100%**	

VIII. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Dennis Roddy – 2006 - Satellite Communications, Fourth edition, India, Mcgraw-Hill
2. M.A. Richards, J.A. Scheer, W.A. Holm – 2010 –Principles of Modern Radar: Basic Principles

2- Essential References.

1. Shree Krishna Sharma, Symeon Chatzinotas and Pantelis-Daniel Arapoglou, Satellite Communications in the 5G Era, The Institution of Engineering and Technology, London, United Kingdom, 2018

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	2. Gerard Maral and Michel Bousquet, Satellite Communications Systems, fifth edition, Wiley, 2009
3- Electronic Materials and Web Sites etc.	
	1. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/ 2. https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems-spring-2007/

IX. Course Policies:

1.	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic
2.	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam-
4.	**Assignments & Projects:** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time-
5.	**Cheating:** For cheating in exam, a student will be considered as failure. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty-
6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination.

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	Lecture notes and assignments my given directly to students using soft or hard copy

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Asst. Prof. Dr. Nasser H. Almofari**
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