Program Specification

For

Doctor of Philosophy Degree

in

Electronics and Communications Engineering

Program Specification
For
Doctor of Philosophy Degree in
Electronics and Communications Engineering

A- Basic Information:

1- Program title: Ph.D in Electronics and Communications Engineering.

2- Program type: **Single** [√] **Double** [ ] **Multiple** [ ]

3- Department (s): Electrical Engineering (Electronics and Communications Engineering Section).

4- Assistance Coordinator: Assist. Prof. Dr. Saly Saad Hassaneen

5- Coordinator: The Head of the Department

6- External evaluator(s): Prof. Dr. Ebrahim Abdel-Ghaffar Badran

7- Last date of program specifications approval: 2020 (Bylaw 2000).

B- Professional Information:

1- Introduction:

Electronics and Communications Engineering is constantly widening its scope in every field of engineering. The prime work of the Electronics and Communication engineer is to design, fabricate, produce, test and supervise the manufacturing of electronic and communication products for various industries. This postgraduate Ph.D. program in Electronics and Communications Engineering transforms graduate engineers to high-quality technical professionals and research scholars who can meet the requisite requirement of educational institutes, R&D organizations, and electronics and communication industry. Also, for the post graduate student who works as an assistant teacher to be professional in doing researches in various fields of Electronics and Communications Engineering and to develop of methods, tools and new techniques of professional practice. The program is focused in emerging fields of semiconductor devices and materials, integrated electronic circuits, communications, signal processing, microwave, wave propagation, and antenna, and optoelectronics, as well as the quantum physics, mathematics, and computing knowledge required to acquire this advanced knowledge. Also, this program is to produce a well-rounded and well-balanced graduate who can use Electronics and Communication Engineering tools to solve real world problems.

2- Graduate Attributes :

After completing the program the graduate would able to be:

A. Proficiency in the application of the basics and the methodologies of scientific research and the use of its different tools to serve professional practice in the field of Electronics and Communications Engineering.
B. Apply the analytical approach and using it in the field of electronics and communication engineering, as well as the topics that affect his/her professional practice.
C. Apply the specialized knowledge integrated with and the use of appropriate engineering tools, such as, computational facilities, laboratory equipment, necessary for his / her professional practice and project management.
D. Specialized engineering concepts related to his / her professional practice in the field of Electronics and Communications Engineering.
E. Show awareness of current problems and modern visions in in the field of Electronics and Communications Engineering.
F. Identify professional problems and find solutions for it.
G. Mastery of an appropriate range of specialized professional and intellectualskills and the use of appropriate technology means to carry out a research study, writing a scientific methodology plain. add new information to the knowledge and write scientific paper.
H. Communicate effectively and lead team works effectively.
I. Take good decisions in different professional contexts.
J. Employ available resources to achieve and maintain the highest benefit.
K. Show awareness of his / her role in community development and environmental conservation in the light of the global and regional variables.
L. Display professional responsibilities and ethical, societal and cultural concerns.
M. Recognize the need to engage to develop him / her academically and being able to learn continuously in the field of Electronics and Communications Engineering.
N. Orientation to develop of methods, tools and new techniques of professional practice.
O. Use of appropriate technology to serve professional applications.

3- Program Aims:

The graduate of the Master program must be able to:

1. Gain a depth of knowledge, understanding and methodologies of scientific research including professional skills, pertinent software and appropriate technological means to make decisions, employ available resources efficiently, develop new skills to deal with a high level complex problems, and engage in continuous learning practice in the field of electronics and communication engineering.
2. Demonstrate sufficient essential knowledge and a deep understanding of concepts, theories, and practice in the field of electronics and communication engineering, as well as the topics that affect his/her professional practice.
3. Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing electronics and communications engineering problems.
4. Communicate and lead team works effectively through professional system considering the detrimental impact of the engineer role on society, environment, societal and cultural concerns.
5. Demonstrate knowledge of contemporary, current, and advanced engineering issues related to electronics and communications engineering problems.

6. Adopt basics and principles of quality and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.
7. Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.
8. Develop of methods, tools and new techniques of professional practice and use of appropriate technology to serve professional applications.

4- Graduate Attributes with Program Aims

Program Aims	Graduates Attributes
1. Gain a depth of knowledge, understanding and methodologies of scientific research including professional skills, pertinent software and appropriate technological means to make decisions, employ available resources efficiently, develop new skills to deal with a high level complex problems, and engage in continuous learning practice in the field of electronics and communication engineering.	A, G, I, and K
2. Demonstrate sufficient essential knowledge and a deep understanding of concepts, theories, and practice in the field of electronics and communication engineering, as well as the topics that affect his/her professional practice.	C, D, and G
3. Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, designing, and analyze risks of the professional practicein electronics and communications engineering.	B, E, F, and G
4. Communicate and lead team works effectively through professional system considering the detrimental impact of the engineer role on society, environment, societal and cultural concerns.	H, I, J, K, and L
5. Demonstrate knowledge of contemporary, current, and advanced engineering issues related to electronics and communications engineering problems.	G, E, and M
6. Adopt basics and principles of quality and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.	L
7. Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.	G
8. Develop of methods, tools, and new techniques of professional practice and use of appropriate technology to serve professional applications.	N, O

5- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communications Engineering Ph.D Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

ILOs	Program Objective
A. Knowledge and understanding	
A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	1, 2, 5
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment	4
A4-1 Gain a depth of knowledge, understanding, and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.	6
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	6
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D. thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	3
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with complete or incomplete data) related to electronics and communications engineering.	3
B3-1 Demonstrate creative and innovative thinking in problems solving, using latest engineering techniques, skills, and tools.	3, 8
B4-1Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.	7, 8
B5-1Assess and analyze risks of the professional practice in electronics and communications engineering.	3
B6-11Plan to improve progress performance in the field of electronics and communications engineering.	5, 6, 7, 8
B7-1 Acquire decision making capabilities in different situation when facing problems related to analysis, design, and development electronics and communications systems.	1
B8-1 Perform applied research on industrial and societal concerns problems that add to the accumulated knowledge of the electronics and communications field.	1, 2, 5, 6, 7, 8
B9-1 Manage discussions on basis of evidence and proofs	4, 6
C. Professional and practical skills	

C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	1, 2, 3, 5, 7, 8
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	
C2-1 Write and evaluate a professional report related to electronics and communications technical matters.	4, 7
C3-1 Evaluate methods and tools reported in specified published articles and researches concerning specified problem related to his/her research topic in electronics and communications field.	5, 6, 7, 8
C4-1 Express competence skills to use technology to advance practice	5, 7, 8
C5-1 Plan professional development courses to improve practice and enhance performance of juniors in the field of electronics and communications.	5, 7, 8
D. General and transferrable skills	
D1-1 Express professional and communication skills effectively in different aspects.	4
D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.	1, 2, 5, 7, 8
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	1, 6
D4-1 Design standards to evaluate others performance.	4, 6
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	2, 6
D6-1Collaborate effectively within multidisciplinary team and lead teams in different professional contexts.	4
D7-1Demonstrate a high level of competence in the time management	1, 4

6- Program Academic Reference Standards (ARS):

1- The main references for standards considered in the development of this program were the Academic Reference Standards (ARS) for postgraduate programs prepared by the National Authority for Quality Assurance and Accreditation (NAQAAE) on 2009 - Supreme Council of Universities in Egypt. These general standards set out the attributes and academic characteristics that are expected to be achieved by the end of the program, **(Appendix 1)**.

2- External references standards (Benchmarks)

External reference benchmark is selected to confirm the ILOs of the program from Arab Academy for Science and Technology & Maritime Transport, College of Computing and Information Technology, Department of Computer Science, Master of Science in Computer Science Program Specification, (**Appendix 1).**

Arab Academy for Science, Technology and Maritime Transport, College of Computing and Information Technology, Abu Quir Campus
Tel.: (03)5621057, (03)5622366/88 Ext. 1610, 1615, Email: ccit_pgrad_Alex@aast.edu,
Internet Site: http://www.aast.edu/en/colleges/ccit/

https://www.google.com/url?sa=t&source=web&rct=j&url=http://www.aast.edu/en/colleges/openfiles/opencmsfiles/pdf_retreive_cms.php%3Fdisp_unit%3D345/Form%252013%2520Computer%2520Science%2520MSc.pdf&ved=2ahUKEwi8y_61hJTtAhXIQUEAHdUPCwQQFjAAegQIBRAB&usg=AOvVaw0eccgYFOr82IKN2w17IdaZ

7- Program Structure and Contents:

7.1 Program Duration minimum of 3 years & a maximum of 5 years (including one year of preparatory courses)

7.2Program Structure: Awarding a Ph. D. degree in Electronics and Communication Engineering required the study of courses amounting to 12 hours weekly for one academic year. This 12 hours constitute specialized courses are selected by the supervision team and approved by the department council. These courses are chosen from among the 600 – level and are directly related to the topic of his research. Also, required for awarding the Ph. D. Degree in Electronics and Communication Engineering is the execution of scientific research that terminated by writing a thesis containing the research results and its complete analysis and defending it successfully. More details can be found in postgraduate bylaw 2000.

7.3 Program Contents (Courses):

- **Specialized Requirements Courses*:**

Course Code	Course Title	Course Hours/Week	Marks Written Exam
ECE 600	Electronics Materials	3	100
ECE 601	Digital Signal Processing Applications	3	100
ECE 602	Satellite Communication Systems	3	100
ECE 603	Digital Communication Systems	3	100
ECE 604	Mobile Communication Systems	3	100
ECE 605	Advanced Electronics Communication Systems	3	100
ECE 606	Data Communications	3	100
ECE 607	Transmission Systems	3	100
ECE 608	Network Planning	3	100
ECE 609	Local Area Network	3	100
ECE 610	Antennas	3	100
ECE 611	Microwave Electronics	3	100
ECE 612	Planner Microwave Circuits	3	100
ECE 613	Opto – Electronic Engineering	3	100
ECE 614	Integrated Optics Engineering	3	100
ECE 615	Optical Measurements	3	100
ECE 616	Optical Wave Guide Engineering	3	100
ECE 617	Optics Engineering	3	100
ECE 618	Optical Communication Systems	3	100
ECE 619	Microwave Theory and Techniques	3	100
ECE 610	Microwave Communication Systems	3	100
ECE 621	Random Signal Analysis	3	100
ECE 622	Theory of Electronic Navigation	3	100
ECE 623	Electronic Navigation Systems	3	100

* Select only four courses related to the research topic.

8- Program Matrix:

The following table explains the ILO's (of the current program) – Course (main ILOs) matrix.

Program Matrix: ILO's (of the current program) – Course (main ILOs) matrix.

Courses Codes	ECE																							Thesis
	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	
ILOs																									
A1-1		x			x		x															x	x	x	
A1-2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
A1-3	x		x	x	x	x	x	x			x	x	x	x	x	x	x			x	x			x	x
A2-1	x		x	x	x		x				x	x	x	x	x					x	x			x	x
A4-1									x	x															x
A5-1				x								x	x	x	x	x				x	x				x
B1-1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
B2-1							x							x	x				x			x	x		x
B3-1	x		x	x	x	x	x				x	x	x	x	x	x	x			x	x		x	x	x
B4-1						x																			x
B5-1	x		x								x	x	x	x	x	x		x		x	x			x	x
B6-1		x																							x
B7-1		x																							x
B8-1								x																	x
B9-1								x																	x
C1-1	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	
C1-2		x				x			x	x						x		x				x	x		x
C2-1	x		x	x		x	x				x	x	x	x	x	x			x	x	x		x	x	x
C3-1			x													x			x					x	x
C4-1								x																	x
C5-1								x																	x
D1-1								x																	x
D2-1		x		x	x	x																x			x
D3-1	x			x		x			x	x	x	x	x	x	x	x				x	x			x	x
D4-1																						x			x
D5-1	x		x	x		x	x	x			x	x	x	x	x	x	x	x	x	x	x		x	x	x
D6-1																						x			x
D7-1																						x			x

9- Program admission requirements

The applicant to the Master of Science program in Electronics and Communications Engineering must hold a Ph. D. in Electrical Engineering (Specialized in Electronics and Communications Engineering) from a recognized university in Egypt or an equivalent degree recognized by the supreme council of universities. More details can be found in the postgraduate bylaw 2000.

10- Methods and rules of evaluating students for the preparatory year

- Written examinations for the preparatory year after 30 weeks.

11- The regulations for starting the registration of the master thesis

The student must pass all the preparatory year's courses with at least pass grade (60%) in each course and successful completion of:

- The qualifying exam in the specialization through a committee composed of five specialized professors proposed by the academic department and approved by the college council.
- The seminar and the oral discussion in the thesis research topic which accomplished in the academic department.
- More details can be found in postgraduate bylaw 2000.

12- The regulations for granting the degree of Master of Science for the student

- The student is required to do a seminar about his thesis and has to be approved by the academic department.
- The student is required to publish at least two scientific papers from the thesis in specialized journal or conference.
- The thesis is required to be approved by an examiners committee suggested by the academic department and approved by the faculty council (including at least one external examiner). The evaluation of the thesis and the discussion is carried out in an open session.
- More details can be found in postgraduate bylaw 2000.

Program Coordination Committee:

Program coordinator: **Assist. Prof. Dr. Saly Saad Hassaneen**

Head of the Department: **Prof. Dr. RawyaYehia Rizk**

Updated Date: / /2020

Appendix 1

The general Academic Reference Standard For Ph.D. Degree

1- **The Academic Reference Standards (ARS)** guidelines of March 2009 for postgraduate programs prepared by the National Authority for Quality Assurance and Accreditation (NAQAAE) on 2009 - Supreme Council of Universities in Egypt.

2- External references standards (Benchmarks)
External reference benchmark is selected from Arab Academy for Science and Technology & Maritime Transport, College of Computing and Information Technology, Department of Computer Science, Master of Science in Computer Science Program Specification.

NAQAAE Academic Reference Standards (ARS)	Bench mark	ILOs
A. Knowledge and understanding		
A1-Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	Have a knowledge & understanding of research methodology & practice.	A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.
		A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.
		A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.
A2- The knowledge related to the impact of professional practice on the Environment, and the work carried out for conservation and preservation.		A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment

A4- The moral and ethical and legal principles of professional practice in the field of specialization.	Understand moral and legal principles of professional practice in the area of specialization and identify the fundamentals of scientific research and its ethics.	A4-1 Gain a depth of knowledge, understanding, and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.
A5- Basics and principles of quality in professional practice in the field of specialization.	Outline the quality principles of professional practice in Computer Science.	A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate information in the field of specialization, and relate it to solve problems and formulate theories.		B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D. thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.
B2- Solve specialized problems with available givens and parameters.		B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with complete or incomplete data) related to electronics and communications engineering.
B3- Be creative and innovative.	Perform problem-solving in academic and industrial environments and linking different knowledge areas to solve professional problems.	B3-1 Demonstrate creative and innovative thinking in problems solving, using latest engineering techniques, skills, and tools.
B4- Write research papers.		B4-1Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.

B5- Assess and analyze risks in professional practice.		B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering.
B6- Plan for performance development in the field of practice.	Develop original ideas in a research context.	B6-1 Plan to improve progress performance in the field of electronics and communications engineering.
	Recognize the need for, and show ability for, dealing with constantly changing technology and continuing professional development.	
B7- Take professional decisions in different practical contexts.	Interpret the contents of articles and other sources, and form a critical judgment of their relative importance and relevance to an area of study.	B7-1 Acquire decision making capabilities in different situation when facing problems related to analysis, design, and development electronics and communications systems.
B8- Perform research and studies to add to the accumulated knowledge.		B8-1 Perform applied research on industrial and societal concerns problems that add to the accumulated knowledge of the electronics and communications field.
B9-Performing conversations and discussions built on the basis of evidence and proofs		B9-1 Manage discussions on basis of evidence and proofs
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	Use and implement basic and modern computing algorithms.	C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.
	Generate and apply appropriate solutions to solve problems based on reasoned rationale.	
	Develop applications to satisfy given requirements.	C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software

	Use, manipulate and develop large computational systems.	packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.
C2- Write and evaluate technical and professional reports.	Propose, plan, undertake and report a self-directed individual skills of investigation, design and implementation.	C2-1 Write and evaluate a professional report related to electronics and communications technical matters.
C3- Evaluate and development the means and tools available in the field of practice.		C3-1 Evaluate methods and tools reported in specified published articles and researches concerning specified problem related to his/her research topic in electronics and communications field.
C4- Use technology to enhance professional practice.		C4-1 Express competence skills to use technology to advance practice
C5- Plan for performance development in the field of practice and enhance performance of others		C5-1 Plan professional development courses to improve practice and enhance performance of juniors in the field of electronics and communications.
D. General and transferrable skills		
D1- Communicate effectively using all different methods		D1-1 Express professional and communication skills effectively in different aspects.
D2- Use information technology to enhance his/her professional practice		D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.
D3- Self-evaluation and continuous learning.	Long-life self-learning.	D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D4- Educating and evaluating others.		D4-1 Design standards to evaluate others performance.
D5- Use different sources to obtain		D5-1 Use different sources of information like library, internet

knowledge and information.		access facilities, etc. to upgrade and enhance their conceptual knowledge.
D6- Work as team leader as well as a member in larger teams		D6-1Collaborate effectively within multidisciplinary team and lead teams in different professional contexts.
D7- Manage scientific meetings and appropriately utilize time.		D7-1Demonstrate a high level of competence in the time management

Quality Assurance & Accreditation Unit

Courses Specification

For

Doctor of Philosophy Degree

in

Electronics and Communications Engineering

ECE 600
Electronic Materials
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Electronic Materials	**Code Symbol: ECE 600**	
Lecture	**3 Hours**	
Tutorial / Laboratory	**-**	
Total	**3 Hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in solid state engineering and electronic materials. For those students who look toward an industrial position after graduation, this course is designed to widen background in material engineering and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in a variety of different areas of solid state engineering and material science: metals, semiconductors, superconductors, optical, magnetic and amorphous materials. The course is meant to create the background needed to understand the physics of device operations and also prepare students for advanced courses in solid state and quantum electronics. General electronic materials physics and properties will be taught in the context of technological applications. Emphasis will be on Semiconductor hetero-junctions materials, dielectric materials, and magnetic materials.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to electronic materials.
2. Build advanced skills in the definition, identify, analysis, and solving of problems related to electronic materials.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications design using electronic materials.
4. Classify quantum statistics to identify/solve complex and open ended engineering problems related to electronic materials.
5. Review the basics and the methodologies of scientific research and the use of its different tools in the area of Electronic Materials.
6. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of Electronic Materials.

3- Intended Learning Outcomes (ILOs):

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Classify the electronic materials according to their physical structure and properties. a1-2-2 Recognize the energy band structure and the lattice vibration process. a1-2-3 Discuss the classical and quantum statistics of electron and hole motion in atoms and crystal. a1-2-4 Discuss the basics differences between the most common electronic materials (Dielectric , magnetic and semiconductor materials) according to their physical structure and conductivity. . a1-2-5 Explain the thermionic emission process. a1-2-6 Describe the thermal and optical effects. a1-2-7 Explain the hetro-juctions materials operation principles.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1Demonstrate knowledge of contemporary, current, and advanced topics related to electronic material and its application paradigms.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Recognize the professional aspects of electronic materials applications and their effects on the Environment.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professionalresearch practicein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to electronic materials.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to electronic materials.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for electronic materials development.

C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to electronic materials problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write a professional report on Photonic semiconductor materials.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency	d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about electronic materials types and technology.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- The material crystal structure concepts and properties	12	12	--
2- Energy band structure and lattice vibrations	12	12	--
3- Classical and quantum statistics of Electrons and Holes generation and recombination process	12	12	--
4. Dielectric and Magnetic Materials.	24	24	
5- Thermo Ionic Emission.	6	6	--
6- Thermal and Optical Effects.	6	6	--
7- Hetero-Junctions Materials.	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-2, A1-3, A2-1	B1-1, B3-1, B5-1	C1-1, C2-1	D3-1 , D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	30%	70%	-	-		100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	The material crystal structure concepts and properties	1-4
2nd	Energy band structure and lattice vibrations	5-8
3rd	Classical and quantum statistics of Electrons and Holes generation and recombination process	9-12
4th	Dielectric and Magnetic Materials	13 - 20
5th	Thermo Ionic Emission.	21-22
6th	Thermal and Optical Effects.	23-24
7th	Hetero-Junctions Materials.	25-28

8- ILOs Matrix Topics

Course ILOs	**Course topics**						
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
a1-2-1 Classify the electronic materials according to their physical structure and properties.	x						
a1-2-2 Recognize the energy band structure and the lattice vibration.		x					
a1-2-3 Discuss the classical and quantum statistics of electron and hole motion in atoms and crystal.			x				
a1-2-4 Discuss the basics differences between the most common electronic materials (Dielectric , magnetic and semiconductor materials) according to their physical structure and conductivity. .				x			
a1-2-5 Explain the thermionic emission processand the thermal and optical effects.					x		
a1-2-6 Describe the thermal and optical effects.						x	
a1-2-7 Explain the hetro-juctions materials operation principles.							x
a1-3-1Demonstrate knowledge of contemporary, current, and advanced topics related to electronic material and its application paradigms.				x	x	x	x
a2-1-1 Recognize the professional aspects of electronic materials applications and their effects on the Environment.				x	x	x	

b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to electronic materials.	x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to hetro-juctions electronic materials.							x
b5-1-1 Evaluate pros and cons of given methodologies for electronic materials development.				x			x
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to electronic materials problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x
c2-1-1 Write a professional report on Photonic semiconductor materials.						x	x
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.				x	x	x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about electronic materials types and technology.				x		x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self-learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-2-6	x				x								
	a1-2-7	x				x								
	a1-3-1	x		x					x					
	a2-1-1	x		x		x			x					
Intellectual Skills	b1-1-1					x								
	b3-1-1					x								
	b5-1-1		x	x					x	x				

Professional Skills	c1-1-1					x								
	c2-1-1		x	x					x	x				
	d3-1-1		x						x	x				
	d5-1-1		x						x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, andproblem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions - Blackboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

No lectures and Labs notes.

Essential Books (Text Books):

- Safa O. Kasap "Electronic Materials and Devices", McGraw-Hill, Second Edition, 2005.
- Rolfe E. Hummel "Electronic Properties of Materials ", Springer, Third Edition, 2004.

13- Program Coordination Committee:

Course Coordinator: **Associate Prof. Dr. Sherif M. Sharroush**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya YehiaRizk**

Updated Date: /10 /2020.

ECE 601

Digital Signal Processing Applications

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Digital Signal Processing Applications.	**Code Symbol: ECE601**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2004**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in digital signal applications . For those students who look toward an industrial position after graduation, this course is designed to widen background in digital signal processing technology and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of digital signal processing applications. The course is meant to create the deep understanding of the basics and theories behind the modern digital signal processing applications. The course is meant also to enhance the ability of the student to integrate the proper digital devices in various digital systems. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to digital signal processing applications.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to digital signal processing applications.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using digital signal processing applications.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to digital signal processing applications.
5. Identify current problems and find solutions for it using digital signal processing applications.
6. Apply the basics and the methodologies of scientific research and the use of its different tools in the area of digital signal processing applications.
7. Build specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of digital signal processing applications.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	a1-1-1.Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and appropriate to different digital signal processing applications.
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1Describe the main differences between Digital filters, adaptive filters. a1-2-2 Illustrate echo cancellers and suppressors, digital signal processing of speech. a1-2-3 Recognize digital image processing techniques. a1-2-4 Discuss the digital image processing applications to Radar. a1-2-5 Discuss the digital image processing applications to Geophysics.
B. Intellectual skills	
B1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to electronics and communications engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the digital signal processing problems.
	b1-1-2differentiate between different digital signal processing applications.
B6-1Plan to improve progress performance in the field of electronics and communications engineering.	b6-1-1 Demonstrate an ability to identify his/her need of further knowledge and to take responsibility for developing such knowledge through digital signal processing applications.
B7-1 Acquire decision making capabilities in different situation when facing problems related to analysis, design and development electronics and communications systems.	b7-1-1 Acquire decision making capabilities in different situation when facing problems related to analysis and design.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to digital signal processing problems, using latest engineering techniques, skills, and tools.
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Use a wide range of computational toolsincludingpertaining software packages to analysis and design a process, component, or system related to digital signal processing field.

D. General and transferrable skills	
D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.	d2-1-1 Use state-of-the-art computer and Internet tools for getting latest information and standards related to digital signal processing systems.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Discrete Fourier Transform, FFTZ transform.	12	12	-	--
2. Digital filters, adaptive filters.	12	12	-	--
3. Application of adaptive filter.	12	12	-	--
4. Echo cancellers and suppressors, digital signal processing of speech.	12	12	-	--
5. Digital image processing.	9	9	-	--
6. Digital image processing applications to Radar.	12	12	-	--
7. Digital signal processing in Geophysics.	15	15	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-1, A1-2	B1-1, B6-1, B7-1	C1-1, C1-2	D2-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	-	100%				100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Discrete Fourier Transform, FFTZ transform.	1-4
2nd	Digital filters, adaptive filters.	5-8
3rd	Application of adaptive filter.	9-12
4th	Echo cancellers and suppressors, digital signal processing of speech.	13-16
5th	Digital image processing.	17-19
6th	Digital image processing applications to Radar.	20-23
7th	Digital signal processing in Geophysics.	24-28

8- ILOs Matrix Topics

Course topics	1st	2nd	3rd	4th	5th	6th	7th
Course ILOs	Knowledge & Understanding						
a1-1-1.Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and appropriate to different digital signal processing applications.	x						
a1-2-1Describe the main differences between Digital filters, adaptive filters.		x	x				
a1-2-2 Illustrate echo cancellers and suppressors, digital signal processing of speech.				x			
a1-2-3 Recognize digital image processing techniques.					x		
a1-2-4 Discuss the digital image processing applications to Radar.						x	
a1-2-5 Discuss the digital image processing applications to Geophysics.							x
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the digital signal processing problems.	x	x	x	x	x	x	x
b1-1-2differentiate between different digital signal processing applications.					x	x	x
b6-1-1 Demonstrate an ability to identify his/her need of further knowledge and to take responsibility for developing such knowledge through digital signal processing applications.					x	x	x
b7-1-1 Acquire decision making capabilities in different situation when facing problems related to analysis and design.					x	x	x
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to digital signal processing problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x

c1-2-1 Use a wide range of computational toolsincludingpertaining software packages to analysis and design a process, component, or system related to digital signal processing field.					x	x	x
d2-1-1 Use state-of-the-art computer and Internet tools for getting latest information and standards related to digital signal processing systems.	x	x	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	x				x								
	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
Intellectual Skills	b1-1-1					x								
	b-1-2	x		x										
	b6-1-1	x		x										
	b7-1-1	x		x										
Professional Skills	c1-1-1			x		x								
	c1-2-1												x	
General Skills	d2-1-1								x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

9.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions - Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. Computer laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using digital systems simulators on general computer labs during the lectures.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of refrences:

- Amy Mar, "Digital Signal Processing Applications,"Prentice Hall, **1990.**
- **J. G. Proakis and D. G. Manolakis, Digital Signal Processing, 3/e, PHI, 2000**
- **A. V. Oppenheim and R. W. Schafer, Discrete-Time Signal Processing, 3rd Edition, |Pearson, 2010.**
- IEEE Standards.

13- Program Coordination Committee:

Course Coordinator:	**Dr. Heba Y. Soliman**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: /10 /2020.

ECE 602

Satellite Communication Systems

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Satellite Communication Systems	**Code Symbol: ECE 602**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2004**

B- Professional Information

1- Course Aims:

This course aims at providing students with the basic knowledge and understanding of satellite communication systems, and with the principles of satellite spacecraft subsystems, satellite orbits, satellite link models, and multiple access arrangements.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to electronic materials.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to electronic materials.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications design using electronic materials.
4. Classify quantum statistics to identify/solve complex and open ended engineering problems related to electronic materials.
5. Identify current problems and find solutions for it in the area of Electronic Materials.
6. Compare the methodologies of scientific research and the use of its different tools in the area of Electronic Materials.
7. Build specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of Electronic Materials.

3- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communication Engineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Recognize components of satellite communication systems a1-2-2 Classify satellite orbits a1-2-3 Discuss and explain link models.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the applications of satellite communication systems. a1-3-2 Report new advances in analysis and design methodologies in satellite systems, and their historical development.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a2-1-1 Report and recognize the various aspects of satellite communication systems and their effects on the Environment.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional researchpractice in Electronics and Communication Engineering .	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to satellite communications.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve satellite link budget analysis problems.
B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering.	b5-1-1 Evaluate pros and cons of different satellite orbital patterns. b5-1-2 Evaluate pros and cons of different multi access techniques.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to satellite communication systems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional	c2-1-1 Write a professional report on satellite

technical report pertaining to electronics and communications technical matters.	orbital patterns.
C3-1 Evaluate methods and tools reported in specified published articles and researches concerning specified problem related to his/her research topic in electronics and communications field.	c3-1-1 Evaluate the use of multiple access techniques in satellite communications.
D. General and transferrable skills	
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about satellite communications.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Satellite systems configurations	6	6	--
2- Link Calculations	12	12	--
3- Orbiting Satellites	6	6	--
4- Signal Processing and Multiplexing	12	12	--
5- Terrestrial interface systems	12	12	--
6- Multiple Access	24	24	--
7- Earth station	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	**Intellectual Skills**	**Professional Skills**	**General Skills**
Program Academic Standards that the course contributes in achieving.	A1-2, A1-3, A2-1	B1-1, B3-1 B5-1	C1-1, C2-1 C3-1	D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	30%	70%	-	-		100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	1- Satellite systems configurations	**1-2**
2nd	2- Link Calculations	**3-6**
3rd	3- Orbiting Satellites	**7-8**
4th	4- Signal Processing and Multiplexing	**9-12**
5th	5- Terrestrial interface systems	**13-16**
6th	6- Multiple Access	**17-24**
7th	7- Earth station	**25-28**

8- ILOs Matrix Topics

Course topics	**Course topics**						
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
a1-2-1 Recognize components of satellite communication systems	x						
a1-2-2 Classify satellite orbits			x				
a1-2-3 Discuss and explain link models.		x					
a2-1-1 Report and recognize the various aspects of satellite communication systems and their effects on the Environment.	x						
a1-3-1 Classify the applications of satellite communication systems.			x				
a1-3-2 Report new advances in analysis and design methodologies in satellite systems, and their historical development.	x		x			x	
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to satellite communications.	x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve satellite link budget analysis problems.		x	x	x	x	x	x

b5-1-1 Evaluate pros and cons of different satellite orbital patterns. b5-1-2 Evaluate pros and cons of different multi access techniques.		x	x			x	
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to satellite communication systems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x
c2-1-1 Write a professional report on satellite orbital patterns.	x	x	x	x	x	x	x
c3-1-1 Evaluate the use of multiple access techniques in satellite communications.						x	
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about satellite communications.				x	x	x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-2-1	x		x		x								
	a1-2-2	x		x		x								
	a1-2-3	x		x		x								
	a2-1-1	x		x		x								
	a1-3-1	x		x		x								
	a1-3-2	x		x		x								
Intellectual Skills	b1-1-1		x											
	b3-1-1		x											
	b5-1-1		x	x					x					
	b5-1-2								x					
Professional Skills	c1-1-1		x											
	c2-1-1		x	x					x					
	c3-1-1									x				
General Skills	d5-1-1								x					

10- Assessment

10.1 Assessment Methods

Final Written Examination	:	to assess students' knowledge, understanding, analysis, creativity, problem solving, andproblem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions- Blackboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

No lectures and Labs notes.

Essential Books (Text Books):

1. **Wayne Tomassi, "Advanced Electronic Communications Systems," Pearson, 6thEdition, 2014.**
2. **Timothy Pratt, and Charles Bostian "Satellite Communications," John Wiley & sons, 2003.**
3. **Dennis Roddy, "Satellite Communications," McGraw-Hill Educatio, 4th edition, 2006.**

13- Program Coordination Committee:

Course Coordinator:	**Associate Prof. Dr. Sherif Abo-El-Enein**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: /10 /2020.

ECE603
Digital Communication Systems
Course Specification

Course Specification

Program on which the course is given	**Ph. D in ElectricalEngineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Digital Communication Systems	**Code Symbol: ECE603**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in digital communication systems engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in digital communications technology and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of digital communications systems engineering. The course is meant to create the deep understanding of the basics and theories behind the modern digital communication systems. The course is meant also to enhance the ability of the student to integrate the proper digital devices in various communication systems. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Objectives

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to digital communication systems engineering.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to digital communication systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using digital communication systems.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to communication systems.
5. Identify current problems and find solutions for it using digital communication systems design.
6. Apply the methodologies of scientific research and the use of its different tools in the area of digital communication systems engineering.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of digital communication systems.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the main differences between analog and digital communication systems. a1-2-2 Recognize the methods of analysis for digital communication systems. a1-2-3 Recognize the differences between analog and digital signals.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the Potential applications of new types of digital communication systems in advanced electronics and communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Report and recognize the professional aspects of digital communication systems applications and their effects on the Environment.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different digital devices and systems development phases
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional researchpracticein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the digital communication systems problems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to digital communication systems.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to digital communication systems problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write a professional report on matched filters.
D. General and transferrable skills	
D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional digital systems problems.
D3-1 Apply self-evaluation and specify	d3-1-1 Apply self-evaluation and specify

his/hereducational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	his/hereducational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about digital communication systems and technology.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Revision on the undergraduate materials related to digital communication systems	12	12	-	--
2. Sampling and pulse modulation, pulse transmission.	12	12	-	--
3. Digital signals and systems, noise and errors.	12	12	-	--
4. Intersymbol Interference, Regenerative repeaters.	12	12	-	--
5. Matched filtering, synchronization techniques.	9	9	-	--
6. Pulse code modulation, band pass digital transmission	12	12	-	--
7. Coherent binary systems, Non coherent binary systems.	15	15	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving	A1-2, A1-3, A2-1, A5-1	B1-1, B3-1	C1-1, C2-1	D2-1, D3-1, D5-1.

6-

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Discretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**			**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision on the undergraduate materials related to digital communication systems	1-4
2nd	Sampling and pulse modulation, pulse transmission	5-8
3rd	Digital signals and systems, noise and errors.	9-12
4th	Intersymbol Interference, Regenerative repeaters.	13-16
5th	Matched filtering, synchronization techniques.	17-19
6th	Pulse code modulation, band pass digital transmission	20-23
7th	Coherent binary systems, Non coherent binary systems.	24-28

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Course ILOs	**Knowledge & Understanding**						
a1-2-1 Describe the main differences between analog and digital communication systems.	x		x				
a1-2-2 Recognize the methods of analysis for digital communication systems.	x	x	x				x
a1-2-3 Recognize the differences between analog and digital signals.	x		x	x	x	x	
a1-3-1 Classify the Potential applications of new types of digital communication systems in advanced electronics and communication systems.		x	x	x	x	x	x
a2-1-1 Report and recognize the professional aspects of digital communication systems applications and their effects on the Environment.	x	x					
a5-1-1 Explain Quality Assurance concepts of different digital devices and systems development phases		x				x	X
Course ILOs	**Intellectual skills**						
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the digital communication systems problems.	x	x		x		x	X
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to digital communication systems.		x	x		x	x	X
Course ILOs	**Professional and practical skills**						
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to digital communication systems problems, using latest engineering		x				x	x

techniques, skills, and tools.							
c2-1-1 Write a professional report on matched filters.						x	
Course ILOs	**General and transferrable skills**						
d2-1-1 Use state-of-the-art computer aided design tools for solving professional digital systems problems.			x	x	x	x	
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.						x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about digital communication systems and technology.						x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**											
		Lecture+ online sessions	**Presentation and**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer**	**Practical**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-3-1		x	x					x	x				
	a2-1-1		x	x					x	x				
	a5-1-1		x							x				
Intellectual Skills	b1-1-1		x											
	b3-1-1		x											
Professional Skills	c1-1-1		x											
	c2-1-1		x	x					x	x				
General Skills	d2-1-1												x	
	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions-Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. **S. Haykin and M. Moher, "Communication Systems" 5th Edition, John Wiley and sons, 2009.**
2. M.K. Simon and M. S. Alouini,''Digital Communication over fading channel.''John Wiley and Sons, 2000.

13- Program Coordination Committee:

Course Coordinator: **Dr. Heba Abd Elatty**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: / 10 /2020.

ECE-604
Mobile Communication Systems
Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Mobile Communication Systems	**Code Symbol: ECE604**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in mobile communication systems engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in mobile communication technology and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of mobile communication systems engineering. The course is meant to create the deep understanding of the basics and theories behind the modern mobile communication systems. The course is meant also to enhance the ability of the student to integrate the proper digital devices in various mobile communication systems. Emphasis will be on the new devices and advanced methods of analysis and design

2- Course Objective

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to mobile communication systems engineering.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to mobile communication systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using mobile communication systems.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to mobile communication systems.
5. Identify current problems and find solutions for it using mobile communication systems design.
6. Apply the methodologies of scientific research and the use of its different tools in the area of mobile communication systems engineering.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of mobile communication systems.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	a1-1-1 Describe the main differences between propagation models faced by mobile communication systems.
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the main differences between analog and digital mobile communication systems. a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of the calculation of probability of signal outage, threshold crossing rate, average fade, non fade duration, and average bit error rate in mobile channels. a1-2-3 Discuss multiple access to mobile radio channels and spatial distributions in mobile slotted ALOHA networks. a1-2-4 Demonstrate sufficient specialized knowledge and a deep understanding of the design and planning of cellular voice networks and evaluate of performance of digital cellular networks.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to mobile communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a2-1-1 discuss the social effects of the increasing usage of the mobile communication systems on the environment.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining toto a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the mobile communication systems problems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to mobile communication systems.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to mobile communication systems problems, using latest

	engineering techniques, skills, and tools.
D. General and transferrable skills	
D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.	d2-1-1 Use state-of-the-art computer and Internet tools for getting latest information and standards related to mobile communication systems.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Introduction, effect of mobiling on communication systems, mobile communication.	12	12	-	--
2. VHF and UHF propagation in land, assessment of deterministic propagation models.	12	12	-	--
3. Probability of signal outage, threshold crossing rate and average fade, non fade duration.	12	12	-	--
4. Average bit error rate in mobile channels with cochannel interference.	12	12	-	--
5. Multiple access to mobile radio channels,.	9	9	-	--
6. Spatial distributions in mobile slotted ALOHA networks.	12	12	-	--
7. Design and planning of cellular voice networks, Performance of digital cellular networks.	15	15	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	**A1-1, A1-3, A1-2, A2-1**	**B1-1, B3-1**	**C1-1**	**D2-1**

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Discretionry subjects	Total
---	---	30%	70%	-			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Introduction, effect of mobiling on communication systems, mobile communication.	1-4
2nd	VHF and UHF propagation in land, Assessment of deterministic propagation models.	5-8
3rd	Probability of signal outage, threshold crossing rate and average fade, non fade duration.	9-12
4th	Average bit error rate in mobile channels with cochannel interference.	13-16
5th	Multiple access to mobile radio channels.	17-19
6th	Spatial distributions in mobile slotted ALOHA networks.	20-23
7th	Design and planning of cellular voice networks, Performance of digital cellular networks.	24-28

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Course ILOs	**Knowledge & Understanding**						
a1-1-1 Describe the main differences between propagation models faced by mobile communication systems.		x				x	x
a1-2-1 Describe the main differences between analog and digital mobile communication systems.	x						
a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of the calculation of probability of signal outage, threshold crossing rate, average fade, non-fade duration, and average bit error rate in mobile channels..			x	x			
a1-2-3 Discuss multiple access to mobile radio channels and spatial distributions in mobile slotted ALOHA networks.					x	x	
a1-2-4 Demonstrate sufficient specialized knowledge and a deep understanding of the design and planning of cellular voice networks and evaluate of performance of digital cellular networks							x
a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to mobile communication systems.					x	x	x
a2-1-1 discuss the social effects of the increasing usage of the mobile communication systems on the environment.	x						x
Course ILOs	**Intellectual skills**						

b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the mobile communication systems problems.	x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to mobile communication systems.					x	x	x
Course ILOs	**Professional and practical skills**						
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to mobile communication systems problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x
Course ILOs	**General and transferrable skills**						
d2-1-1 Use state-of-the-art computer and Internet tools for getting latest information and standards related to mobile communication systems.	x		x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1-1-1	x				x								
	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-3-1	x				x								
	a2-1-1	x				x								
Intellectual Skills	b1-1-1					x								
	b3-1-1		x			x			x					
Professional Skills	c1-1-1	x				x								
General Skills	d2-1-1		x	x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written : to assess students' knowledge, understanding, analysis,

Examination	creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	Decided by the College Council
Total	**100%**	

11- Facilities required for teaching and learning

Internet for online sessions- Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. William Lee,"Mobile cellular Telecommunications,"McGraw Hill, 2000.
2. **G. Stuber, "Principles of Mobile Communications," Springer and Business Media, 2017.**
3. IEEE Standards.

13- Program Coordination Committee:

Course Coordinator:	**Dr. Heba Abd Elatty**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 605

Advanced Electronics Communication Systems

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Advanced Electronic Communication Systems	**Code Symbol: ECE 605**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2004**

B- Professional Information

1- Course Aims:

This course aims at providing students with the basic knowledge and understanding of electronic communication signals and systems including; definition of digital signal and systems, base band digital communication systems, modulated digital signals, multiple access techniques, satellite communication systems, mobile communication systems, and data communication systems.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of digital communication systems.
2. Develop models digital modulation systems.
3. Identify multiple access techniques and assess their performances.
4. Review communication systems such as mobile, satellite, and data communication systems.
5. Compare different tools to simulate digital communication systems.
6. Apply specialized knowledge and combine it with relevant knowledge in data communication systems.

3- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communication Engineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Recognize different communication systems and understand the theory behind their operation. a1-2-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofbase-band digital communication systems to develop his/her professional research practice in dealing with this systems.. a1-2-3 Discuss the different modern Digital Modulation Techniques to deal with modulated signals. a1-2-4 Recognize the fundamentals of communications access technologies a1-2-5 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofsatellite and mobile communication systems to be able to do research related to these systems. a1-2-6 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofdata communications field.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to advanced electronic communication systems.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to electronic materials.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze and manipulate data from a variety of sources and relate it to suggest solutions to communication problems.
B4-1Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.	b4-1-1 Compare multiple access techniques.

C. Professional and practical skills	
C1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Use a computational tools including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in advanced electronic communication systems.
C2-1 Write and evaluate a professional report on specialized related to electronics and communications technical matters.	c2-1-1 Write a professional technical report pertaining to electronics and communications technical matters.
D. General and transferrable skills	
D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.	d2-1-1 Use state-of-the-art computer aided design tools for simulation of digital communication systems.
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced communication systems/

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Digital Signals and Systems	6	6	--
2- Base-band digital communication systems	12	12	--
3- Modulated digital signals	12	12	--
4- Fundamentals of Communications Access Technologies: FDMA - TDMA - CDMA	18	18	
5- Satellite Comm. Systems.	12	12	--
6- Mobile Comm. Systems	12	12	--
7- Data Communications.	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-2, A1-3	B1-1, B3-1 B4-1	C1-1, C1-2, C2-1	D2-1, D3-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**	**-**		**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Digital Signals and Systems	**1-2**
2nd	Base-band digital communication systems	**3-6**
3rd	Modern Digital Modulation Techniques	**7-10**
4th	Fundamentals of Communications Access Technologies: FDMA - TDMA - CDMA	**11-16**
5th	Satellite Comm. Systems.	**17-20**
6th	Mobile Comm. Systems	**21-24**
7th	Data Communications.	**25-28**

8- ILOs Matrix Topics

Course ILOs	Course topics						
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
a1-2-1 Recognize different communication systems and understand the theory behind their operation.	x	x			x	x	
a1-2-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofbase-band digital communication systems to develop his/her professional research practice in dealing with this systems.		x					
a1-2-3 Discuss the different modern Digital Modulation Techniques to deal with modulated			x				

signals.							
a1-2-4 Recognize the fundamentals of communications access technologies				x			
a1-2-5 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofsatellite and mobile communication systems to be able to do research related to these systems.					x	x	
a1-2-6 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofdata communications field.							x
a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to advanced electronic communication systems.					x	x	x
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to electronic materials.	x	x	x	x	x	x	X
b3-1-1 Analyze and manipulate data from a variety of sources and relate it to suggest solutions to communication problems.			x	x	x	x	x
b4-1-1 Compare multiple access techniques.				x			
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to electronic materials problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x
c1-2-1 Use a computational tools including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in advanced electronic communication systems.				x	x	x	x
c2-1-1 Write a professional report on the advances of a given communication system, such as mobile, satellite, or data comm. systems.					x	x	x
d2-1-1 Use state-of-the-art computer aided design tools for simulation of digital communication systems.					x	x	
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.					x	x	
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced communication systems/	x	x	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning	Teaching and Learning Method

outcomes (ILOs)		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-2-6	x				x								
	a1-3-1	x				x								
Intellectual Skills	b1-1-1			x		x								
	b3-1-1			x		x								
	b4-1-1	x		x					x					
Professional Skills	c1-1-1					x								
	c1-2-1												x	
	c2-1-1		x	x					x					
General Skills	d2-1-1												x	
	d3-1-1		x	x					x	x				
	d5-1-1		x	x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, andproblem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Blackboard – Internet for online sessions- Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments during the lectures and home.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of

laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

Lecture notes are provided.

Essential Books (Text Books):

Wayne Tomasi, "Advanced Electronic Communications Systems," British Library Cataloguing-in-Publication Data, 2014

13- Program Coordination Committee:

Course Coordinator:	**Dr. Saly S. Hassaneen**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: / 10/2020

ECE 606
Data Communications
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Data Communication	**Code Symbol: ECE 606**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course aims at providing students with advanced knowledge and understanding of Data Communication Systems; understanding of message and switching, layering, delay models in data networks, multi access, carrier sensing, packet radio, flow control, and examples of systems.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of messaging, switching, and layering in data networks.
2. Collect advanced skills in the definition, analysis, and solving problems.
3. Identify and describe layers of data networks.
4. Identify multi access methods.
5. Explore packet radio.
6. Apply the methodologies of scientific research in the area of data communications.

3- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communication Engineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	a1-1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics appropriate to data communication systems analysis and design.

A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Recognize different data communication systems and the theory behind their operation a1-2-2 Basic facts & theories in the field of electronics and communications, and interrelated fields.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to data communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Report and discuss social effects of data communications.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional researchpracticein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to data communications.
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	b2-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to data communications.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Evaluate pros and cons of different multi access techniques.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Data communication problems, using computer simulation tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write a professional report on network layers and different protocols.
D. General and transferrable skills	
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about data communications.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Message and switching	6	6	--
2- Layering	18	18	--
3- Multi Access Communication	6	6	--
4- Slotted Multi Access	6	6	--
5- Carrier sensing	6	6	--
6- Multi Access reservation	6	6	--
7- Packet Radio Networks	6	6	--
8- Radio in Data networks	6	6	--
9- Flow control	6	6	--
10- Examples	6	6	--
11- Internetworking, ISDN	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	**Intellectual Skills**	**Professional Skills**	**General Skills**
Program Academic Standards that the course contributes in achieving.	A1-1, A1-2, A1-3, A2 -1	B1-1, B2-1, B3-1	C1-1, C2-1	D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**	**-**		**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	1- Message and switching	**1-2**
2nd	2- Layering	**3-8**

3rd	3- Multi Access Communication	**9-10**
4th	4- Slotted Multi Access	**11-12**
5th	5- Carrier sensing	**13-14**
6th	6- Multi Access reservation	**15-16**
7th	7- Packet Radio Networks	**17-18**
8th	8- Radio in Data networks	**19-20**
9th	9- Flow control	**21-22**
10th	10- Examples	**23-24**
11th	11- Internetworking, ISDN	**25-28**

8- ILOs Matrix Topics

Course topics	**Course topics**										
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**11th**
a1-1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics appropriate to data communication systems analysis and design.	x									x	
a1-2-1 Recognize different data communication systems and the theory behind their operation			x	x	x	x	x	x	x	x	x
a1-2-2 Basic facts & theories in the field of electronics and communications, and interrelated fields.										x	
a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to data communication systems.					x					x	
a2-1-1 Report and discuss social effects of data communications.			x	x						x	x
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to data communications.	x	x	x	x	x	x	x	x	x	x	x
b2-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to data communications.	x	x	x	x	x	x	x	x	x	X	x
b3-1-1 Evaluate pros and cons of different			x	x	x	x					

multi access techniques.											
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Data communication problems, using computer simulation tools.	x	x	x	x	x	x	x	x	x	x	x
c2-1-1 Write a professional report on network layers and different protocols.										x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about data communications.					x					x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	x		x	x	x								
	a1-2-1	x		x	x	x								
	a1-2-2	x		x	x	x								
	a1-3-1	x		x	x	x								
	a2-1-1	x		x	x	x								
Intellectual Skills	b1-1-1		x											
	b3-1-1		x											
	b5-1-1		x	x					x	x				
Professional Skills	c1-1-1					x					x			
	c2-1-1		x	x					x	x				
	d5-1-1			x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

10- Facilities required for teaching and learning

Internet for online sessions -Blackboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

11- List of References:

Course and Lab Notes:

Lectures and Labs notes are provided.

Essential Books (Text Books):

Behrouz A. Forouzan, "Data Communications and networking," Library of Congress Cataloguing-in-Publication Data, 2007.

12- Program Coordination Committee:

Course Coordinator:	**Dr. Islam E. Shaalan**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 607
Transmission Systems
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Transmission Systems.	**Code Symbol: ECE607**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in transmission systems. For those students who look toward an industrial position after graduation, this course is designed to widen background in transmission technology and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of transmission systems applications. The course is meant to create the deep understanding of the basics and theories behind the modern transmission systems applications. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to transmission systems.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to transmission systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using transmission systems applications.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to transmission systems.
5. Identify current problems and find solutions for it using transmission systems.
6. Apply the methodologies of scientific research and the use of its different tools in the area of transmission systems.
7. Relate the specialized knowledge to the industrial area of transmission systems.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the main differences between different transmission lines. a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the Audio frequency systems. a1-2-3 Describe the main differences between pair lines and coaxial carrier systems. a1-2-4 Discuss line system reliability. a1-2-5Explain submarine cable systems and pulse code modulation systems.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to radio systems, satellite communication systems and communication systems.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the transmission systems problems.
B8-1 Perform applied research on industrial and societal concerns problems that add to the accumulated knowledge of the electronics and communications field.	b8-1-1 apply research on industrial and societal concerns in transmission systems field.
B9-1 Manage discussions on basis of evidence and proofs	b9-1-1 explain the basis of evidence and proofs
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to transmission systems, using latest engineering techniques, skills, and tools
C4-1 Express competence skills to use technology to advance practice	c4-1-1 Use technology in advanced practice of transmission systems
C5-1 Plan professional development courses to improve practice and enhance performance of juniors in the field of electronics and communications.	c5-1-1 apply professional development courses in the field of transmission systems.
D. General and transferrable skills	
D1-1 Express professional and communication skills effectively in different aspects.	d1-1-1 Communicate research ideas and their appropriate theoretical and methodological

	issues effectively and efficiently.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge in transmission systems.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Line transmission.	12	12	-	--
2. Audio frequency systems.	12	12	-	--
3. Carrier systems for pair, type lines.	12	12	-	--
4. Coaxial cable carrier systems.	12	12	-	--
5. Line system reliability.	9	9	-	--
6. Submarine cable systems, pulse code modulation systems.	12	12	-	--
7. Radio systems, satellite communication systems.	15	15	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2, A1-3	B1-1, B8-1, B9-1	C1-1, C4-1, C5-1	D1-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Discretionry subjects	Total
---	---	30%	70%	-			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Line transmission.	1-4

2nd	Audio frequency systems.	5-8
3rd	Carrier systems for pair, type lines.	9-12
4th	Coaxial cable carrier systems.	13-16
5th	Line system reliability.	17-19
6th	Submarine cable systems, pulse code modulation systems.	20-23
7th	Radio systems, satellite communication systems.	24-28

8- ILOs Matrix Topics

Course topics	1st	2nd	3rd	4th	5th	6th	7th
Course ILOs	Knowledge & Understanding						
a1-2-1 Describe the main differences between different transmission lines.	x						
a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the audio frequency systems.		x					
a1-2-3 Describe the main differences between pair lines and coaxial carrier systems.			x	x			
a1-2-4 Discuss line system reliability.					x		
a1-2-5 Explain submarine cable systems and pulse code modulation systems.						x	
a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to radio systems, satellite communication systems and communication systems.							x
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the digital signal processing problems.	x	x	x	x	x	x	x
b8-1-1 apply research on industrial and societal concerns in transmission systems field.	x	x	x	x	x	x	x
b9-1-1 explain the basis of evidence and proofs	x	x	x	x	x	x	x
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to digital signal processing problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x
c4-1-1 Use technology in advanced practice of transmission systems	x	x	x	x	x	x	x
c5-1-1 apply professional development courses in the field of transmission systems.	x	x	x	x	x	x	x

d1-1-1 Communicate research ideas and their appropriate theoretical and methodological issues effectively and efficiently.						x	x
d5-1-1 Use state-of-the-art computer and Internet tools for getting latest information and standards related to digital signal processing systems.						x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method											
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & Understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-3-1	x				x								
Intellectual Skills	b1-1-1					x								
	b8-1-1					x								
	b9-1-1					x								
Professional Skills	c1-1-1			x		x								
	c4-1-1			x		x								
	c5-1-1			x		x								
General Skills	d1-1-1		x	x					x					
	d5-1-1		x	x					x					

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions -Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. David R. Smith,"Digital Transmission Systems,"Springer, 2004.
2. IEEE Standards.

12- Program Coordination Committee:

Course Coordinator:	**Dr. Dr. Heba Y. Soliman**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020

ECE 608
Network Planning
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Network Planning	**Code Symbol: ECE608**	
Lecture	**3 hours**	
Tutorial/ Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

The aims of this course are to provide the student with the fundamentals of Stages in Planning. This course will also provide the students with the ability to understand Present Network Knowledge and network standards. It is also aimed that the student will get acquainted with Routing Plan, Grade of Services, Local Area Planning, and Growth Planning. It will provide the students with the ability to analyze network performance, and simulate the network.

2- Course Objectives:

The main Objectives of this course are to:

1- Demonstrate the knowledge and understanding of the fundamentals of Stages in Planning.
2- Define the Network Standards.
3- Demonstrate the Local Area Planning, and Growth Planning.
4- Recognize the Grade of Services.
5- Simulate and analyze the network performance.

.

3- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the present network knowledge and planning stages. a1-2-2 Recognize the network and signaling Standards. a1-2-3 Discuss the routing plan techniques and the grade of services

	a1-2-4 Ilustrate the Local Area and Growth Planning methodologies.. a1-2-5 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of Testing, configuring and simulating a network.
A4-1 Gain a depth of knowledge, understanding, and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.	a4-1-1 Gain a depth of knowledge, understanding and fundamentals of ethical & legal professional practice of scientific research in the field by doingnew Research points on the computer networks.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining toto a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 Demonstrate analytic thinking approach to solve problems related to network planning. b1-1-2 Interpret, analyze, and evaluate a network specification information
C. Professional and practical skills	
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Use a wide range of computational tools including pertaining software packages to analysis and design a process, component, or system related to the computer networks.

D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
Stages in Planning	9	9	--
Present Network Knowledge	9	9	--

Network Standards, and Signaling Standards	9	9	--
Routing Plan	9	9	--
Grade of Services	9	9	--
Local Area Planning	9	9	--
Growth Planning.	9	9	--
Testing, Configuring and Simulating the network	9	9	--
New Research points on the computer networks	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-2, A4-1	B1-1	C1-2	D3-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---		70%	30%	-		100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Stages in Planning	1-3
2nd	Present Network Knowledge	4-6
3rd	Network Standards, and Signaling Standards	7-9
4th	Routing Plan	10-12
5th	Grade of Services	13-15
6th	Local Area Planning	16-18
7th	Growth Planning.	19-21
8th	Testing, Configuring and Simulating the network	22-24
9th	New Research points on the computer networks	25-28

8- ILOs Matrix Topics:

Course Intended Learning Outcomes (ILOs)		Course topics								
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Knowledge & Understanding	a1-2-1 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the present network knowledge and planning stages.	**x**	**x**							
	a1-2-2 Recognize the network and signaling standards.			**x**						
	a1-2-3 Discuss the routing plan techniques and the grade of services				**x**	**x**				
	a1-2-4 Ilustrate the Local Area and Growth Planning methodologies.						**x**	**x**		
	a1-2-5 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of Testing, configuring and simulating a network.								**x**	
	a4-1-1 Gain a depth of knowledge, understanding and fundamentals of ethical & legal professional practice of scientific research in the field by doingnew Research points on the computer networks.									**x**
Intellectual Skills	b1-1-1Demonstrate analytic thinking approach to solve problems related to network planning.				**x**		**x**	**x**	**x**	**x**
	b1-1-2 Interpret, analyze, and evaluate a network specification information					**x**			**x**	
Professional Skill	c1-2-1 Use a wide range of computational tools includingpertaining software packages to analysis and design a process, component,								**x**	**x**

	or system related to the computer networks..									
General Skills	d3-1-1 Apply self-evaluation and specify his educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.									**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a4-1-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b1-1-2	x				x								
Professional Skills	c1-2-1			x									x	
General Skills	d3-1-1		x	x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions - Blackboard – Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using MATLAB simulators using general computer labs during the lectures (class) or/and at home..

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

11.1- Essential books (text books)

1- M. D. Prycker, Asynchronous Transfer Mode Solution for Broadband ISDN. Englewood Cliffs, NJ: Prentice-Hall, 1995.

2- W. Stallings, Data and Computer Communications. Upper Saddle River, NJ: Prentice-Hall, 1997.

3- S. Tanenbaur, Computer Networks. Upper Saddle River, NJ: Prentice-Hall, 1996.

4- R. O. Onvural, Asynchronous Transfer Mode Networks Performance Issues. Boston: Artech House, 2001.

5- W. Buchanan, Advanced Data Communications and Networks. London: Chapman & Hall, 2003.

6- W. Stallings, High-Speed Networks: TCP/IP and ATM Design Principles. Upper Saddle River, NJ: Prentice-Hall, 1998.

7- M. Schwartz, Broadband Integrated Networks. Upper Saddle River, NJ: Prentice-Hall, 2002.

11.2- Web sites

"NS-2 Network Simulator" http://www.isi.edu/nsnam/ns/

13- Program Coordination Committee:

Course Coordinator:	**Prof. Dr. Rawya Yehia Rizk**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 609
Local Area Network
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Local Area Networks	**Code Symbol: ECE609**	
Lecture	**3 hours**	
Tutorial/ Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

The aims of this course are to provide the student with the fundamentals of computer networks and their applications. This course will also provide the students with the ability to understand Carrier Sense Multiple Access/Collision Detection Protocol, differentiate between network connection models, and understand Transfer models. It is also aimed that the student will get acquainted with Metropolitan Growth Planning. It will provide the students with the ability to analyze network performance, and simulate the network.

2- Course Objectives:

The main Objectives of this course are to:

1- Demonstrate the knowledge and understanding of the fundamentals of computer networks and their applications.
2- Define the Network architecture, and Carrier Sense Multiple Access/Collision Detection Protocols.
3- Demonstrate the Metropolitan Growth Planning.
4- Recognize the different types of topologies, switching techniques, and communication media.
5- Simulate and analyze the network performance.

3- Intended Learning Outcomes (ILOs):

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofThe key components of the local area networks and the characteristics of network architecture: fault tolerance, scalability and quality of services a1-2-2 Recognize the layered network

	architecture and standard network models (OSI and TCP/IP). a1-2-3 Discuss functionality and protocols of application, transports, and network layers of OSI model. a1-2-4 Discuss data link layer protocols, the media access control methods, the network topologies, and encapsulation. a1-2-5 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofthe physical layer protocols and services , signaling, encoding, and the common media. a1-2-6 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of Testing, configuring and simulating a network.
A4-1 Gain a depth of knowledge, understanding, and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.	a4-1-1 Gain a depth of knowledge, understanding and fundamentals of ethical & legal professional practice of scientific research in the field by doingnew Research points on the computer networks.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional researchpracticein Electronics and Communication Engineering.	b1-1-1 Demonstrate analytic thinking approach to solve problems related to network planning. b1-1-2 Interpret, analyze, and evaluate a network specification information
C. Professional and practical skills	
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Use a wide range of computational tools including pertaining software packages to analysis and design a process, component, or system related to the computer networks.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency

4- Course Contents:

No.	*Topic*	*Total hours*	*Lec. hours*	*Tut. hours*

1	The key components of data networks and the characteristics of network architecture: fault tolerance, scalability, and quality of services.	9	9	-
2	Layered network architecture and standard network models (OSI and TCP/IP)	9	9	-
3	Application layer functionality and protocols	9	9	-
4	Transport layer protocols (TCP and UDP), error handling, and reliability	9	9	-
5	Network layer protocols (IPv4 and IPv6), the principles of grouping and division of devices, Addressing the Network-IPv4, classification of networks.	9	9	-
6	Data link layer protocols, the media access control methods, the network topologies, and encapsulation.	9	9	-
7	Physical layer protocols and services, signaling, encoding, and the common media.	9	9	-
8	Planning, Testing, Configuring and Simulating the network	9	9	-
9	New Research points on the computer networks	12	12	-
Total		84	84	-

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2, A4-1	B1-1	C1-2	D3-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	-	70%	30%			100%

7- Course Topics.

Topic No.	Topic	Weeks
1	The key components of data networks and the characteristics of network architecture: fault tolerance, scalability, and quality of services.	1-3

2	Layered network architecture and standard network models (OSI and TCP/IP)	4-6
3	Application layer functionality and protocols	7-9
4	Transport layer protocols (TCP and UDP), error handling, and reliability	10-12
5	Network layer protocols (IPv4 and IPv6), the principles of grouping and division of devices, Addressing the Network-IPv4, classification of networks.	13-15
6	Data link layer protocols, the media access control methods, the network topologies, and encapsulation.	16-18
7	Physical layer protocols and services, signaling, encoding, and the common media.	19-21
8	Planning, Testing, Configuring and Simulating the network	22-24
9	New Research points on the computer networks	25-28

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		**Course topics**								
		1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**
Knowledge & Understanding	a1-2-1 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories ofThe key components of the local area networks and the characteristics of network architecture: fault tolerance, scalability and quality of services	**x**								
	a1-2-2 Recognize the layered network architecture and standard network models (OSI and TCP/IP).		**x**							
	a1-2-3 Discuss functionality and protocols of application, transports, and network layers of OSI model.			**x**	**x**	**x**				
	a1-2-4 Discuss data link layer protocols, the media access control methods, the network topologies, and encapsulation.						**x**			
	a1-2-5 Demonstrate sufficient specialized knowledge and a deep understanding of the							**x**		

	concepts and theories ofthe physical layer protocols and services , signaling, encoding, and the common media..									
	a1-2-6 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of Testing, configuring and simulating a network								**x**	
	a4-1-1 Gain a depth of knowledge, understanding and fundamentals of ethical & legal professional practice of scientific research in the field by doingnew Research points on the computer networks.									**x**
Intellectual Skills	b1-1-1 Demonstrate analytic thinking approach to solve Solve the addressing problems.					**x**	**x**	**x**	**x**	**x**
	b1-1-2 Interpret, analyze, and evaluate the performance of the network.				**x**				**x**	**x**
Professional Skill	c1-2-1 Use a wide range of computational tools including pertaining software packages to analysis and design a process, component, or system related to the computer networks.								**x**	**x**
General Skills	d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.								**x**	**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								

	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-2-6	x				x								
	a4-1-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b1-1-2	x				x								
Professional Skills	c1-2-1			x									x	
General Skills	d3-1-1		x	x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions- Whiteboard – Class Room Equipped with Computer and Video Projector - Computer Lab - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using computer labs during the lectures and at home.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports.

12- List of references:

12.1- Essential books (text books)

1- M. D. Prycker, *Asynchronous Transfer Mode Solution for Broadband ISDN*. Englewood Cliffs, NJ: Prentice-Hall, 1995.

2- W. Stallings, *Data and Computer Communications.* Upper Saddle River, NJ: Prentice-Hall, 1997.

3- S. Tanenbaur, *Computer Networks*. Upper Saddle River, NJ: Prentice-Hall, 1996.

4- R. O. Onvural, *Asynchronous Transfer Mode Networks Performance Issues*. Boston: Artech House, 2001.

5- W. Buchanan, *Advanced Data Communications and Networks*. London: Chapman & Hall, 2003.

6- W. Stallings, *High-Speed Networks: TCP/IP and ATM Design Principles.* Upper Saddle River, NJ: Prentice-Hall, 1998.

7- M. Schwartz, *Broadband Integrated Networks*. Upper Saddle River, NJ: Prentice-Hall, 2002.

12.2- Web sites

"NS-2 Network Simulator" http://www.isi.edu/nsnam/ns/

13- Program Coordination Committee:

Course Coordinator:	**Prof. Dr. Rawya Yehia Rizk**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 610
Antennas
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Antennas	**Code Symbol: ECE610**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in antenna engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in antennas and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of antenna engineering. The course is meant to create the deep understanding of the physics behind the phenomena of radiation and reception of electromagnetic waves by antennas. The course is meant also to enhance the ability of the student to integrate the proper antenna in various communication systems. Emphasis will be on the recent antenna types and advanced methods of analysis and synthesis.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to microwave electronics.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to microwave electronic circuits and systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using microwave electronic components.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to microwave electronic systems.
5. Identify current problems and find solutions for it using microwave electronic components in the area of communication systems.
6. Compare the methodologies of scientific research and the use of its different tools in the area of microwave electronics.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of microwave electronics.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Recognize the radiation phenomenon of the antenna. a1-2-2 Recognize the wave reception by the antenna. a1-2-3 Classify the antennas according to their physical structure and properties. a1-2-4 Discuss the main methods of analysis and design of the antennas.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to antenna field.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a2-1-1 Report and discuss social effects of antenna applications.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional researchpractice in Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the antenna problems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to antennas.
B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for antennas development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to antenna problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write a professional report on integrated antenna systems.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical	d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.

competency.	
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about antenna types and technology.

4- Course Contents

Topic	*Total Hours*	*Contact hrs*		
		Lec.	**Tut.**	**Lab.**
1. Revision on the undergraduate materials related to the antennas	6	6	-	--
2. Radiation Integrals and Auxiliary Potential Functions	6	6	-	--
3. Antenna Arrays: Linear, Planar, and Circular	9	9	-	--
4. Antenna Synthesis	9	9	-	--
5. Integral Equations, Moment Method, and Self and Mutual Impedances	9	9	-	--
6. Broadband Dipoles and Matching Techniques	9	9	-	--
7. Traveling Wave and Broadband Antennas	9	9	-	--
8. Frequency Independent Antennas,and Antenna Miniaturization	9	9	-	--
9. Aperture antennas	9	9	-	--
10. Microstrip and planar antennas	9	9	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2,A2-1, A1-3	B1-1, B3-1, B5-1	C1-1, C2-1	D3-1, D5-1

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Discretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**			**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision on the undergraduate materials related to the antennas	1-2
2nd	Radiation Integrals and Auxiliary Potential Functions	3-4
3rd	Antenna Arrays: Linear, Planar, and Circular	5-7
4th	Antenna Synthesis	8-10
5th	Integral Equations, Moment Method, and Self and Mutual Impedances	11-13
6th	Broadband Dipoles and Matching Techniques	14-16
7th	Traveling Wave and Broadband Antennas	17-19
8th	Frequency Independent Antennas, and Antenna Miniaturization	20-22
9th	Aperture antennas	23-25
10th	Microstrip and planar antennas	26-28

8- ILOs Matrix Topics

Course ILOs	**Course topics**									
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**
a1-2-1 Recognize the radiation phenomenon of the antenna.	x	x					x		x	x
a1-2-2 Recognize the wave reception by the antenna.	x	x			x		x		x	x
a1-2-3 Classify the antennas according to their physical structure and properties.	x		x	x		x	x	x	x	x
a1-2-4 Discuss the main methods of analysis and design of the antennas.	x	x	x	x	x	x	x	x	x	x
a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to antenna field.			x	x		x			x	x
a2-1-1 Report and discuss social effects of antenna applications.		x	x						x	
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the antenna problems.	x	x	x	x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to antennas.			x	x	x	x		x		
b5-1-1 Evaluate pros and cons of given methodologies for antennas development.			x	x	x	x	x	x	x	x
c1-1-1 Express competence skills, such as identifying, formulating, analyzing,			x	x	x	x	x	x	x	x

and creating engineering solutions related to antenna problems, using latest engineering techniques, skills, and tools.											
c2-1-1 Write and evaluate a professional report on integrated antenna systems.											x
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.	x		x	x	x		x	x	x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about antenna types and technology.			x			x	x	x	x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture+ online sessions	Presentation and	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-3-1		x	x					x	x				
	a2-1-1		x	x					x	x				
Intellectual Skills	b1-1-1		x											
	b3-1-1		x											
	b5-1-1		x	x					x	x				
Professional Skills	c1-1-1		x											
	c2-1-1		x	x					x	x				
General skills	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions -Blackboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. C. A. Balanis, "Antenna Theory – Analysis and Design," John Wiley & Sons, 2005.
2. W. L. Stutzman and G. A. Thiele, " Antenna Theory and Design," John Wiley & Sons, 1998.

13- Program Coordination Committee:

Course Coordinator: **Dr. Heba Y. Soliman**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. RawyaYehia Rizk**

Updated Date: 10/2020.

ECE-611

Microwave Electronics

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Microwave Electronics	**Code Symbol: ECE611**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in microwave electronics. For those students who look toward an industrial position after graduation, this course is designed to widen background in microwave electronics and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of microwave electronics. The course is meant to create the deep understanding of the physics behind the phenomena of generation and amplification of microwave signals by microwave electronic active devices. The course is meant also to enhance the ability of the student to integrate the proper microwave electronic device in various communication systems. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to microwave electronics.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to microwave electronic circuits and systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using microwave electronic components.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to microwave electronic systems.
5. Identify current problems and find solutions for it using microwave electronic components in the area of communication systems.
6. Compare the methodologies of scientific research and the use of its different tools in the area of microwave electronics.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of microwave electronics.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the electron motion in atoms and crystals. a1-2-2 Recognize the energy band structure for compound semiconductors. a1-2-3 Recognize the differences between microwave electronic devices and other electronic devices operating at lower frequencies.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the Potential applications of new types of microwave electronic devices in advanced electronics and communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a2-1-1 Report and discuss social effects of microwave electronics applications.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different microwave electronic components and systems development phases
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the microwave electronics problems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to microwave electronics.
B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for microwave electronic component development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to microwave problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write a professional report on microwave amplifiers.
D. General and transferrable skills	

D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about microwave electronic components and technology.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Revision on the undergraduate materials related to electronics	6	6	-	--
2. Revision on the undergraduate materials related to Microwaves	6	6	-	--
3. Passive microwave diodes	9	9	-	--
4. Avalanch diode	6	6	-	--
5. Gunn device	9	9	-	--
6. IMPATT diodes	9	9	-	--
7. Microwave transistors	9	9	-	--
8. Microwave amplifiers	12	12	-	--
9. Microwave oscillators	9	9	-	--
10. Microwave mixers	9	9	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2,A1-3, A2-1, A5-1	B1-1, B3-1, B5-1	C1-1, C2-1	D3-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	

Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Discretionry subjects	Total
---	---	30%	70%	-			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision on the undergraduate materials related to electronics	1-2
2nd	Revision on the undergraduate materials related to Microwaves	3-4
3rd	Passive microwave diodes	5-7
4th	Avalanche diode	8-9
5th	Gunn device	10-12
6th	IMPATT diodes	13-15
7th	Microwave transistors	16-18
8th	Microwave amplifiers	29-22
9th	Microwave oscillators	23-25
10th	Microwave mixers	26-28

8- ILOs Matrix Topics

Course ILOs	Course topics									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
a1-2-1 Describe the electron motion in atoms and crystals.	x		x	x	x	x	x			
a1-2-2 Recognize the energy band structure for compound semiconductors.	x		x	x	x	x	x			
a1-2-3 Recognize the differences between microwave electronic devices and other electronic devices operating at lower frequencies.		x	x	x	x	x	x	x		
a1-3-1 Classify the potential applications of new types of microwave electronic devices in advanced electronics and communication systems.			x				x	x	x	x
a2-1-1 Report and discuss social effects of microwave electronics applications.		x	x				x	x	x	
a5-1-1 Explain Quality Assurance concepts of different microwave electronic components and systems development phases.								x		

b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the microwave electronics problems.	x	x	x	x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to microwave electronics.							x	x		
b5-1-1 Evaluate pros and cons of given methodologies for microwave electronic component development.			x	x	x	x	x	x	x	x
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to microwave problems, using latest engineering techniques, skills, and tools.			x				x	x	x	x
c2-1-1 Write a professional report on microwave amplifiers.								x		
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.	x		x	x	x	x	x	x	x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about microwave electronic components and technology.								x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer**	**Practical**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-3-1		x	x					x	x				
	a2-1-1		x	x					x	x				
	a5-1-1		x							x				
Intellectual	b1-1-1		x											

Skills	b3-1-1		x											
	b5-1-1		x	x					x	x				
Professional Skills	c1-1-1		x											
	c2-1-1		x	x					x	x				
. General skills	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions -Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. I. A. Glover, S. R. Pennock and P. R. Shepherd," Microwave Devices, Circuits and Subsystems for Communications Engineering," John Wiley & Sons, 2005.

2. David M. Pozar, " Microwave Engineering," John Wiley & Sons, 2005.

13- Program Coordination Committee:

Course Coordinator: **Dr. Sherif Sharosh**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: / 10/2020.

ECE-612

Planar Microwave Circuits

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Planar Microwave Circuits	**Code Symbol: ECE612**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in microwave planar circuits engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in planar microwave technology and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of planar microwave circuits engineering. The course is meant to create the deep understanding of the physics behind the phenomena of guided wave propagation in different planar microwave structures. The course is meant also to enhance the ability of the student to integrate the proper planar microwave component in various communication systems. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to planar microwave circuits engineering.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to planar microwave circuits and systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using planar microwave components.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to microwave systems.
5. Identify current problems and find solutions for it using planar microwave components in the area of communication systems.
6. Compare the methodologies of scientific research and the use of its different tools in the area of planar microwave circuits engineering.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of planar microwave circuits.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the microwave propagation in planar guiding structures. a1-2-2 Recognize the methods of analysis for planar microwave circuits. a1-2-3 Recognize the differences between microstrip circuits components and other components operating at lower frequencies.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the Potential applications of new types of planar microwave devices in advanced electronics and communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a2-1-1 Report and discuss social effects of planar microwave circuits applications.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different planar microwave components and systems development phases
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the planar microwave circuits problems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to planar microwave circuits.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for planar microwave component development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to planar microwave circuits problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on microstrip filters.
D. General and transferrable skills	

D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about planar microwave components and technology.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Revision on the undergraduate materials related to microstrip lines and circuits	12	12	-	--
2. Analysis of planar microwave circuits	12	12	-	--
3. Use of planar circuits in design of passive microwave devices	12	12	-	--
4. Micrpstrip power dividers and couplers	12	12	-	--
5. Impedance transformers	9	9	-	--
6. Micrpstrip filters	12	12	-	--
7. Use of planar circuits in design of active microwave devices such as detectors, mixers and amplifiers	15	15	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2,A1-3, A2-1, A5-1	B1-1, B3-1, B5-1	C1-1, C2-1	D3-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	30%	70%	-			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision on the undergraduate materials related to microstrip lines and circuits	1-4
2nd	Analysis of planar microwave circuits	5-8
3rd	Use of planar circuits in design of passive microwave devices	9-12
4th	Micrpstrip power dividers and couplers	13-16
5th	Impedance transformers	17-19
6th	Micrpstrip filters	20-23
7th	Use of planar circuits in design of active microwave devices such as detectors, mixers and amplifiers	24-28

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Course ILOs	**Knowledge & Understanding**						
a1-2-1 Describe the microwave propagation in planar guiding structures.	x		x				
a1-2-2 Recognize the methods of analysis for planar microwave circuits.	x	x	x				x
a1-2-3 Recognize the differences between microstrip circuits components and other components operating at lower frequencies.	x	x	x	x	x	x	
a1-3-1 Classify the Potential applications of new types of planar microwave devices in advanced electronics and communication systems.			x	x	x	x	x
a2-1-1 Report and discuss social effects of planar microwave circuits applications.	x						
a5-1-1 Explain Quality Assurance concepts of different planar microwave components and systems development phases		x	x			x	x
Course ILOs	**Intellectual skills**						
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the planar microwave circuits problems.	x	x					x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to planar microwave circuits.		x					x
b5-1-1 Evaluate pros and cons of given methodologies for planar microwave component development.		x	x	x	x	x	x
Course ILOs	**Professional and practical skills**						
c1-1-1 Express competence skills, such		x				x	x

as identifying, formulating, analyzing, and creating engineering solutions related to planar microwave circuits problems, using latest engineering techniques, skills, and tools.								
c2-1-1 Write and evaluate a professional report on microstrip filters.						x		
Course ILOs	**General and transferrable skills**							
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.			x	x	x	x	x	
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about planar microwave components and technology.			x				x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer**	**Practical**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-3-1		x	x					x	x				
	a2-1-1		x	x					x	x				
	a5-1-1		x							x				
Intellectual Skills	b1-1-1		x											
	b3-1-1		x											
	b5-1-1		x	x					x	x				
Professional Skills	c1-1-1		x											
	c2-1-1		x	x					x	x				
. General skills	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions-Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. E. H. Fooks,and R.A. Zakarevicius " Microwave Engineering Using Microstrip Circuits," Printice Hall, 1990.
2. Jia-Sheng Hong, and M. J. Lancaster, " Microstrip Filters for RF/Microwave Applications," John Wiley & Sons, 2001.
3. Noyan Kinayman, and M. I. Aksun, "Modern Microwave Circuits," Artech House, 2005

13- Program Coordination Committee:

Course Coordinator: **Dr. Sherif Sharosh**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020

ECE 613

Opto - Electronics Engineering

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Opto - Electronics Engineering	**Code Symbol: ECE 613**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in optoelectronics and principles of the optoelectronic devices operation. This course provides the background in optoelectronics, help students meet the demand of growing semiconductor optoelectronic industry and prepares them to advanced study and research in the semiconductor optics and optoelectronics devices and to be familiar with recent trends in optoelectronics. The covered topics relate to: basic semiconductor optical properties, hetero-junctions optical materials, analysis and design of LED for Optical communication, principles of laser action and theory of semiconductor laser.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to opto-electronic engineering field.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to opto-electronic engineering field.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications design using opto-electronic materials and devices.
4. Build the skills that necessary to identify and solve complex and open ended engineering problems related to optical electronic components and subsystems design and implementation.
5. Compare the methodologies of scientific research and the use of its different tools in the area ofopto-electronic engineering.
6. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area ofopto-electronic engineering

3- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Demonstrate sufficient essential knowledge and a deep understanding of the basic semiconductor optical properties. a1-2-2 Classify the basic semiconductor optical devices according to their physical structure and properties. a1-2-3 Classify the hetero-Junctions optical materials according to their physical structure and properties. a1-2-4 Demonstrate sufficient essential knowledge and a deep understanding to the principles of LD Action. a1-2-5 Describe different effective techniques and methods to analyze and design different types of LED for Optical Communication. a1-2-6 Demonstrate sufficient essential knowledge and a deep understanding to the principles of Laser Action. a1-2-7 Explain the theory of Semiconductor Laser with emphasis on their physical structure, properties, and applications. a1-2-8 Demonstrate a basic understanding of the Quantum Well Lasers.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the Potential applications of Optical Electronics and Communications field.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a2-1-1 Report and discuss social effects of Optical Electronics and Communications field.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain quality assurance concepts of optical Electronics and Communications systems development phases.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve

develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	problems related to Optical Electronics and Communications and its applications.
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	b2-1-1 identify and apply appropriate methods for discrimination of physics-based optical device models in the context of specific technological constraints .
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Optical Electronics and Communications and its applications.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for Optical Electronics and Communications systems development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical Electronics and Communications systems problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on semiconductor optical properties.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems types and technology.

4-Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours

1- Basic Semiconductor Optical Properties.	18	18	--
2- Hetero-Junctions Optical Materials.	12	12	--
3- Principles of LD Action.	12	12	--
4- Analysis and Design of LED for Optical Communication.	12	12	--
5- Principles of Laser Action.	12	12	--
6- Theory of Semiconductor Laser.	12	12	--
7- Quantum Well Lasers.	6	6	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2,A1-3, A2-1, A5-1	B1-1, B2-1, B3-1, B5-1	C1-1, C2-1	D3-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	30%	70%	-	-		100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	1- Basic Semiconductor Optical Properties.	**1-6**
2nd	2- Hetero-Junctions Optical Materials.	**7-10**
3rd	3- Principles of LD Action.	**11-14**
4th	4- Analysis and Design of LED for Optical Communication.	**15-18**
5th	5- Principles of Laser Action.	**19-22**
6th	6- Theory of Semiconductor Laser and applications.	**23-26**
7th	7- Quantum Well Lasers.	**27-28**

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Course ILOs	**Knowledge & Understanding**						

a1-2-1 Demonstrate sufficient essential knowledge and a deep understanding of the basic semiconductor optical properties.	x						
a1-2-2 Classify the basic semiconductor optical devices according to their physical structure and properties.	x	x					
a1-2-3 Classify the hetero-Junctions optical materials according to their physical structure and properties.		x					
a1-2-4 Demonstrate sufficient essential knowledge and a deep understanding to the principles of LD Action.			x				
a1-2-5 Describe different effective techniques and methods to analyze and design different types of LED for optical communication.				x			
a1-2-6 Demonstrate sufficient essential knowledge and a deep understanding to the principles of Laser Action.					x		
a1-2-7 Explain the theory of Semiconductor Laser with emphasis on their physical structure, properties, and applications.						x	
a1-2-8 Demonstrate a basic understanding of the Quantum Well Lasers.							x
a1-3-1 Classify the Potential applications of Optical Electronics and Communications field.				x		x	
a2-1-1 Report and discuss social effects of Optical Electronics and Communications field.	x	x					
a5-1-1 Explain quality assurance concepts of optical Electronics and Communications systems development phases.				x	x	x	x
Course ILOs	**Intellectual Skills**						
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to Optical Electronics and Communications and its applications.	x	x	x	x	x	x	x
b2-1-1 identify and apply appropriate methods for discrimination of physics-based optical device models in the context of specific technological constraints .				x		x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Optical Electronics and Communications and its applications.				x		x	x
b5-1-1 Evaluate pros and cons of given methodologies for Optical Electronics and Communications systems development.				x		x	x
Course ILOs	**Professional Skill**						
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating				x		x	

engineering solutions related to optical Electronics and Communications systems problems, using latest engineering techniques, skills, and tools.							
c2-1-1 Write and evaluate a professional report on Photonic semiconductor materials.		x					x
Course ILOs	**General Skills**						
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.							x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems types and technology.							x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**											
		Lecture+ online sessions	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1-2-1	x			x	x								
	a1-2-2	x			x	x								
	a1-2-3	x			x	x								
	a1-2-4	x			x	x								
	a1-2-5	x			x	x								
	a1-2-6	x			x	x								
	a1-2-7	x			x	x								
	a1-2-8	x			x	x								
	a1-3-1	x			x	x			x	x				
	a2-1-1		x	x					x	x				
	a5-1-1		x	x					x	x		x		
Intellectual Skills	b1-1-1				x	x								
	b2-1-1				x	x								
	b3-1-1				x	x								
	b5-1-1				x	x				x				
Professional Skills	c1-1-1				x	x								
	c2-1-1		x	x					x					
General Skills	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination	:	to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Blackboard – Internet for online sessions- Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

No lectures and Labs notes.

Essential Books (Text Books):

- Joseph T. Verdeyen., "Laser Electronics", Prentice-Hall Inc., 1993.
- Pallab Bhattacharya " Semiconductor Optoelectronics Devices", Prentice Hill, Second Edition, 1996.
- Clifford R. Pollock, "Fundamentals of Optoelectronics", Richard D. Irwin Inc., 1994
- **J. Singh, "Electronic and Optoelectronic Properties of Semiconductor Structures," Cambridge University Press, 2003**.

Recommended Books:

- Wallace B. Leigh, "Device for Optoelectronics", CRC, 1966.

13- Program Coordination Committee:

Course Coordinator:	**Dr. Rania M. Abd Allah**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 614

Integrated Optics Engineering

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	***2020***

A- Basic Information

Title: Integrated Optics Engineering	**Code Symbol: ECE 614**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in Opto-Electronics and Photonic. The main objective of the course is to familiarize the students with the fundamental aspects of integrated optics. This course is designed to widen student's background in Opto-Electronics engineering and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in a variety of different areas of Photonic Electronics science. The covered topics relate to : analysis and design of open and symmetric Slab wave-guide, multi-layer wave-guide, graded index wave-guide; also included are integrated optics fabrication and characterization techniques.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and fabrication and characterization techniques relevant to integrated optical components and systems.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to optics engineering field.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications design using integrated opto-electronic and wave guides.
4. Identify and solve complex and open ended engineering problems related to optical electronic components and subsystems design and implementation.
5. Compare the methodologies of scientific research and the use of its different tools in the area of integrated optics.
6. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of integrated optics.
7. Analyze simple channel waveguides

3- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Classify the different types of the wave-guides based on their physical structure, properties, principles of operations, and applications. a1-2-2 Demonstrate sufficient essential knowledge and a deep understanding to analyze and design different types of Wave-Guides a1-2-3 Describe different effective techniques and methods, such as the WKB method, the Effective method, beam propagation method, to analyze and design optical wave guides. a1-2-4 Explain the two dimensional wave-guide physical structure, concepts, and properties. a1-2-5 Classify the basic integrated optical components according to their physical structure, properties, and applications. a1-2-6 Discuss the basics integrated optics fabrication techniques. a1-2-7 Explain the most important integrated optics characterization techniques. a1-2-8 Demonstrate a basic understanding of the devices used in optoelectronic integrated circuits and optical signal processing.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the Potential applications of Optical Electronics and Communications field.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Report and discuss social effects of Optical Electronics and Communications field.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain quality assurance concepts of optical Electronics and Communications systems development phases.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional researchpracticein Electronics and Communication	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to Optical Electronics and Communications and its applications.

Engineering.	
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	b2-1-1 identify and apply appropriate methods for discrimination of physics-based integrated optical device models in the context of specific technological constraints .
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Optical Electronics and Communications and its applications.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for Optical Electronics and Communications systems development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical Electronics and Communications systems problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on Photonic semiconductor materials.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems types and technology.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Analysis of Open Wave-Guides.	12	12	--
2- Symmetric Slab Wave-Guide.	6	6	--
3- Multi Layer Wave-Guide Graded Index Wave-Guide.	6	6	--
4- The WKB Method.	6	6	--

5- Two Dimensional Wave-Guide.	6	6	--
6- The Effective Index Method (EIM).	6	6	--
7- Integrated Optical Components.	12	12	--
8- Beam Propagation Method.	6	6	--
9- Fabrication Techniques.	6	6	--
10- Characterization Techniques.	6	6	--
11- Integrated Opto-Electronic.	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2,A1-3, A2-1, A5-1	B1-1, B2-1, B3-1, B5-1	C1-1, C2-1	D3-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	30%	70%	-	-		100%

Course Topics.

Topic No.	Topic	Weeks
1st	1- Analysis of Open Wave-Guides.	**1-4**
2nd	2- Symmetric Slab Wave-Guide.	**5-6**
3rd	3- Multi Layer Wave-Guide Graded Index Wave-Guide.	**7-8**
4th	4- The WKB Method.	**9-10**
5th	5- Two Dimensional Wave-Guide.	**11-12**
6th	6- The Effective Index Method (EIM).	**13-14**
7th	7- Integrated Optical Components.	**15-18**
8th	8- Beam Propagation Method.	**19-20**
9th	9- Fabrication Techniques.	**21-22**
10th	10- Characterization Techniques.	**23-24**
11th	11- Integrated Opto-Electronic.	**25-28**

7- ILOs Matrix Topics

Course topics	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Course ILOs	**Knowledge & Understanding**										
a1-2-1 Classify the different types of the wave-guides based on their physical structure, properties, principles of operations, and applications.	x	x	x								
a1-2-2 Demonstrate sufficient essential knowledge and a deep understanding to analyze and design different types of Wave-Guides.	x	x	x								
a1-2-3 Describe different effective techniques and methods, such as the WKB method, the Effective method, beam propagation method, to analyze and design optical wave guides.				x		x		x			
a1-2-4 Explain the two dimensional wave-guide physical structure, concepts, and properties.					x						
a1-2-5 Classify the basic integrated optical components according to their physical structure, properties, and applications.							x				
a1-2-6 Discuss the basics integrated optics fabrication techniques.									x		
a1-2-7 Explain the most important integrated optics characterization techniques.										x	
a1-2-8 Demonstrate a basic understanding of the devices used in optoelectronic integrated circuits and optical signal processing.											x
a1-3-1 Classify the Potential applications of Optical Electronics and Communications field.											x
a2-1-1 Report and discuss social effects of Optical Electronics and Communications field.											x
a5-1-1 Explain quality assurance concepts of optical Electronics and Communications systems development phases.									x		x
Course ILOs	**Intellectual Skills**										

b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to Optical Electronics and Communications and its applications.	x	x	x	x	x	x	x	x	x	x	x
b2-1-1 identify and apply appropriate methods for discrimination of physics-based integrated optical device models in the context of specific technological constraints .				x		x		x			
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Optical Electronics and Communications and its applications.				x		x		x			
b5-1-1 Evaluate pros and cons of given methodologies for Optical Electronics and Communications systems development.				x		x		x			

Course ILOs	**Professional Skill**										
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical Electronics and Communications systems problems, using latest engineering techniques, skills, and tools.				x		x		x			
c2-1-1 Write and evaluate a professional report on Photonic semiconductor materials.											x
Course ILOs	General Skills										
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.											x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems types and technology.									x	x	

8- Teaching and Learning Method:

Course Intended learning	**Teaching and Learning Method**

outcomes (ILOs)		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-2-1	x			x	x								
	a1-2-2	x			x	x								
	a1-2-3	x			x	x								
	a1-2-4	x			x	x								
	a1-2-5	x			x	x								
	a1-2-6	x			x	x								
	a1-2-7	x			x	x								
	a1-2-8	x			x	x								
	a1-3-1		x	x					x	x				
	a2-1-1		x	x					x	x				
	a5-1-1									x		x		
Intellectual Skills	b1-1-1				x	x								
	b2-1-1				x	x								
	b3-1-1				x	x								
	b5-1-1				x	x				x				
Professional Skills	c1-1-1				x	x								
	c2-1-1		x	x					x					
General Skills	d3-1-1		x							x				
	d5-1-1		x							x				

9- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

10- Facilities required for teaching and learning

Blackboard – Internet for online sessions -Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

11- List of References:*Course and Lab Notes:* No lectures and Labs notes.

Essential Books (Text Books):

- Robert G. Hunsperger, “Integrated Optics”, Springer., Fifth Edition, 2002.
- Reinhard Marz, "Integrated Optics: Design and Modeling", Artech House Publisher, 1995.

Recommended Books:

- Clifford R. Pollock, “Fundamentals of Optoelectronics”, Richard D. Irwin Inc., 1994.

12- Program Coordination Committee:

Course Coordinator:	**Associate Prof. Dr. Sherif M. Sharroush**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020

ECE 615
Optical Measurements
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Optical Measurements	**Code Symbol: ECE 615**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts for the measurement of fast optical processes techniques and methods. Also, this course provides the background relating to the manufacturing and characterization techniques of some types of optoelectronic devices and optical fiber measurements, help students meet the demand of growing semiconductor optoelectronic industry and prepares them to advanced study and research in the semiconductor optics and optoelectronics devices and to be familiar with recent trends in optoelectronics measurements. The students will gain sufficient background to deal with basic optical instrumentation, and to properly carry out measurements employing these instruments. The practical experience will come from the lab work, analysis and write up of the lab measurements.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced optical measurements facts, concepts, principles, techniques and measuring instruments.
2. Collect advanced skills to perform measurements for different optical wave-guides, devices, and systems.
3. Review tools, techniques, equipment and software relevant to optical measurements and how to use them efficiently.
4. Develop methods and use techniques, principles and laws of engineering science to present, evaluate, and interpret experimental data concern with an optical wave-guide, component, system , to develop lines of argument and make sound judgments in accordance with their basic theories and concepts.
5. Identify and categorize the experimental optical components to be built, constructs them on breadboard, and performs the experiment.
6. Compare the methodologies of scientific research and the use of its different tools in the area of optical measurements.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of optical measurements.

3- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Demonstrate sufficient essential knowledge and a deep understanding of the basic concepts for the measurement of fast processes techniques and methods a1-2-2 Classify the basic concepts for the measurement of fast processes techniques and methods according to their use. a1-2-3 Describe different effective techniques and methods to measure of the intensity correlation function. a1-2-4 Demonstrate sufficient essential knowledge and a deep understanding for measurement of The intensity cross correlation functions. a1-2-5 Demonstrate sufficient essential knowledge and a deep understanding to the principles of fluorescence measurement ultra-fast spectroscopy. a1-2-6 Classify the high resolution nonlinear optical spectroscopy measurements methods according to their measurements principles. a1-2-7 Describe Four Wave Mixing and Multi-Photon Spectroscopy measurements methods. a1-2-8 Explain and describe the most common optical fiber and LD measurements.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Report new advances in analysis and design methodologies in Optical Electronics and Communications measurements techniques.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain quality assurance concepts of optical Electronics and Communications systems measurements techniques phases.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and	b1-1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to

designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	**Optical Measurements.**
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems..	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve practical problems related to Optical Electronics and Communications and its applications.
B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering..	b5-1-1 Evaluate pros and cons of given methodologies for Optical Electronics and Communications systems measurements.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, developing plans and creating engineering solutions related to optical Electronics and Communications systems measurement problems, using latest engineering techniques, skills, and tools.
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Deal effectively with the skills that necessary to Use tools, techniques, and equipment relevant to optical wave-guide, device, and systems measurements c1-2-2 Deal effectively with the skills that necessary to identify, design, analysis and categorize the experimental optical components to be built, constructs them on breadboard, and performs the experiment.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on advanced measurement techniques for optical communication systems.
C3-1 Evaluate methods and tools reported in specified published articles and researches concerning specified problem related to his/her research topic in electronics and communications field.	C3-1-1 Evaluate measurements methods, techniques and tools reported in this course.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and

facilities, etc. to upgrade and enhance their conceptual knowledge.	enhance their conceptual knowledge about optical Electronics and Communications systems measurements techniques.

4- Course Contents

Lecture Topic (The lecture will be done inside the Lab)	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Basic Concepts for the Measurement of Fast Processes Techniques and Methods:Sampling Techniques, Intervals Measurement as Spatial Displacement, Signal Conversion Correlation Methods, Limits for Time Resolution. Non Linear Optical Methods for Measuring Ultra-Short Light Pluses.	24	24	--
2- Measurement of The Intensity Correlation Function By Means of Second Harmonic Generation and Two Photon florescence.	12	12	--
3- Measurement Of Intensity Cross Correlation Functions.	6	6	--
4- Fluorescence Measurement Ultra-Fast Spectroscopy.	6	6	--
5- High Resolution Nonlinear Optical Spectroscopy Measurements Methods: Four Wave Mixing and Multi-Photon Spectroscopy.	12	12	
6- Optical Fiber Measurements.	12	12	
7- LD Measurements.	12	12	
Total	84	84	**--**

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-2, A1-3, A5-1	B1-1, B3-1, B5-1	C1-1, C1-2, C2-1, C3-1	D3-1, D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**-**	**30**	**-**	**70**		**100%**

7- Course Topics.

Topic No.	Topic	Weeks

1st	1- Basic Concepts for the Measurement of Fast Processes Techniques and Method:Sampling Techniques, Intervals Measurement as Spatial Displacement, Signal Conversion Correlation Methods, Limits for Time Resolution. Non Linear Optical Methods for Measuring Ultra-Short Light Pluses.	**1-8**
2nd	2- Measurement of The Intensity Correlation Function By Means of Second Harmonic Generation and Two Photon florescence.	**9-12**
3rd	3- Measurement Of Intensity Cross Correlation Functions.	**13-14**
4th	4- Fluorescence Measurement Ultra-Fast Spectroscopy.	**15-16**
5th	5- High Resolution Nonlinear Optical Spectroscopy Measurements Methods: Four Wave Mixing and Multi-Photon Spectroscopy.	**17-20**
6th	6- Optical Fiber Measurements.	**21-24**
7th	7- LD Measurements.	**25-28**

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Course ILOs	**Knowledge & Understanding**						
a1-2-1 Demonstrate sufficient essential knowledge and a deep understanding of the basic concepts for the measurement of fast processes techniques and methods.	x						
a1-2-2 Classify the basic concepts for the measurement of fast processes techniques and methods according to their use.	x						
a1-2-3 Describe different effective techniques and methods to measure of the intensity correlation function.		x					
a1-2-4 Demonstrate sufficient essential knowledge and a deep understanding for measurement of the intensity cross correlation functions.			x				
a1-2-5 Demonstrate sufficient essential knowledge and a deep understanding to the principles of fluorescence measurement ultra-fast spectroscopy.				x			
a1-2-6 Classify the high resolution nonlinear optical spectroscopy measurements methods according to their measurements principles.					x		
a1-2-7 Describe Four Wave Mixing and Multi-Photon Spectroscopy measurements methods.					x		
a1-2-8 Explain and describe the most common optical fiber and LD measurements.						x	x
a1-3-1 Report new advances in analysis and design methodologies in Optical Electronics and Communications measurements techniques.						x	x

a5-1-1 Explain quality assurance concepts of optical Electronics and Communications systems measurements techniques phases.						x	x
Course ILOs	**Intellectual Skills**						
b1-1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to**Optical Measurements.**						x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve practical problems related to Optical Electronics and Communications and its applications.						x	x
b5-1-1 Evaluate pros and cons of given methodologies for Optical Electronics and Communications systems measurements.	x	x	x	x			
Course ILOs	**Professional Skill**						
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, developing plans and creating engineering solutions related to optical Electronics and Communications systems measurement problems, using latest engineering techniques, skills, and tools.						x	x
c1-2-1 Deal effectively with the skills that necessary to use tools, techniques and equipment relevant to optical wave-guide, device, and systems measurements.						x	x
c1-2-2 Deal effectively with the skills that necessary to identify, design, analysis and categorize the experimental optical components to be built, constructs them on breadboard, and performs the experiment.						x	x
c2-1-1 Write and evaluate a professional report on advanced measurement techniques for optical communication systems.						x	x
c3-1-1 Evaluate measurements methods, techniques and tools reported in this course.	x	x	x	x	x	x	x
Course ILOs	**General Skills**						
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.		x	x	x	x	x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems measurements techniques.		x	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method (The teching process will be done inside the Lab)												
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-2-1	x				x								x
	a1-2-2	x				x								x
	a1-2-3	x				x								x
	a1-2-4	x				x								x
	a1-2-5	x				x								x
	a1-2-6	x				x								x
	a1-2-7	x				x								x
	a1-2-8	x				x								x
	a1-3-1			x					x	x				
	a5-1-1			x					x	x				
	b1-1-1					x								x
	b3-1-1					x								
	b5-1-1			x		x			x					
Professional Skills	c1-1-1					x								x
	c1-2-1								x					x
	c1-2-2								x					x
	c2-1-1		x	x					x					
	c3-1-1		x	x					x					x
General Skills	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions-Blackboard – Class Room Equipped with Computer and Video Projector –Optical Measurement Practical Lab - Library.

A. laboratory Usage (During Lectures):

The teaching process will be done inside the Lab and the professor and thestudents are expected to prepare and conduct some practical experiments.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

No lectures and Labs notes.

Essential Books (Text Books):

- Steve Vanlanduit and Patrick Guillaume, “Optical Measurements Techniques”, Elsevier Ltd, 2008.

- Franz Mayinger and Oliver Feldmann, "Optical Measurements Techniques and Applications", Second Edition, Elsevier Ltd, 2001.

Recommended Books:

- Rongqing Hui and Maurice O'Sullivan "Fiber Optic Measurements Techniques" , Academic Press, 2008
- Pramod K. Rastogi, "Optical Measurements Techniques and Applications", Artech House Publisher, 1997.

13- Program Coordination Committee:

Course Coordinator:	**Associate Prof. Dr. Sherif M. Sharroush**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 616

Optical Wave Guide Engineering

Course Specification

Course Specification

Program on which the course is given:	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program:	**Major**
Department offering the program:	**Electrical Engineering**
Department offering the course:	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval:	**2020**

A- Basic Information

Title: Optical Wave Guide Engineering	**Code Symbol: ECE 616**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2004**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in optical engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in optical engineering and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in a variety of different areas of optical engineering and optical waveguides design.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to optical engineering.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to optical waveguides.
3. Develop models and methods and use techniques, principles and laws of optical engineering in order to lead to optical waveguides design.
4. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of optical communications.

3- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communication Engineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the	a1-2-1 Recognize the concepts of the most common asymmetric slide optical waveguides. a1-2-2 Classify the optical fibers according to their

courses that affect his/her professional research practice in Electronics and Communication Engineering.	coefficients. a1-2-3 Describe the wave motion in waveguides. a1-2-4 Recognize the energy band structure and the lattice vibration. a1-2-5 Discuss the WKB method.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the Potential applications of optical waveguides in advanced electronics and communication systems.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to optical waveguides.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to optical waveguides.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems..	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical waveguide design.
D. General and transferrable skills	
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical waveguides types and technology.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Optical communications systems.	6	6	--
2- The use of optical waveguides.	6	6	--
3- Asymmetric slide waveguide.	6	6	--
4-Types of optical waveguides.	6	6	--

5- Refractive index.	6	6	--
6- WKB method.	6	6	--
7- WKB method.	6	6	--
8- Wave processing.	12	12	--
9- Dispersion.	12	12	--
10- Attenuation.	6	6	--
11 - Detection.	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	**A1-2, A1-3**	**B1-1, B3-1**	**C1-1**	**D5-1**

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**	**-**		**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Optical communications systems**.**	**1-2**
2nd	The use of optical waveguides.	**3-4**
3rd	Types of optical waveguides Asymmetric slide waveguide.	**5-8**
4th	Refractive index.	**9-10**
5th	WKB method.	**11-14**
6th	Wave processing.	**15-18**
7th	Dispersion.	**19-22**
8th	Attenuation.	**23-24**
9th	Detection.	**25-28**

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**
Course ILOs	**Knowledge & Understanding**								
a1-2-1 Recognize the concepts of the most common asymmetric slide optical			x						

waveguides.									
a1-2-2 Classify the optical fibers according to their coefficients.		x	x	x					
a1-5-3 Describe the wave motion in waveguides.		x	x			x	x	x	x
a1-2-4 Recognize the energy band structure and the lattice vibration.		x	x	x					
a1-2-5 Discuss the WKB method.					x				
a1-3-1 Classify the Potential applications of optical waveguides in advanced electronics and communication systems.	x	x							
Course ILOs	**Intellectual Skills**								
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to optical waveguides.			x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to optical waveguides.			x	x	x	x	x	x	x
Course ILOs	**Professional Skill**								
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical waveguide design.			x	x	x	x	x	x	x
Course ILOs	**General Skills**								
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical waveguides types and technology.						x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)	Teaching and Learning Method												
	Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments

Knowledge & understanding	a1-2-1	x			x	x								
	a1-2-2	x			x	x								
	a1-2-3	x			x	x								
	a1-2-4	x			x	x								
	a1-2-5	x			x	x								
	A1-3-1	x			x	x								
Intellectual Skills	b1-1-1		x			x								
	b3-1-1		x			x								
Professional Skills	c1-1-1		x			x								
General Skills	d5-1-1		x						x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions- Blackboard – Class Room Equipped with Computer and Video Projector - - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

No lectures and Labs notes.

Essential Books (Text Books):

- Safa O. Kasap "Optical waveguides and Devices", McGraw-Hill, Second Edition, 2005.

13- Program Coordination Committee:

.Course Coordinator	Program Coordinator
Dr. Mohamed Farouk Abdelkader	**Assist. Dr. Saly Hassaneen**

Head of the Department
Prof. Dr. Rawya Yehia Rizk
Electrical Engineering Dept. Faculty of Engineering-Port Said.
Update Date: 10/2020.

ECE 617
Optics Engineering
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	***2020***

A- Basic Information

Title: Optics Engineering	**Code Symbol: ECE 617**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in optics engineering theories and principles. Students will gain an understanding of diffraction theory, principles and integral, Gaussian beam propagation, lens and laser characteristics, fiber optic properties and geometrical optic. Ultimately, the tools acquired in this course will prepare students for more advanced optical engineering topics.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to lens properties, laser characteristics, fiber optic capabilities and other aspects of optical communication and technology.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to optics engineering field.
3. Develop models and methods and use techniques, principles and laws of engineering science to incorporate various optics elements into the design of optical systems for research and innovation.
4. Identify techniques which enables three-dimensional images to be made.
5. Review the tools required to prepare students for more advanced optical engineering topics.

3- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient	a1-2-1 Demonstrate sufficient essential knowledge

specializedknowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	and a deep understanding of the basics of diffraction theory, principles and integral. a1-2-2 Describe the behavior of the field of a Gaussian beam as it propagates. a1-2-3 Demonstrate sufficient essential knowledge and a deep understanding of the basics of waves optics of thin lenses. a1-2-4 Describe the behavior of the propagation of light in optical systems using Fourier transform techniques. a1-2-5 Describe Holography technique which enables three-dimensional images to be made. a1-2-6 Demonstrate sufficient essential knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to fiber optic.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	b1-1-1 apply relevant scientific and engineering principles to solve real world optical engineering problems.
B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering.	b5-1-1 Assess and analyze risks of the professional practice to select the most appropriate model of an optical component to perform analysis and search for optimized solutions.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical engineering problems, using latest engineering techniques, skills, and tools.
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1Use a wide range of computational and technical toolsincludingpertaining software packages to develop models to incorporate various optics elements into the design of optical systems for research and innovation.
D. General and transferrable skills	
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems types and technology.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Diffraction Theory, Principles and Integral.	12	12	--
2- Gaussian Beam Propagation.	12	12	--
3- Wave Optics of Thin Lenses.	15	15	--
4- Fourier Optics.	15	15	--
5- Holography.	12	12	--
6- Optical Fiber: Step and Graded Index.	18	18	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-2	B1-1, B5-1	C1-1, C1-2	D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	30%	70%	-	-		100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	1- Diffraction Theory, Principles and Integral.	**1-4**
2nd	2- Gaussian Beam Propagation.	**5-8**
3rd	3- Wave Optics of Thin Lenses.	**9-13**
4th	4- Fourier Optics.	**14-18**
5th	5- Holography.	**19-22**
6th	6- Optical Fiber: Step and Graded Index.	**23-28**

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	
Course ILOs	**Knowledge & Understanding**						
a1-2-1 Demonstrate sufficient essential knowledge and a deep understanding of the basics of diffraction theory,	x						

principles and integral.							
a1-2-2 Describe the behavior of the field of a Gaussian beam as it propagates.		x					
a1-2-3 Demonstrate sufficient essential knowledge and a deep understanding of the basics of waves optics of thin lenses.			x				
a1-2-4 Describe the behavior of the propagation of light in optical systems using Fourier transform techniques.				x			
a1-2-5 Describe Holography technique which enables three-dimensional images to be made.					x		
a1-2-6 Demonstrate sufficient essential knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to fiber optic.						x	
Course ILOs	**Intellectual Skills**						
b1-1-1 apply relevant scientific and engineering principles to solve real world optical engineering problems	x	x	x	x	x	x	
b5-1-1 Assess and analyze risks of the professional practice to select the most appropriate model of an optical component to perform analysis and search for optimized solutions.	x	x	x	x	x	x	
Course ILOs	**Professional Skill**						
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to optical engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	
c1-2-1Use a wide range of computational and technical toolsincludingpertaining software packages to develop models to incorporate various optics elements into the design of optical systems for research and innovation.	x	x	x	x	x	x	
Course ILOs	**General Skills**						
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about optical Electronics and Communications systems types and technology.						x	

9- Teaching and Learning Method:

Course Intended learning	Teaching and Learning Method

outcomes (ILOs)		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-2-6	x				x								
Intellectual Skills	b1-1-1			x		x								
	b5-1-1			x		x								
Professional Skills	c1-1-1			x		x								
	c1-2-1			x		x							x	
General Skills	d5-1-1		x						x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions- Blackboard – Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using MATLAB simulators using general computer labs during the class and at home.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of References:

Course and Lab Notes:

No lectures and Labs notes.

Essential Books (Text Books):

- Optics, 4th edition, by Eugene Hecht, (Addison Wesley Longman, 2002)

Recommended Books:

- Modern Optical Engineering, 3th ed., Warren J. Smith, Mc Graw Hill, 2000)

13- Program Coordination Committee:

Course Coordinator:	**Associate Prof. Dr. Sherif M. Sharroush**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 618

Optical Communication Systems

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Optical Communication Systems	**Code Symbol: ECE618**	
Lecture	**3 hours**	
Tutorial / Laboratory	**0 hours**	
Total	**3 hours**	**Bylaw 2004**

B- Professional Information

1- Course Aims:

The aims of this course are to provide the students with a solid background on the problems encountered in optical fiber communications such as attenuation and dispersion. Also, the transmitter, receiver systems, splices, connectors, and fiber-optic networks will be considered.

2- Course Objectives:

1. Revise the basic necessary background in waveguides and transmission of light in optical fiber.
2. Review the optical amplification methods.
3. Compare methods of optical fiber components and multiplexing and demultiplexing.
4. Report on optical-fiber network components.

3- Intended Learning Outcomes (ILOs):

Field	Program ILOs that the course contribute in achieving	Course ILOs
Knowledge & Understanding	A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	**a-1-2-1 Review the basic physics of light necessary for understanding optical-fiber communications.** **a1-2-2 Describe the propagation of plane waves inside the optical fiber.** **a1-2-3 Studying the principles of design of Optical amplification – multiplexing and demultiplexing**. **a1-2-4 Describe Fabrication, cabling, and installation – testing of an optical communication system** **a1-2-5 Explain Splices and connectors – light sources and transmitters – receivers.** **a1-2-6 Describe the fiber optic networks**

		and its components. **a1-2-7 Studying the impact of optical communications on the realm of communications and the internet.**
Intellectual skills	B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practicein Electronics and Communication Engineering.	**b1-1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining toOptical Communication Systems**
	B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	**b2-1-1 Solve specialized problems with available givens and parameters in optical components, optical amplifiers, multiplexing, and demultiplexing.**
Professional skills	C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	**c1-1-1Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solveproblems pertaining toOptical Communication Systems**
	C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	**c2-1-1 Professionally write reports about the evaluation of the performance of the current optical communication systems.**
	C3-1 Evaluate methods and tools reported in specified published articles and researches concerning specified problem related to his/her research topic in electronics and communications field.	**c3-1-1 Evaluate methods and tools reported in a specified published articles and researches concerning optical amplifiers, multiplexing, and demultiplexing.**
General skills	D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	**d5-1-1Use information technology to search for the state-of-of-the-art technologies and enhancements in Optical Communication Systems.**

4-Course Contents

Week No.	Topic	Total Hours	Contact hrs		
			Lec.	Tut.	Lab.
Week 1+2+3+4	**Lecture:** Introduction to telecommunications and fiber optics - Physics of light (waveguide and quantum theories).	12	12	-	

Week 5+6+7	**Lecture:** Attenuation and dispersion.	9	9		
Week 8+9+10	**Lecture:** Optical amplification – multiplexing and demultiplexing.	9	9		
Week 11+12+13	**Lecture:** Fabrication, cabling, and installation – testing	9	9		
Week 14+15+16+17+18	**Lecture:** Splices and connectors – light sources and transmitters – receivers.	15	15		
Week 19+20+21+22+23+24	**Lecture:** Introduction to fiber optic networks and its components.	18	18		
Week 25+26+27	**Lecture:** Impact of optical communications on the realm of communications and the internet.	9	9		
Week28	General Revision.	3	3		

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	**Intellectual Skills**	**Professional Skills**	**General Skills**
Program Academic Standards that the course contributes in achieving.	**A1-2**	**B1-1, B2-1**	**C1-1, C2-1, C3-1**	**D5-1**

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30**	**70%**	**-**	**-**		**100%**

7- Course Topics.

Topic No.	**Topic**	**Weeks**
1st	Introduction to telecommunications and fiber optics.	1-4
2nd	Attenuation and dispersion.	5-7

3th	Optical amplification – multiplexing and demultiplexing.	8-9
4th	Fabrication, cabling, and installation – testing	11-13
5th	Splices and connectors – light sources and transmitters – receivers.	14-18
6th	Introduction to fiber optic networks and its components.	19 - 24
7th	Impact of optical communications on the realm of communications and the internet.	25- 28

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics						
		1st	2nd	3rd	4th	5th	6th	7th
Knowledge & Understanding	**a-1-2-1 Review the basic physics of light necessary for understanding optical-fiber communications.**	X						
	a1-2-2 Describe the propagation of plane waves inside the optical fiber.		X					
	a1-2-3 Studying the principles of design of Optical amplification – multiplexing and demultiplexing.			X				
	a1-2-4 Describe Fabrication, cabling, and installation – testing of an optical communication system				X			
	a1-2-5 Explain Splices and connectors – light sources and transmitters – receivers.					X		
	a1-2-6 Describe the fiber optic networks and its components.						X	
	a1-2-7 Studying the impact of optical communications on the realm of communications and the internet.							X
Intellectual Skills	**b1-1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining toOptical Communication Systems**		X	X	X	X	X	X
	b2-1-1 Solve specialized problems with available givens and parameters in optical components, optical amplifiers, multiplexing, and demultiplexing.			X			X	
Professional Skill	**c1-1-1Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solveproblems pertaining toOptical Communication Systems**	X	X	X	X	X	X	X
	c2-1-1 Professionally write reports about the evaluation of the performance of the current optical communication systems.					X	X	X

	c3-1-1 Evaluate methods and tools reported in a specified published articles and researches concerning optical amplifiers, multiplexing, and demultiplexing.			x			x	
General Skills	**d5-1-1Use information technology to search for the state-of-of-the-art technologies and enhancements in Optical Communication Systems.**			x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1--1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-2-6	x				x								
	a1-2-7	x				x								
Intellectual Skills	b1-1-1					x							x	
	b2-1-1					x							x	
Professional Skills	c1-1-1					x			x	x				
	c2-1-1		x						x	x				
	c3-1-1							x					x	
General Skills	d5-1-1								x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions- Blackboard – Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using MATLAB simulators using general computer labs during the class and at home.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. D. K. Mynbaev and L. L. Scheiner, Fiber-Optic Communications Technology, Prentice Hall, 2001.

2. J. M. Senior, Optical Fiber Communications: Principles and Practice, Prentice-Hall, Third Edition, 2009.

13- Program Coordination Committee:

.Course Coordinator	Program Coordinator
Dr. Saly S. Hassaneen	**Assist. Dr. Saly Hassaneen**

Head of the Department

Prof. Dr. Rawya Yehia Rizk

Electrical Engineering Dept. Faculty of Engineering-Port Said.

Updated Date: 10/2020

ECE-619

Microwave Theory and Technique

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Microwave Theory and Technique	**Code Symbol: ECE619**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in microwave engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in microwave theory and techniques and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of microwave engineering. The course is meant to create the deep understanding of the physics behind the phenomena of guided wave propagation in different microwave structures. The course is meant also to enhance the ability of the student to integrate the proper microwave component in various communication systems. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to microwave engineering.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to microwave circuits and systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using microwave components.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to microwave systems.
5. Identify current problems and find solutions for it using microwave components in the area of communication systems.
6. Compare the methodologies of scientific research and the use of its different tools in the area of microwave engineering.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of microwave engineering.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the microwave propagation in guiding structures. a1-2-2 Recognize the methods of analysis for microwaves. a1-2-3 Recognize the differences between microwave circuits components and other components operating at lower frequencies.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the potential applications of new types of microwave devices in advanced electronics and communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Report and discuss social effects of microwave applications.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain quality assurance concepts of different microwave components and systems development phases
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practicein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the microwave problems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to microwaves.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for microwave component development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to microwave problems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on vector network analyzer.

D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about microwave components and technology.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Revision on the undergraduate materials related to microwaves	9	9	-	--
2. Microwave network analysis	9	9	-	--
3. Passive microwave components	9	9	-	--
4. Micrpstrip components	9	9	-	--
5. Dielectric waveguides and resonators	9	9	-	--
6. Excitation of waveguides and resonators	9	9	-	--
7. Impedance transformation and matching	9	9	-	--
8. Ferrimagnetic components	9	9	-	--
9. Microwave filters	12	12	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2, A1-3, A2-1, A5-1	B1-1, B3-1, B5-1	C1-1, C2-1	D3-1,D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Discretionary subjects	Total
---	---	30%	70%	-			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision on the undergraduate materials related to microwaves	1-3
2nd	Microwave network analysis	4-6
3rd	Passive microwave components	7-9
4th	Micrpstrip components	10-12
5th	Dielectric waveguides and resonators	13-15
6th	Excitation of waveguides and resonators	16-18
7th	Impedance transformation and matching	19-21
8th	Ferromagnetic components	22-24
9th	Microwave filters	25-28

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**
Course ILOs	**Knowledge & Understanding**								
a1-2-1 Describe the microwave propagation in guiding structures.	x		x		x			x	
a1-2-2 Recognize the methods of analysis for microwaves.	x	x	x	x	x	x		x	
a1-2-3 Recognize the differences between microwave circuits components and other components operating at lower frequencies.	x	x	x	x	x		x		x
a1-3-1 Classify the Potential applications of new types of microwave devices in advanced electronics and communication systems.			x	x	x			x	x
a2-1-1 Report and discuss social effects of microwave applications.	x	x							
a5-1-1 Explain Quality Assurance concepts of different microwave components and systems development phases.		x					x		x
Course ILOs	**Intellectual Skills**								
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the microwave problems.	x	x				x			x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to microwaves.		x				x	x		x
b5-1-1 Evaluate pros and cons of given methodologies for microwave component development.			x	x	x		x	x	x
Course ILOs	**Professional Skill**								
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to microwave problems, using latest engineering techniques, skills, and tools.						x	x		x

c2-1-1 Write and evaluate a professional report on vector network analyzer.		x							
Course ILOs	**General Skills**								
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.		x	x	x	x	x	x	x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about microwave components and technology.		x	x	x	x			x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer**	**Practical**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-3-1	x				x								
	a2-1-1	x				x								
	a5-1-1	x				x								
Intellectual Skills	b1-1-1					x								
	b3-1-1			x		x								
	b5-1-1		x	x					x					
Professional Skills	c1-1-1					x								
	c2-1-1		x	x					x	x				
General Skills	d3-1-1		x						x	x				
	d5-2-1		x						x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions-Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. David M. Pozar, " Microwave Engineering," John Wiley & Sons, 2005.
2. R. E. Collin, " Foundations for Microwave Engineering," John Wiley & Sons, 2001.

13- Program Coordination Committee:

Course Coordinator:	**Dr. Heba Yousef**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020

ECE-620

Microwave Communication Systems

Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Microwave Communication Systems	**Code Symbol: ECE620**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in microwave engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in microwave theory and techniques and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of microwave engineering. The course is meant to create the deep understanding of the physics behind the phenomena of guided wave propagation in different microwave structures. The course is meant also to enhance the ability of the student to integrate the proper microwave component in various communication systems. Emphasis will be on the new devices and advanced methods of analysis and design.

2- Course Aims:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to microwave engineering.
2. Collect advanced skills in the definition, physics, analysis, and solving of problems related to microwave circuits and systems.
3. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using microwave components.
4. Classify modern methods to identify/solve complex and open ended engineering problems related to microwave systems.
5. Identify current problems and find solutions for it using microwave components in the area of communication systems.
6. Compare the methodologies of scientific research and the use of its different tools in the area of microwave engineering.
7. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of microwave engineering.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	

A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Describe the microwave propagation effects. a1-2-2 Recognize the methods of analysis for microwave propagation. a1-2-3 Recognize the differences between microwave communication techniques.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to microwave devices in communication systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Report and discuss social effects of microwave communication systems.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different microwave communication systems development phases
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practicein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the problems of microwave communication systems.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to microwave communication systems.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given methodologies for microwave communication systems development.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to the problems arising in microwave communication systems, using latest engineering techniques, skills, and tools.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on diversity techniques.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and

electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about microwave communication systems.

4- Course Contents

Topic	Total Hours	Contact hrs		
		Lec.	Tut.	Lab.
1. Revision on the undergraduate materials related to microwave propagation	12	12	-	--
2. Review on propagation effects including reflection, refraction, multipath, scattering and absorption	12	12	-	--
3. Classification of microwave communication systems	12	12	-	--
4. Analysis and design terrestrial radio links	12	12	-	--
5. Analysis and design satellite radio links	12	12	-	--
6. Effect of noise, interference and fading	12	12	-	--
7. Diversity techniques	12	12	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1-2, A1-3, A2-1, A5-1	B1-1, B3-1, B5-1	C1-1, C2-1	D3-1,D5-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Discretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**			**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision on the undergraduate materials related to microwave propagation	1-4
2nd	Review on propagation effects including reflection, refraction, multipath, scattering and absorption	5-8
3rd	Classification of microwave communication systems	9-12
4th	Analysis and design terrestrial radio links	13-16
5th	Analysis and design satellite radio links	17-20
6th	Effect of noise, interference and fading	21-24
7th	Diversity techniques	25-28

8- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**
Course ILOs	**Knowledge & Understanding**						
a1-2-1 Describe the microwave propagation effects.	x	x					
a1-2-2 Recognize the methods of analysis for microwave propagation.	x	x	x	x			
a1-2-3 Recognize the differences between microwave communication techniques.			x	x	x		x
a1-3-1 Classify the Potential applications of new types of microwave devices in communication systems.			x	x			
a2-1-1 Report and discuss social effects of microwave communication systems.	x	x	x	x			
a5-1-1 Explain Quality Assurance concepts of different microwave communication systems development phases.				x	x	x	x
Course ILOs	**Intellectual skills**						
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the problems of microwave communication systems.	x	x		x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to microwave communication systems.		x		x	x	x	x
b5-1-1 Evaluate pros and cons of given methodologies for microwave communication systems development.			x	x	x		x
Course ILOs	**Professional and practical skills**						
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to the problems arising in microwave communication systems, using latest		x		x	x	x	x

engineering techniques, skills, and tools.							
c2-1-1 Write and evaluate a professional report on diversity techniques.							x
Course ILOs	**General and transferrable skills**						
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.		x	x	x	x	x	x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about microwave communication systems.			x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**											
		Lecture+ online sessions	**Presentation and**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer**	**Practical**
Knowledge & understanding	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-3-1		x	x					x	x				
	a2-1-1		x	x					x	x				
	a5-1-1		x							x				
Intellectual Skills	b1-1-1		x											
	b3-1-1		x											
	b5-1-1		x	x					x	x				
Professional Skills	c1-1-1		x											
	c2-1-1		x	x					x	x				
General Skills	d3-1-1		x							x				
	d5-1-1		x							x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. Roger L. Freeman, " Radio System Design for Telecommunications ," Third Edition, John Wiley & Sons, 2007.

2. Louis J. Ippolito, Jr., "Satellite Communications Systems Engineering Atmospheric Effects, Satellite Link Design and System Performance," John Wiley & Sons, 2008.

13- Program Coordination Committee:

Course Coordinator:	**Dr. Rania M. Abd Allah**
Program coordinator:	**Assist. Dr. Saly Hassaneen**
Head of the Department:	**Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 621
Random System Analysis
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering)**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Random System Analysis	**Code Symbol: ECE621**	
Lecture	**3 hours**	
Tutorial / Laboratory	**--**	
Total	**3 hours**	**By law 2000**

B- Professional Information

1- Course Aims:

This course is designed to extend basic concepts learned in systems engineering. For those students who look toward an industrial position after graduation, this course is designed to widen background in system analysis and help them to meet the industry demand. This course will also provide an excellent opportunity to prepare the graduates for advanced study in different areas of random system analysis. The course is meant to create the deep understanding of the basics and theories behind the modern random system analysis. Emphasis will be on the new methods of analysis and design.

2- Course Aims:

The main Objectives of this course are to:

1. Gain knowledge and understanding of key and advanced facts, theories, concepts, principles and techniques relevant to random system analysis.
2. Develop models and methods and use techniques, principles and laws of engineering science in order to lead to engineering applications using random system analysis.
3. Classify modern methods to identify/solve complex and open ended engineering problems related to random systems.
4. Identify current problems and find solutions for it using random system analysis.
5. Apply specialized knowledge and combine it with relevant knowledge in his / her professional practice in the area of random systems.

3- Intended Learning Outcomes (ILOs)

Program ILOs	Course ILOs
A. Knowledge and understanding	

A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	a1-1-1 Demonstrate sufficient essential knowledge, concepts and theories of mathematics to understandprobabilities and stochastic processes a1-1-2 Demonstrate sufficient essential knowledge, concepts and theories of mathematics to develop mathematical models for random signals.
A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Illustrate the response of linear systems to random inputs. a1-2-2 Describe Kalman filter. a1-2-3 Demonstrate additional knowledge on kalman filters and their applications. a1-2-4 Recognize the methods of analysis for random systems. a1-2-5 Describe the main differences between determined and random systems.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practicein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the random systems problems.
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	b2-1-1 Analyze, interpret and manipulate data with a non-classical nature and relate it to solve professional problems related to random systems.
Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems related to Random System Analysis
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Use a wide range of computational and technical tools and techniques, including pertaining software packages to analysis and design professional random systems problems.
D. General and transferrable skills	
D2-1 Demonstrate efficient IT	d2-1-1 Use state-of-the-art computer aided design

capabilities in such a way that serves in the development of him/ her professional practice and research.	tools for solving professional random systems problems.
D4-1 Design standards to evaluate others performance.	d4-1-1 Demonstrate ability to critically evaluate other performance in a systematic and standard way.
D6-1 Collaborate effectively within multidisciplinary team and lead teams in different professional contexts.	d6-1-1 Demonstrate significantly enhanced group working abilities to implement a certain project.
D7-1Demonstrate a high level of competence in the time management.	d7-1-1 Manage time and work to deadlines.

4- Course Contents

Topic	*Total Hours*	*Contact hrs*		
		Lec.	**Tut.**	**Lab.**
1. Probabilities and stochastic processes	12	12	-	--
2. Mathematical models for random signals.	12	12	-	--
3. Response of linear systems to random inputs.	12	12	-	--
4. Kalman filter.	12	12	-	--
5. Applications and additional topics on kalman filters.	9	9	-	--
6. Smoothing and applications.	12	12	-	--
7. Integrated problems.	15	15	-	--
Total	84	84	-	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	**Intellectual Skills**	**Professional Skills**	**General Skills**
Program Academic Standards that the course contribute in achieving	**A1-1, A1-2**	**B1-1, B2-1**	**C1-1, C1-2**	**D2-1, D4-1, D6-1, D7-1**

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**			**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Probabilities and stochastic processes	1-4
2nd	Mathematical models for random signals.	5-8
3rd	Response of linear systems to random inputs.	9-12
4th	Kalman filter.	13-16
5th	Applications and additional topics on kalman filters.	17-19
6th	Smoothing and applications.	20-23
7th	Integrated problems.	24-28

8- ILOs Matrix Topics

Course topics	1st	2nd	3rd	4th	5th	6th	7th
Course ILOs	Knowledge & Understanding						
a1-1-1 Demonstrate sufficient essential knowledge, concepts and theories of mathematics to understand probabilities and stochastic processes	x						
a1-1-2 Demonstrate sufficient essential knowledge, concepts and theories of mathematics to develop mathematical models for random signals.		x					
a1-2-1 Illustrate the response of linear systems to random inputs.			x				
a1-2-2 Describe Kalman filter.				x			
a1-2-3 Demonstrate additional knowledgeon kalman filters and their applications.					x		
a1-2-4 Recognize the methods of analysis for random systems.					x	x	
a1-2-5 Describe the main differences between determined and random systems.					x		x
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve the random systems problems.	x	x	x	x	x	x	x
b2-1-1 Analyze, interpret and manipulate data with a non-classical nature and relate it to solve professional problems related to random systems.						x	x
c1-1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems related to Random System Analysis	x	x	x	x	x	x	x
c1-2-1 Use a wide range of computational and technical tools and techniques, includingpertaining software packages to analysis and design professional random systems problems.	x	x	x	x	x	x	x

d2-1-1 Use state-of-the-art computer aided design tools for solving professional random systems problems.	x	x	x	x	x	x	x
d4-1-1 Demonstrate ability to critically evaluate other performance in a systematic and standard way.	x	x	x	x	x	x	x
d6-1-1 Demonstrate significantly enhanced group working abilities to implement a certain project.	x	x	x	x	x	x	x
d7-1-1 Manage time and work to deadlines.	x	x	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	x				x								
	a1-1-2	x				x								
	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
Intellectual Skills	b1-1-1					x								
	b2-1-1					x							x	
Professional and practical skills	c1-1-1					x								
	c2-1-1			x		x							x	
General Skills	d2-1-1			x					x				x	
	d4-1-1							x						
	d6-1-1							x						
	d7-1-1							x						

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week

Final Examination	**100**	Decided by the College Council
Total	**100%**	

11- Facilities required for teaching and learning

Internet for online sessions- Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using random systems simulators on general computer labs during the class or/and home.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

12- List of references:

1. S.L.Miller, " Probability and random processes with applications to signal processing and communications," Academic Press, **2nd edition, 2012.**

2. D.F.Mix,''Random Signal Analysis.'' **Prentice Hall, 1995.**

13- Program Coordination Committee:

Course Coordinator: **Dr. Mohamed Farouk Abdelkader**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020

ECE 622
Theory of Electronic Navigation
Course Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Theory of Electronic Navigation	**Code Symbol: ECE 622**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course aims at providing students with the basic knowledge and understanding of theories of navigation systems. This includes Mathematical and statistical methods of basic navigation systems, error analysis, and error ellipse.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of principles of navigation systems.
2. Compare error analysis methods.
3. Build advanced skills in assessing navigation systems performance.
4. Determine error ellipses for navigation systems.
5. Apply the methodologies of scientific research and the use of its different tools in the area of navigation systems.

3- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communication Engineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	a1-1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of statistical methods required in analysis of navigation systems. a1-1-2Demonstrate sufficient essential knowledge concepts and theories of mathematics required in modeling of navigation systems.

A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Discuss error analysis and error ellipse a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of how different navigation systems work and perform.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practicein Electronics and Communication Engineering.	b1-1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining torelated to navigation.
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	b2-1-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems related to error analysis and error ellipse.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Evaluate pros and cons of given methodologies for a navigation system.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problems.	c1-1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern and principle of professional skills to solve engineering problemrelated to navigation.
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1 Use a wide range of computational and technical tools and techniques, includingpertaining software packages to analysis and design a navigation system.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on Mathematical Models of Navigation Systems.
D. General and transferrable skills	
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about navigation systems.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Principles of Radio Navigation	18	18	--
2- Error Analysis	18	18	--
3- Error Ellipse	12	12	--
4- Principles of Navigation Systems	18	18	--
5- Mathematical Models of Navigation Systems	18	18	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	**Intellectual Skills**	**Professional Skills**	**General Skills**
Program Academic Standards that the course contributes in achieving.	**A1-1, A1-2**	**B1-1, B2-1, B3-1**	**C1-1, C1-2, C2-1**	**D5-1**

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**	**-**		**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	1- Principles of Radio Navigation	**1-6**
2nd	2- Error Analysis	**7-12**
3rd	3- Error Ellipse	**13-15**
4th	4- Principles of Navigation Systems	**16-21**
5th	5- Mathematical Models of Navigation Systems	**22-28**

8- ILOs Matrix Topics

Course topics	Course topics

	1st	2nd	3rd	4th	5th
a1-1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of statistical methods required in analysis of navigation systems.		x	x		x
a1-1-2Demonstrate sufficient essential knowledge concepts and theories of mathematics required in modeling of navigation systems.					x
a1-2-1 Discuss error analysis and error ellipse		x	x		
a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of how different navigation systems work and perform.	x				x
b1-1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining torelated to navigation.		x	x	x	x
b2-1-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems related to error analysis and error ellipse.		x	x		
b3-1-1 Evaluate pros and cons of given methodologies for a navigation system.	x				x
c1-1-1 Express competence skills, such as identifying, formulating, analyzing navigation errors and performances.		x	x	x	x
c1-2-1 Use a wide range of computational and technical tools and techniques, includingpertaining software packages to analysis and design a navigation system.		x	x		x
c2-1-1 Write and evaluate a professional report on error ellipse methods.		x	x		
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about navigation systems.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture+ online sessions	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	x				x								
	a1-1-2	x				x								
	a1-2-1	x				x								
	a1-2-2	x				x								
Intellectual	b1-1-1					x								

Skills	b2-1-1			x		x							x	
	b3-1-1			x		x							x	
Professional Skills	c1-1-1			x		x								
	c1-2-1												x	
	c2-1-1		x	x					x	x				
	d5-1-1		x	x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

10- Facilities required for teaching and learning

Internet for online sessions- Blackboard – Class Room Equipped with Computer and Video Projector - Computer Lab with Preinstalled MATLAB software package (last version) - Library.

A. laboratory Usage (During Lectures):

Students are expected to prepare and conduct some computer simulation assignments using MATLAB simulators using general computer labs during the class and/or at home.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

11- List of References:

Course and Lab Notes:

Lectures notes are provided

Essential Books (Text Books):

Electronic Navigation Systems, Laurie Tetley and David Calcutt, 3rd edition, 2001, ISBN: 0 7506 51385

12- Program Coordination Committee:

Course Coordinator: **Associate Prof. Dr. Sherif Abo-El-Enein**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

ECE 623
Electronic Navigation Systems
Course
Specification

Course Specification

Program on which the course is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D Preparatory Year**
Date of specification approval	**2020**

A- Basic Information

Title: Electronic Navigation Systems	**Code Symbol: ECE 623**	
Lecture	**3 hours**	
Tutorial / Laboratory	**-**	
Total	**3 hours**	**Bylaw 2000**

B- Professional Information

1- Course Aims:

This course aims at providing students with advanced knowledge and understanding of electronic navigation system including direction finders, position fixing systems, inertial navigation systems, echo sounders, LORAN systems, and integrated navigation systems.

2- Course Objectives:

The main Objectives of this course are to:

1. Gain knowledge and understanding of electronic navigation systems.
2. Assess the performance of different systems used in navigation.
3. Identify different technologies utilized in electronic navigation.
4. Compare the methodologies of scientific research and the use of its different tools in the area of electronic navigation.
5. Review electronic navigation.

3- Intended Learning Outcomes (ILOs) for the whole program

Electronics and Communication Engineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

Program ILOs	Course ILOs
A. Knowledge and understanding	
A1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics and computer science appropriate to their areas of specialization in Electronics and Communication Engineering.	a1-1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics to deal effectively with analyzing and designing navigation systems.

A1-2Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of the courses pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practice in Electronics and Communication Engineering.	a1-2-1 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of signals and systems. a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of Radio and Inertial navigation systems. a1-2-3 Recognize direction finders and position fixing systems a1-2-4 Discuss Echo sounders and LORAN. a1-2-5 Demonstrate sufficient specialized knowledge to be able to identifying, formulating, solving, analyzing, and designing problems pertaining Integrated Navigation Systems.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to electronic navigation systems.
A2-1 Discuss mutual influence between professional practice of electronics and communication technologiesand its impacts on the environment.	a2-1-1 Report and recognize the professional aspects of navigation systems and their effects on the environment.
B. Intellectual skills	
B1-1 Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing problems pertaining to a Ph. D thesis, as well as the courses that affect his/her professional research practicein Electronics and Communication Engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach to solve problems related to electronic navigation systems.
B3-1Demonstrate a high level of competence in the coordination of different sources of knowledge to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems in electronic navigation.
B5-1 Assess and analyze risks of the professional practicein electronics and communications engineering.	b5-1-1 Evaluate pros and cons of given electronic navigation system.
C. Professional and practical skills	
C1-1 Apply knowledge of mathematics, science, information technology, design, numerical modeling, modern, and principle of professional skills to solve engineering problems.	c1-1-1 Express competence skills, such as identifying, formulating, and analyzing various navigation systems.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write and evaluate a professional report on integrated navigation systems.
C3-1 Evaluate methods and tools reported in specified published articles	c3-1-1 Research and evaluate latest methods and tools reported in analyzing and designing satellite

and researches concerning specified problem related to his/her research topic in electronics and communications field.	navigational systems.
D. General and transferrable skills	
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about electronic navigation systems.

4- Course Contents

Lecture Topic	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- Signals and Systems	3	3	--
2- Radio Navigation Systems	9	9	--
3- Direction Finders	12	12	--
4- Position Fixing Systems	12	12	--
5- Inertial Navigation Systems	12	12	--
6- Echo Sounders	12	12	--
7- LORAN	12	12	--
8- Integrated Navigation Systems	12	12	--
Total	84	84	--

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	**A1-1, A1-2, A1-3. A2-1**	**B1-1, B3-1, B5-1**	**C1-1, C2-1, C3-1**	**D3-1 D5-1**

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**-**	**-**		**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Signals and Systems	**1**
2nd	Radio Navigation Systems	**2-4**
3rd	Direction Finders	**5-8**
4th	Position Fixing Systems	**9-12**
5th	Inertial Navigation Systems	**13-16**
6th	Echo Sounders	**17-20**
7th	LORAN	**12-24**
8th	Integrated Navigation Systems	**25-28**

8- ILOs Matrix Topics

Course ILOs	Course topics							
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
a1-1-1 Demonstrate sufficient essential knowledge and understanding of the concepts and theories of mathematics to deal effectively with analyzing and designing navigation systems.	x	x	x	x	x	x	x	x
a1-2-1 Demonstrate sufficient specialized knowledge and a deep understanding of the concepts and theories of signals and systems.	x							
a1-2-2 Demonstrate sufficient specialized knowledge and a deep understanding of Radio and Inertial navigation systems.		x			x			
a1-2-3 Recognize direction finders and position fixing systems			x	x				
a1-2-4 Discuss Echo sounders and LORAN.						x	x	
a1-2-5 Demonstrate sufficient specialized knowledgeto be able to identifying, formulating, solving, analyzing, and designing problems pertaining Integrated Navigation Systems.								x
a1-3-1 Demonstrate knowledge of contemporary, current, and advanced topics related to electronic navigation systems.								x
a2-1-1 Report and recognize the professional aspects of navigation systems and their		x			x			x

effects on the environment.								
b1-1-1 Demonstrate an investigatory and analytic thinking approach to solve problems related to electronic navigation systems.		x	x	x	x	x	x	x
b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems in electronic navigation.		x	x	x	x	x	x	x
b5-1-1 Evaluate pros and cons of given electronic navigation system.		x			x			x
c1-1-1 Express competence skills, such as identifying, formulating, and analyzing various navigation systems.		x	x	x	x	x	x	x
c2-1-1 Write and evaluate a professional report on integrated navigation systems.								x
c3-1-1 Research and evaluate latest methods and tools reported in analyzing and designing satellite navigational systems.		x			x			x
d3-1-1 Apply self-evaluation and specify his/her educational needs related to his/her practice with strong foundation of continuous learning so they can maintain their technical competency.					x			x
d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about electronic navigation systems.					x			x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method**												
		Lecture+ online sessions	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Report**	**Self learning**	**Cooperative**	**Discovering**	**Computer Simulation**	**Practical Experiments**
Knowledge & understanding	a1-1-1	x				x								
	a1-2-1	x				x								
	a1-2-2	x				x								
	a1-2-3	x				x								
	a1-2-4	x				x								
	a1-2-5	x				x								
	a1-3-1	x				x								
	a2-1-1	x				x								

Intellectual Skills	b1-1-1			x		x								
	b3-1-1			x		x								
	b5-1-1			x		x			x					
Professional Skills	c1-1-1			x		x			x					
	c2-1-1		x	x					x	x				
	c3-1-1		x	x					x	x				
General Skills	d3-1-1								x	x				
	d5-1-1			x					x	x				

10- Assessment

10.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	Decided by the College Council
Total	100%	

11- Facilities required for teaching and learning

Internet for online sessions- Blackboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage (During Lectures):

Students should be encouraged to use library technical resources in the preparation of reports and presentation.

12- List of References:

Course and Lab Notes:

Lectures notes.

Essential Books (Text Books):

Electronic Navigation Systems, Laurie Tetley and David Calcutt, 3rd edition, 2001, ISBN: 0 7506 51385

12- Program Coordination Committee:

Course Coordinator: **Dr. Islam E. Shaalan**

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.

Doctor of Philosophy

Thesis

Specification

Thesis Specification

Program on which the thesis is given	**Ph. D in Electrical Engineering (Specialization: Electronics and Communications Engineering).**
Major or minor element of program	**Major**
Department offering the program	**Electrical Engineering**
Department offering the course	**Electrical Engineering**
Academic year/Level	**Ph. D (At least 3 years & Not more than 5 years)**
Date of specification approval	**2020**

A- Basic Information

Title: Thesis	**Code Symbol: Without**	
Lecture	**Independent but regular contacts with the supervisor is required**	
Tutorial / Laboratory	**Independent**	
Total	**At least 3 years & Not more than 5 years**	**Bylaw 2000**

B- Professional Information

1- Thesis Aims:

The Doctor's Thesis is an independent project (degree project) to develop and display the skills and abilities of the student to carry out individual, independent scientific work on a specific topic, exploring it in a trans-disciplinary manner, and assessing solutions and conclusions with respect to the different dimensions of sustainability. It does not aim to provide additional substantive material or methodological toolkit, the way typical graduate courses do. Its goal is rather modest as it attempts to apply student cumulative understanding and skills to specific research situation. From the perspective of one's program of study, however, the thesis phase poses a real-world test helping to make a realistic transition from coursework to dissertation. Completing a dissertation successfully is the last and often most challenging part of master studies. The goal is to put one's theoretical knowledge and research proficiency to practical test by carrying out an independent, albeit guided, project producing an original piece of research and making a significant contribution to solving a problem and expanding the knowledge base in the specific discipline. While research is an ongoing process, in which one is expected to stay on top of the relevant developments in the discipline, the assumption is that students are capable of thinking through the important milestones in the dissertation process and developing a dissertation prospectus that spells out the core concepts and questions as well as the designs of research and the structure of intended dissertation. The overall aim of the thesis phase is that the students should further develop and enhance their ability to independently plan, conduct and report on a research project which makes a contribution to the current state-of-the-art in the area. Also, the student should exhibit ability to in detail, creatively, with a high level of clarity and authority, using scientific scrutiny and adequate tools identify, explain, analyze and assess issues pertinent to a Ph. D thesis in the research field, within which the thesis project is placed.

2- Thesis Objectives:

On balance, a successful completion of the thesis phase is marked by student ability to do the following:

1. Apply his/her theoretical and methodological understanding and skills into devising researchable ideas and specific research questions and hypotheses,
2. Conduct a focused review of the relevant literature and create appropriate conceptual framework,
3. Develop a realistic research design with specific research strategies,
4. Communicate research ideas and their appropriate theoretical and methodological issues effectively and efficiently,
5. Gain understanding of the process of dissertation including stress, time, and project management, committee formation, dissertation proposition and defense, and human subjects reviews.
6. Develop and execute his/her survey to collect the necessary data to prove / support the problem that he has set up.
7. Identify own knowledge needs with respect to the planned project.
8. Write theses and report on research projects in a scientifically sound way.
9. Describe what the contribution of his/her thesis is and relate it to the current state-of-the-art within one or several international knowledge communities within the discipline
10. State the threats against and argue for the validity of her/his research methods, and in doing so, show awareness of that the concept of validity may have different values and be used in different ways within qualitative and quantitative research approaches.
11. Analyze a Doctor's thesis in a constructively critical way and identify the major strong and weak points of the thesis.
12. Describe how and where he/she has searched for, and why he/she has probably found the most relevant related work.

3- Intended Learning Outcomes (ILOs) for the whole program

The thesis is designed to achieve the above objectives through the following **Intended Learning Outcomes (ILOs)**:

Program ILOs	Thesis ILOs
A. Knowledge and understanding	
A2-1 Discuss mutual influence between professional practice of electronics and communication technologies and its impacts on the environment.	a1-2-1 Report and Discuss mutual relation between professional social aspects of his/her research and its effects on the Environment.
A1-3 Demonstrate knowledge of contemporary, current, and advanced topics related to electronics and communications engineering issues.	a1-3-1 Classify the potential applications of his/her research and its value in relation to contemporary, current, and advanced research issues. a1-3-2 Describe what the contribution of his/her thesis is and relate it to the current state-of-the-art within one or several international knowledge communities within the discipline.

A4-1 Gain a depth of knowledge, understanding, and fundamentals of ethical & legal professional practice of scientific research in the field of electronics and communication engineering.	a4-1-1 Describe and explain principles for ethical considerations in relation to scientific research.
A5-1 Explain quality assurance concepts of different electronics and communication components and systems development phases.	a5-1-1 Explain quality assurance concepts of different microwave communication systems development phases
B. Intellectual skills	
B2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with limited and contradictory information) related to electronics and communications engineering.	b2-1-1 Apply his/her theoretical and methodological understanding and skills into devising researchable ideas and specific research questions and hypotheses and to formulate judgments with incomplete data.
B3-1 Use integrated approaches including the coordination of different sources of knowledge and practices to solve professional scientific problems.	b3-1-1 Integrate, critically and systematically, theoretical knowledge and empirical data, using appropriate research methods and properly handling uncertainties, thereby contributing to the production of knowledge. b3-1-2 Demonstrate an ability to integrate knowledge and handle complexity, and to formulate judgments with incomplete data.
B4-1Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.	b4-1-1 Demonstrate an ability to critically, independently and creatively identify and formulate a realistic research plan with specific research strategies for his applied research, specifying steps and timelines, and write scientific paper. b4-1-2 Carry out one or several research study and publish them in specialized journal or conference, describing what the contribution of his/her thesis.
B5-1 Assess and analyze risks of the professional practice in electronics and communications engineering.	b5-1-1 Analyze his/herDoctor's Thesis in a constructively critical way and identify the major risks of the professional practice related to the thesis.
B6-1Plan to improve progress performance in the field of electronics and communications engineering.	b6-1-1 Demonstrate an ability to identify his/her need of further knowledge and to take responsibility for developing such knowledge through a plan to guide progress in his / her professional career.. b6-1-2 Assess and argue for the relevance of the findings with regard to practical implications, and identify the need for further knowledge within the field.
B7-1 Acquire decision making capabilities in different situation when facing problems related to analysis, design and development	b7-1-1 Acquire decision making capabilities in different situation when facing problems related to analysis, design and development

electronics and communications systems.	his/her research plan.
B8-1 Perform applied research on industrial and societal concerns problems that add to the accumulated knowledge of the electronics and communications field.	b8-1-1 apply research on industrial and societal concerns in electronics and communications field.
B9-1 Manage discussions on basis of evidence and proofs	b9-1-1 explain the basis of evidence and proofs
C. Professional and practical skills	
C1-2 Use a wide range of computational and technical tools, techniques and lab equipment, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.	c1-2-1Use a wide range of computational and technical tools, techniques, including pertaining software packages to analysis and design a process, component, or system related to his/her research topic in electronics and communications field.
C2-1 Write and evaluate a professional technical report pertaining to electronics and communications technical matters.	c2-1-1 Write thesis and report on research projects in a scientifically sound way. c2-1-2 Conduct a focused review of the relevant literature and create appropriate conceptual framework,
C3-1 Evaluate methods and tools reported in specified published articles and researches concerning specified problem related to his/her research topic in electronics and communications field.	c3-1-1 Analyze and evaluate methods and tools reported in a specified published articles and researches concerning specified problem related to electronics and communications field in a constructively critical way and identify the major strong and weak points of them.
C4-1 Express competence skills to use technology to advance practice	c4-1-1 Use technology in advanced practice
C5-1 Plan professional development courses to improve practice and enhance performance of juniors in the field of electronics and communications.	c5-1-1 apply professional development courses in the field of electronics and communications.
D. General and transferrable skills	
D1-1 Express professional and communication skills effectively in different aspects.	d1-1-1 Communicate research ideas and their appropriate theoretical and methodological issues effectively and efficiently.
D2-1 Demonstrate efficient IT capabilities in such a way that serves in the development of him/ her professional practice and research.	d2-1-1 Use state-of-the-art computer aided design tools for solving electronics and communications engineering problems.
D3-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.	d3-1-1 Apply self-evaluation and specify his/her educational needs related to electronics and communications aspects with strong foundation of continuous learning so they can maintain their technical competency.
D4-1 Design standards to evaluate others performance.	d4-1-1 Demonstrate ability to critically evaluate other people's performance in a systematic and standard way.
D5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to develop and execute his/her survey to collect the necessary data to prove / support the

	problem that he/she has set up.
D6-1 Collaborate effectively within multidisciplinary team and lead teams in different professional contexts.	d6-1-1 Demonstrate significantly enhanced group working abilities to implement a certain project.
D7-1Demonstrate a high level of competence in the time management.	d7-1-1 Manage time and work to deadlines.

4- Thesis Phases:

The Doctor's Thesis is an independent project (degree project) to develop and display the skills and abilities of the student to carry out individual, independent scientific work on a specific topic. The readings for the thesis work are selected by the individual student in collaboration with the supervisor. **The Doctor's Thesis phases can be outlined as follow:**

1. Developing a thesis proposal by formulating a realistic research plan with specific research strategies and specifying steps and timelines
2. Identify and construct a problem/thesis statement.
3. Presentation and defending of self-authored materials describing the thesis proposal at a seminar with external discussants (Department Staff).
4. Conduct a focused review of the relevant literature and create appropriate conceptual framework.
5. Analyze and evaluate methods and tools reported in a specified published articles and researches concerning the thesis problem in a constructively critical way and identify the major strong and weak points of them.
6. Carry out research:
   - Use state-of-the-art computer aided design tools.
   - Provide practical and/or laboratory services that can help.
7. Analysis and discussion of the simulated / practical results.
8. Developing defensible conclusions.
9. Writing the final thesis.
10. Presentation and defending of self-authored materials describing the thesis at a seminar with external discussants (Department Staff).
11. Reporting on and presenting the thesis in a final defense. At the examination seminar, the student should be able to respond to criticism given and also act as an opponent.

- The thesis work also includes a number of thesis workshop sessions in advance, where research and writing methods are discussed, and where the individual initial drafting of the thesis scope and outline is discussed.
- Throughout these phases:
  - The academic supervisor helps and guides the students.
  - The student is to write a manuscript in the format of a scientific article to be published.
  - Documentation is carried out.

5- Relationship between the course and the Program

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contributes in achieving.	A1-3, A2-1, A4-1, A5-1	B2-1, B3-1, B4-1, B5-1, B6-1, B7-1, B8-1, B9-1	C1-2, C2-1, C3-1, C4-1, C5-1	D1-1, D2-1, D3-1, D4-1, D5-1, D6-1, D7-1

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	-	-	-	100		100%

7- Learning and Teaching Methods:

Besides proposing, planning, conducting and presenting one's own master thesis project, the student is required to read, analyze and evaluate methods and tools reported in a specified published articles and researches concerning the thesis problem in a constructively critical way and identify the major strong and weak points of them and write an opponent report about it. The supervisor supports and supervises the student throughout the entire thesis project, but it is the student who must take on the responsibility of requesting support and supervision during the on-going project. The student is expected to report to her/his supervisor at least every four weeks. Besides this, the student is required to hand in a written progress report at least every three months. One or several lectures or seminars held by internal guest researchers, and focusing on research methods and the art of presenting research results, are arranged during the thesis development. In-seminar discussions should be enhanced with additional student-advisor (and committee, if appropriate) meetings. Students are expected to be prepared for all seminar meetings. It is mandatory for the student to have regular contacts with the supervisor so that the supervisor is able to follow the student's work process to secure the progress and the quality of the work. The thesis work also includes a number of thesis workshop sessions in advance, where research and writing methods are discussed, and where the individual initial drafting of the thesis scope and outline is discussed.

8- Assessment Methods:

8.1 Assessment is carried out by evaluating of the student ability to clearly present the thesis orally and to discuss and defend the conclusions and the knowledge and arguments behind them, in a dialogue with examiner committee.

8.2 For a passing grade the student must (a) make an acceptable oral presentation of the thesis; (b) perform an acceptable defense of the thesis and should be able to respond to criticism given by the examiner committee and also act as an opponent.

9- Facilities required for teaching and learning

Blackboard – Class Room Equipped with Computer and Video Projector - Computer Lab – Specialized Electronic and Communication Lab - Library.

A. laboratory Usage:

Students are expected to prepare and conduct some computer simulation and practical works using computer ad specialized Electronic and Communication labs.

B. Library Usage:

Students should be encouraged to use library technical resources during the thesis development.

10- List of References:

The readings for the thesis work are selected by the individual student in collaboration with the supervisor.

11- Program Coordination Committee:

Program coordinator: **Assist. Dr. Saly Hassaneen**

Head of the Department: **Prof. Dr. Rawya Yehia Rizk**

Updated Date: 10/2020.