جـــامعة بنها
كلية الهندسة بشبرا
برنامج الهندسة الكهربائية والتحكم
الدراسة الذاتية لعام الأكاديمي ٢٠٢١/٢٠٢٠

مرفقات المعيار الخامس
تصميم البرنامج

مرفق ٥-١-٢-١

إعتماد مجلس الكلية للتوصيف المحدث لبرنامج الهندسة الكهربائية و التحكم

محضر مجلس برنامج الهندسة الكهربية والتحكم
بنظام الساعات المعتمدة

رقم (37) بتاريخ 6 / 2021/1 والممتدة حتي 2021/1/18

- التصديق على محضر الجلسة السابقة

مجلس الكلية رقم (٤) بتاريخ ٢٠٢١/١/٨٩
القرار
أمين المجلس

القرار: المصادقة

1- بشأن الموافقة علي الاعتذار المقدم من الطالب/ جاسل بهاء بدر الدين محمود رقمه الجامعي 181901428 - عن الفصل الدراسي الثاني للعام الجامعي 2020/2019وهو العذر الأول له نظرا لظروف خاصة

القرار: عدم الموافقة طبقا للقواعد والقوانين المعمول بها .

2- بشأن الموافقة علي اعتماد جدول امتحانات نهاية الفصل الدراسي الأول للعام الجامعي 2021/2020 لبرنامج الهندسة الكهربائية والتحكم بعد التعديل ليبدأ من تاريخ 20 فبراير 2021 .

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

3- بشأن الموافقة علي اعتماد التوصيف المحدث المتوافق مع NARS2018 لبرنامج الهندسة الكهربائية والتحكم متضمنا جميع المصفوفات المطلوبة كمتطلب من متطلبات الاعتماد البرامجي .

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

4- بشأن إعتماد رسالة وأهداف برنامج الهندسة الكهربية والتحكم .

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

5- بشأن الموافقة علي اعتماد تحديث مواصفات خريج برنامج الهندسة الكهربائية والتحكم بعد المراجعة في ضوء الاستبيانات التي تمت في شهر ديسمبر بناءً على المعايير الأكاديمية المؤسسية والمعتمدة من الهيئة القومية لضمان جودة التعليم (NAQAAE) (دليل اعتماد كليات ومعاهد التعليم العالي اصدار 2018).

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

6- بشأم الموافقة على تشكيل لجنة لوضع سياسات التعليم والتعلم وآليات مراجعتها تتفق وطبيعة برنامج الهندسة الكهربائية والتحكم للعام الدراسي 2020-2021 كمتطلب من متطلبات الاعتماد البرامجي وتتكون اللجنة من:

م	الاســـم
1	أ.د/ موسى عوض الله عبد الله
2	أ.د/ محمود احمد محمد الاحمر
3	أ.م.د./محمد أنور ابو العطا طنطاوي

القرار: الموافقة طبقا للقواعد والقوانين المعمول بها .

أمين السر
٢٠٢١/١/١٨

جـــامعة بنـها
كلية الهندسة بشبرا
برنامج الهندسة الكهربائية والتحكم

توصيف برنامج الهندسة الكهربائية والتحكم

Electrical Engineering and Control Program Specifications 2020-2021

University: Benha
Faculty: Engineering at Shoubra
Department: Electrical Engineering
Program: Electrical Engineering and Control (B.Sc. Program)

A- Basic Information

1- Program title: Electrical Engineering and Control Program (Credit Hours)
2- Program type: Single
3- Department: Electrical Engineering
4- Coordinator: Assoc. Prof. Dr. Mohammed Anwar
5- External evaluator: Prof. Dr. Gamal Hashem
6- Internal evaluator: Prof. Dr. Mousa Awadhalla
7- Date of program Bylaw Approval: Faculty Council Number (8) March 2017
8- Date of program Specification Approval: Faculty Council Number (4) January 2021

B- Professional Information

1. Faculty Mission

"*The faculty of Engineering at Shoubra is committed to prepare a graduate with competencies and problem-solving skills that qualify each engineer to compete in local and regional labor markets, the graduate will be able to innovate and become an entrepreneur. The faculty also committed to the development of engineering sciences and producing internationally distinguished scientific research, with the framework of human values and social responsibility* "

2. Program Mission

"*The Electrical Engineering and Control Program is committed to offer a distinguished educational service[1] by graduating engineers who are able to compete at the local and regional levels[2], and develop research studies[3] thus contributing to spread the values of innovation, entrepreneurship[4] and social responsibility[5]*"

To judge the compatibility between the program mission and faculty mission, both are divided to keywords and the matrix given in **Appendix A** is used.

3. Program Educational Objectives

The Electrical Engineering and Control (EEC) Program prepares its graduates to become intellectual leaders in industry. Graduates are grounded in scientific, mathematical, and technical knowledge and relevant technologies that give them ability to analyze, synthesize, and design engineering systems.
The EEC program aims to:

PEO#1: Provide a distinguished academic curriculum in accordance with international standards in the field of Electrical Engineering and Control to ensure continuous development and recognize the contemporary scientific issues.

PEO#2: Provide an educational environment that enables students to achieve their goals in a program that supports their ability to innovate and entrepreneurship.

PEO#3: Provide students with the principals of engineering sciences and mathematics to coagulate the basics of electrical engineering and move forward to conduct advanced studies in these fields.

PEO#4: Qualify graduates to work not only in the local markets but also at the regional level, especially the Arab world and Africa, in order to achieve economic growth

PEO#5: Develop communication skills and teamwork, taking into account the professional, ethical and social aspects, so that graduates are prepared to take the responsibility and engaged in long-life learning.

PEO#6: Provide students with the ability to develop new energy alternatives and solution plans according to high technical specifications.

PEO#7: Prepare a qualified engineer to work in the field of control systems and robotics, and to use the latest technologies in these fields.

To judge the compatibility of program mission with its Educational Objectives, the matrix given in **Appendix B** is used.

4. Graduate Attributes

According to the National Academic Reference Standard (NARS2018), the graduates of EEC program must satisfy the following attributes:

GA#1: Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.

GA#2: Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.

GA#3: Behave professionally and adhere to engineering ethics and standards.

GA#4: Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.

GA#5: Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;

GA#6: Value the importance of the environment, both physical and natural, and work to promote sustainability principles.

GA#7: Use techniques, skills and modern engineering tools necessary for engineering practice.

GA#8: Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.

GA#9: Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.

GA#10: Demonstrate leadership qualities, business administration and entrepreneurial skills.

Besides the above-mentioned general attributes of all Engineering graduates, the Electrical Engineering and Control program's graduates must satisfy the following attributes:

GA#11: Design electrical power systems generated from renewable sources, using technological and professional tools.

GA#12: Gain the skills needed for the market such as utilizing Programmable Logic Controllers (PLC), Advanced Process Control (APC), Distributed Control Systems (DCS) and Supervisory Control and Data Acquisition (SCADA).

GA#13: Apply computer software packages in the design and simulation of various control systems as well as the power systems.

GA#14: Test, maintain, and modify conventional electrical power systems.

To judge the compatibility of program mission as well as its Educational Objectives with the graduate attributes, the two matrices given in Table [3] and Table [4] in **Appendix C** are used.

5. Program Competences

According to the National Academic Reference Standard, any program competences are classified into three categories: General competences (Level A), Speciality Competences (Level B), and either Sub-Speciality (Level C) or Inter-Disciplinary competences (Level D). For EEC Program, and in light of NARS 2018, the program competences are categorised into three categories as follows:

1- General Engineering NARS		
Level A Competences	A.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics.
	A.2	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
	A.3	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.

1- General Engineering NARS		
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

In addition to the Competences for all Engineering Programs, the Basic Electrical Engineering graduate must be able to:

2- Electrical Engineering NARS		
Level B Competences	B.1	Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems.
	B.2	Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.
	B.3	Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.
	B.4	Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation and evaluate its suitability for a specific application.
	B.5	Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

In addition to the competences for all Engineering Programs and the competences for the Electrical Engineering Discipline, the Electrical Engineering and Control Program graduate must be able to:

3- Electrical Engineering & Control ARS		
Level C Competences	C.1	Demonstrate additional abilities to model, design and integrate computer-operated systems including analog, digital and intelligent systems
	C.2	Design and supervise the construction of systems to generate, transmit, control and use electrical energy obtained from renewable resources.
	C.3	Apply advanced digital techniques for modeling and analyzing electrical power systems while maintain their protection.
	C.4	Develop and/or redesign components/systems in the field of industrial control for improving the quality life of humans

To judge the compatibility of program educational objectives as well as the Graduate Attributes with the program competences, the two matrices given in in Table [5] and Table [6] in **Appendix D** are used.

6. Academic Standards of Program

The "Electrical Engineering and Control" program adopts the National Academic Reference Standards (NARS) for Engineering 2nd edition, issued in 2018.

- See Table [1] for a relationship matrix of **"Institute's Mission Vs Program's Mission"**.
- See Table [2] for a relationship matrix of **"Program's Mission Vs Program's Educational Objectives"**.

- See Table [3] for a relationship matrix of **"Program Mission Vs Graduate's Attributes"**.
- See Table [4] for a relationship matrix of **"Program Educational Objectives Vs Graduate's Attributes"**.
- See Table [5] for a relationship matrix of **" Program Educational Objectives Vs Program Competences "**.
- See Table [6] for a relationship matrix of **" Program Graduate's Attributes Vs Program Competences "**.
- See Table [7] for a relationship matrix of **"Program Graduate's Attributes Vs Program's Structure"**.
- See Table [8] for a relationship matrix of **"Program Competences Vs Program's Courses"**.

7. Curriculum Structure and Contents

a. Program Duration: 10 semesters (5-years), 175 credit-hours.

b. Program Structure: Credit and Contact hours (1 credit hour = 1-hour lecture or 2-hour tutorial or 3-hour lab

i– No. of Credit hours: 175 : 159 Compulsory 16 Elective
ii– No. of Contact hours: 270 : 119 Lectures 34 Tutorial/Exercises 117 Lab
iii– Contact hours of Lectures & Tutorials: 153 hours = 56.67%
iv– Contact hours of Lab: 117 hours = 43.33%

c. Indicative Curricula Content by Subject Area

#	Subject Area	Credit Hours	NARS %	Program %
A	Humanities and Social Sciences (Univ. Req.)	16	9-12	9.14
B	Mathematics and Basic Sciences	39	20-26	22.29
C	Basic Engineering Sciences (Faculty/Spec. Req.)	37	20-23	21.14
D	Applied Engineering and Design	38	20-22	21.71
E	Computer Applications and ICT	16	9-11	9.14
F	Projects and Practice	13	6-10	7.44
Subtotal		159		90.86
G	Discretionary (Program character-identifying) subjects	16	6-8	9.14
Total		175		100

To judge the compatibility of program graduate's attributes with the program's Curricula Content by Subject Area, the matrix given in Table [7] in **Appendix E** is used.

I. University Requirements:

(A) Humanities & Social Science Requirements							
No.	**Code**	**Course**	Credit Hours	**Contact Hrs**			**Prerequisites**
				Lec.	**Tut**	**Lab**	
1	GEN099	English Language (A Remedial Course)	0	-	-	-	-
2	GEN101	English Language	2	2	-	-	GEN099
3	GEN102	Engineering & Society	2	2	-	-	-
4	GEN201	Technical Report Writing	2	2	-	-	GEN101

(A) Humanities & Social Science Requirements							
No.	**Code**	**Course**	**Credit Hours**	**Contact Hrs**			**Prerequisites**
				Lec.	**Tut**	**Lab**	
5	GEN202	Psychology & organization Behavior	2	2	-	-	_
6	GEN301	Leadership and Management Skills	2	2	-	-	_
7	GEN302	Professional Ethics	2	2	-	-	_
8	GEN401	Legislations, contract, and procurement management	2	2	-	-	_
9	GEN402	Human Resources Management	2	2	-	-	_
		Total Credit Hour	**16**	**16**	**-**	**-**	

II. Mathematics and Basic Sciences Requirements

(B) Mathematics and Basic Sciences Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
1	EMP101	Engineering Mathematics (1)	3	2	2	-	-
2	EMP102	Engineering Mathematics (2)	3	2	2	-	EMP101
3	EMP201	Engineering Mathematics (3)	3	2	2	-	EMP102
4	EMP202	Engineering Mathematics (4)	3	2	2	-	EMP201
5	EEC314	Engineering Mathematics (5)	3	2	2	-	EMP202
6	EEC325	Engineering Mathematics (6)	3	2	2	-	EMP202
7	EMP103	Physics (1)	3	2	-	3	-
8	EMP104	Physics (2)	3	2	-	3	EMP103
9	EMP105	Engineering Chemistry	3	2	-	3	-
10	EMP106	Engineering Mechanics (1)	3	2	2	-	-
11	EMP107	Engineering Mechanics (2)	3	2	2	-	EMP106
12	EEC221	Electromagnetics (1)	3	2	2	-	EMP104
13	CPE101	Computer Programming	3	2	-	3	-
		Total Credit Hour	**39**	**26**	**18**	**12**	

III. Basic Engineering Sciences Requirements

(C) Basic Engineering Sciences Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
1	MDP101	Engineering Drawing (1)	3	2	-	3	-
2	MDP102	Engineering Drawing (2)	3	2	-	3	MDP101
3	MDP103	Production Technology & Workshops	3	2	-	3	-
4	MPE101	Fluid and Thermal Systems	3	2	2	-	MPE104

(C) Basic Engineering Sciences Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
5	EEC211	Electric Circuits (1)	3	2	-	3	EMP104
6	EEC222	Electric Circuits (2)	4	3	2	-	EEC211
7	EEC223	Electronics (1)	4	2	2	3	EEC211
8	EEC224	Signals and Systems	3	2	2	-	EMP201
9	EEC324	Communications Systems	3	2	2	-	EEC224
10	EEC312	Electric Machines (1)	3	2	-	3	EEC222
11	EEC313	Electric Power Systems (1)	3	2	2	-	EEC222
12	EEC322	Electromagnetics (2)	2	2	-	-	EEC221
		Total Credit Hour	**37**	**25**	**12**	**18**	

IV. Applied Engineering Sciences and Design Requirements

(D) Applied Engineering Sciences and Design Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
1	EEC414	Electric Power Systems (2)	3	2	-	3	EEC313
2	EEC321	Automatic Control (1)	3	2	2	-	EEC224
3	EEC323	Electric Machines (2)	4	3	-	3	EEC312
4	EEC311	Electronics (2)	3	2	-	3	EEC223
5	EEC411	High Voltage Engineering (1)	3	2	-	3	EEC322
6	EEC412	Industrial Controls (1)	3	2	-	3	EEC213, EEC222
7	EEC413	Power Electronics (1)	4	3	-	3	EEC223, EEC222
8	EEC415	Automatic Control (2)	3	2	-	3	EEC321
9	EEC422	Digital Control	3	2	-	3	EEC415
10	EEC423	Electric Drive Systems (1)	3	2	-	3	EEC323,EEC413
11	EEC424	Power Electronics (2)	3	2	-	3	EEC413
12	EEC513	Power Systems Protection (1)	3	2	2	-	EEC414
		Total Credit Hour	**38**	**26**	**4**	**30**	

V. Computer Applications and Information Systems Requirements

(E) Computer Applications and Information Systems Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
1	EEC212	Structured Programming	3	2	-	3	CPE101
2	EEC213	Logic Design	3	2	-	3	CPE101
3	EEC421	Microcontrollers	4	3	-	3	EEC213, EEC223

(E) Computer Applications and Information Systems Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
4	EEC512	Robotics Engineering (1)	3	2	-	3	EEC223
5	EEC522	Intelligent Control	3	2	-	3	EEC415
		Total Credit Hour	**16**	**11**	**-**	**15**	

VI. Practical and Applied Projects Requirements

(F) Practical and Applied Projects Requirements							
No	**Course code**	**Course Title**	**Credit Hours**	**Contact Hours**			**Prerequisites**
				Lec.	**Tut.**	**Lab**	
1	EEC315	Electronic Measurements	3	2	-	3	EEC223
2	INT301	Industrial Training (1)	3	-	-	9	60 Credits
3	INT401	Industrial Training (2)	3	-	-	9	100 Credits
4	EEC511	Graduation Project (1)	2	1	-	3	120 Credits
5	EEC521	Graduation Project (2)	2	-	-	6	EEC511
		Total Credit Hour	**13**	**3**	**-**	**30**	

To judge the compatibility of program competences with program's courses, the matrix given in Table [8] in **Appendix F** is used.

d. Program Years:

Year	Credit Hours		
	Compulsory	Elective	**Total**
First (Preparatory)	37	0	37
Second	34	0	34
Third	34	0	34
Fourth	33	0	33
Fifth	15	16	31
Subtotal Credit Hours			169
Summer Training*			6
Total Credit Hours			175

*Students perform industrial training (1 & 2) during summer period for 6 weeks each.

e. Program Levels and Courses

First Year (Preparatory Year / Zero Level of Program)

First Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EMP101	Engineering Mathematics (1)	3	2	2	-	4	As attached matrix Table [7]
EMP103	Physics (1)	3	2	-	3	5	
EMP105	Engineering Chemistry	3	2	-	3	5	
EMP106	Engineering Mechanics (1)	3	2	2	-	4	
MDP101	Engineering Drawing (1)	3	2	-	3	5	
GEN101	English Language	2	2	-	-	2	
Total		17	12	4	9	25	

Second Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EMP102	Engineering Mathematics (2)	3	2	2	-	4	As attached matrix Table [7]
EMP104	Physics (2)	3	2	-	3	5	
EMP107	Engineering Mechanics (2)	3	2	2	-	4	
CPE101	Computer Programming	3	2	-	3	5	
MDP103	Production Technology & Workshops	3	2	-	3	5	
MDP102	Engineering Drawing (2)	3	2	-	3	5	
GEN102	Engineering & Society	2	2	-	-	2	
Total		20	14	4	12	30	

Second Year (First Level of Program)

First Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC211	Electric Circuits (1)	3	2	-	3	5	As attached matrix Table [7]
MPE101	Fluid and Thermal Systems	3	2	2	-	4	
EEC212	Structured Programming	3	2	-	3	5	
EEC213	Logic Design	3	2	-	3	5	
EMP201	Engineering Mathematics (3)	3	2	2	-	4	
GEN201	Technical Report Writing	2	2	-	-	2	
Total		17	12	4	9	25	

Second Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC221	Electromagnetics (1)	3	2	2	-	4	As attached matrix Table [7]
EEC222	Electric Circuits (2)	4	3	2	-	5	
EEC223	Electronics (1)	4	2	2	3	7	
EEC224	Signals and Systems	3	2	2	-	4	
EMP202	Engineering Mathematics (4)	3	2	2	-	4	
Total		17	11	10	3	24	

Third Year (Second Level of Program)

First Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC311	Electronics (2)	3	2	-	3	5	As attached matrix Table [7]
EEC312	Electric Machines (1)	3	2	-	3	5	
EEC313	Electric Power Systems (1)	3	2	2	-	4	
EEC314	Engineering Mathematics (5)	3	2	2	-	4	
EEC315	Electronic Measurements	3	2	-	3	5	
GEN202	Psychology & Organization Behavior	2	2	-	-	2	
Total		17	12	4	9	25	

Second Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC321	Automatic Control (1)	3	2	2	-	4	As attached matrix Table [7]
EEC322	Electromagnetics (2)	2	2	-	-	2	
EEC323	Electric Machines (2)	4	3	-	3	6	
EEC324	Communications Systems	3	2	2	-	4	
EEC325	Engineering Mathematics (6)	3	2	2	-	4	
GEN301	Leadership and Management Skills	2	2	-	-	2	
Total		17	13	6	3	22	

After completion of this semester, student performs Industrial Training (1) course (INT301) for six weeks during summer corresponding to 3 Credit Hours.

Fourth Year (Third Level of Program)

First Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC411	High Voltage Engineering (1)	3	2	-	3	5	As attached matrix Table [7]
EEC412	Industrial Controls (1)	3	2	-	3	5	
EEC413	Power Electronics (1)	4	3	-	3	6	
EEC414	Electric Power Systems (2)	3	2	-	3	5	
EEC415	Automatic Control (2)	3	2	-	3	5	
GEN302	Professional Ethics	2	2	-	-	2	
Total		18	13	-	15	28	

Second Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC421	Microcontrollers	4	3	-	3	6	As attached matrix Table [7]
EEC422	Digital Control	3	2	-	3	5	
EEC423	Electric Drive Systems (1)	3	2	-	3	5	
EEC424	Power Electronics (2)	3	2	-	3	5	
GEN401	Legislations, Contract & Procurement Management	2	2	-	-	2	
Total		15	11	-	12	23	

After completion of this semester, student performs Industrial Training (2) course (INT401) for six weeks during summer corresponding to 3 Credit Hours.

Fifth Year (Fourth Level of Program)

First Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC511	Graduation Project (1)	2	1	-	3	4	As attached matrix Table [7]
EEC512	Robotics Engineering (1)	3	2	-	3	5	
EEC513	Power System Protection (1)	3	2	2	-	4	
EEC5XX	Select a course from “Elective Group (1)”	3	2	-	3	5	
EEC5XX	Select a 2nd course from “Elective Group(1)”	3	2	-	3	5	
EEC5XX	Select a course from “Elective Group (2)”	2	2	-	-	2	
Total		16	11	2	12	25	

Second Semester:

Code	Course Title	Credit Hours	Contact hours / week				Program NARS Covered
			Lect.	Tut.	Lab.	Total	
EEC521	Graduation Project (2)	2	-	-	6	6	As attached matrix Table [7]
EEC522	Intelligent Control	3	2	-	3	5	
EEC5XX	Select a 3rd course from "Elective Group (1)"	3	2	-	3	5	
EEC5XX	Select a 4th course from "Elective Group (1)"	3	2	-	3	5	
EEC5XX	Select a 2nd course from "Elective Group(2)"	2	2	-	-	2	
GEN402	Human Resources Management	2	2	-	-	2	
Total		15	10	-	15	25	

Elective **Group I** (students must select 4 courses from that list)

Code	Course Title	Credit Hours	No. of hours / week				Program NARS Covered
			Lect.	Tut.	Lab	Total	
EEC551	Industrial Controls (2)	3	2	-	3	5	As attached matrix Table [7]
EEC552	Power Electronics (3)	3	2	-	3	5	
EEC553	Embedded Systems	3	2	-	3	5	
EEC554	Smart Grid	3	2	-	3	5	
EEC555	Power System Control	3	2	-	3	5	
EEC556	Robotics Engineering (2)	3	2	-	3	5	
EEC557	Special Electrical Machines	3	2	-	3	5	
EEC558	Electrical Drive Systems (2)	3	2	-	3	5	
EEC559	Protection of Power Systems (2)	3	2	-	3	5	
EEC560	Electric Power Plants	3	2	-	3	5	
EEC561	Power Distribution Systems	3	2	-	3	5	
EEC562	Modern Control Systems	3	2	-	3	5	
EEC563	High Voltage Engineering (2)	3	2	-	3	5	
EEC564	Utilization of Electric Energy	3	2	-	3	5	
EEC565	Renewable Energy Systems	3	2	-	3	5	
EEC566	Technology of Electric Power Station	3	2	-	3	5	
EEC567	Selected Topics in Electrical/Control Engineering	3	2	-	3	5	
Total (to be selected)		12	8	-	12	20	

Elective **Group 2** (students must select 2 courses from that list)

Code	Course Title	Credit Hours	No. of hours / week				Program NARS Covered
			Lect.	Tut.	Lab	Total	
EEC568	Management of Energy Resources	2	2	-	-	2	As attached matrix Table [7]
EEC569	Operations research	2	2	-	-	2	
EEC570	Management of international business	2	2	-	-	2	
EEC571	Environmental Impacts of Electric Energy	2	2	-	-	2	
EEC572	Electrical Safety	2	2	-	-	2	
EEC568	Management of Energy Resources	2	2	-	-	2	
Total (to be selected)		4	4	-	-	4	

8. Program Admission Requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics is considered the main condition to join the EEC program. Program admission rules are illustrated in the bylaw (2016) articles 5 to 16.

To maintain the quality and excellency of the "EEC Program", the candidate students applying to the program, either Freshman students who have passed Level 0, or Sophomores transferred from other programs, should qualify to the program needs.

9. Regulations for progression and program completion

a. The student can register a number of courses with no less than 12 credit hours in each semester within the registration dates and rules issued by the college and published in the student's guide. Registration is not considered final until paying the tuition fees. Moreover, student can register a number of courses according to the following table:

Credit Hours Registered / semester	GPA
Up to 21	≥ 3
Up to 18	< 3 and ≥ 2
Up to 14	< 2 and ≥ 1

b. The student cannot register a course that have a prerequisite,
c. The student gets a bachelor's degree of Engineering Science if he/she successfully passed 175 credit hours with minimum GPA of 2.0,
d. The grades of the successful / failed student in a course and in the general grade are evaluated as follows:

Grade	% achieved	Points
A+	≥ 97	4.0
A	≥ 93 and < 97	4.0
A–	≥ 89 and < 93	3.7
B+	≥ 84 and < 89	3.3
B	≥ 80 and < 84	3.0
B–	≥ 76 and < 80	2.7
C+	≥ 73 and < 76	2.3
C	≥ 70 and < 73	2.0
C–	≥ 67 and < 70	1.7
D+	≥ 64 and < 67	1.3
D	≥ 60 and < 64	1.0
F	< 60	0

The course points are calculated by multiplying the achieved points in that course by its credit hours, The semester points are the sum of all achieved points of courses registered in that semester.

$$semester\ GPA = \frac{semester\ points}{total\ credit\ hours\ of\ the\ semester}$$

By the same concept, the cumulative GPA is calculated by

$$cumulative\ GPA = \frac{total\ points}{total\ credit\ hours}$$

– The student is awarded an honor degree if his/her cumulative GPA is ≥ 3.3 in all semesters of study. Moreover, he/she did not get grade (F) in any course.

Program progression and completion rules are illustrated in the bylaw (2016) articles 17 to 25.

10. Teaching and Learning Methods

Considering that the program competences illustrate a wholistic status that would be achieved through a journey involves many different courses within different levels, and the final competence achievement can only be assessed at the end of its journey, each single competence is broken-down into measurable Learning Outcomes LOs that should be achieved in different courses. Thus, the program graduate competence may be considered as the final goal, while the courses LOs may be considered as the procedural aims/objectives. Hence, different teaching and learning methods are applied in program courses to cover the three domains given by the following table. For more details, please refer to the course specifications.

Teaching & Learning Methods	Courses LOs		
	Cognitive	Psychomotor	Affective
Face-to-Face Lectures	■		■
Online Lectures	■		■
Tutorial & Exercises	■		■
Labs.	■	■	■
Collaborate Projects	■	■	■
Research & Report	■	■	■
Brain Storming	■		■

11. Assessment Methods

Different assessment methods are applied in the program courses to assess these Learning Outcomes. The following table illustrates the assessment methods and what they assess in most cases. For further detail, refer to the courses' specifications.

Assessment Methods	Courses LOs		
	Cognitive	Psychomotor	Affective
Written Exams	■		■
Practical Exams	■	■	
Oral Exams	■	■	■
Online Exams	■	■	■
Projects	■	■	■
Research	■	■	■
Assignments	■	■	
Quizzes	■		■

12. Evaluation of Program Competences

Evaluator	Tool	Sample
1. Senior students	Evaluation sheet	25%
2. Alumni	Evaluation sheet & interview	5%
3. Stakeholders (Employers)	Evaluation sheet & interview	5
4. External Evaluator(s) (External Examiner(s))	Report	1
5. Internal Evaluator(s) (Internal Examiner(s))	Report	1

Appendix #A

Table [1] The relationship matrix of "**Institute's Mission Vs Program's Mission**"

Keywords of Program Mission \ Keywords of Faculty Mission	prepare a graduate with competencies and problem-solving skills	compete in local and regional labor markets	innovate and become an entrepreneur	development of engineering sciences	producing internationally distinguished scientific research	human values and social responsibility
Offer a distinguished educational service [1]	√			√		
Compete at the local and regional levels [2]		√				
Develop research studies [3]					√	
Spread the values of innovation and entrepreneurship [4]			√			
Social responsibility [5]						√

Appendix #B

Table [2] The relationship matrix of **"Program's Mission Vs Program's Educational Objectives"**

Keywords of Program Mission / Program Educational Objectives	*Offer a distinguished educational service* [1]	*Compete at the local and regional levels* [2]	*Develop research studies* [3]	Spread the values of innovation and entrepreneurship [4]	*Social responsibility* [5]
PEO #1	√				
PEO #2				√	
PEO #3			√		
PEO #4		√			
PEO #5					√
PEO #6	√				
PEO #7	√				

Appendix #C

Table [3] The relationship matrix of **"Program's Mission Vs Program's Graduate Attributes"**

Keywords of Program Mission / Program Graduate Attributes	*Offer a distinguished educational service* [1]	*Compete at the local and regional levels* [2]	*Develop research studies* [3]	Spread the values of innovation and entrepreneurship [4]	*Social responsibility* [5]
GA #1	√	√			
GA #2	√	√			
GA #3	√				√
GA #4		√		√	
GA #5		√			√
GA #6	√				√
GA #7		√	√		
GA #8			√	√	
GA #9			√	√	
GA #10				√	
GA #11	√				
GA #12	√				
GA #13	√				
GA #14	√				

Table [4] The relationship matrix of **"Program's Educational Objectives Vs Program's Graduate Attributes"**

Program Educational Objectives / Program Graduate Attributes	PEO #1	PEO #2	PEO #3	PEO #4	PEO #5	PEO #6	PEO #7
GA #1	√						
GA #2		√				√	
GA #3					√		
GA #4					√		
GA #5			√	√			
GA #6				√			
GA #7	√						
GA #8			√				
GA #9					√		
GA #10		√					
GA #11						√	
GA #12							√
GA #13							√
GA #14							√

Appendix #D

Table [5] The relationship matrix of **"Program's Educational Objectives Vs Program's Competences"**

Program Objectives	Program Competences																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
PEO #1				√						√	√					√			
PEO #2						√			√										√
PEO #3	√				√								√						
PEO #4									√			√		√					
PEO #5							√	√		√					√				
PEO #6		√	√										√				√		
PEO #7	√	√										√				√		√	

Table [6] The relationship matrix of "**Program's Graduate Attributes Vs Program's Competences**"

Graduate Attributes	Program Competences																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
GA #1				√						√	√					√			
GA #2						√			√										√
GA #3																			
GA #4							√	√		√					√				
GA #5	√				√								√						
GA #6									√			√		√					
GA #7				√						√	√					√			
GA #8	√				√								√						
GA #9							√	√		√					√				
GA #10						√			√										√
GA #11		√	√										√				√		
GA #12	√	√										√				√		√	
GA #13	√	√										√				√		√	
GA #14	√	√										√				√		√	

Appendix #E

Table [7] The relationship matrix of " **Program Graduate's Attributes Vs Program's Curricula Content by Subject Area** "

Program Structure / Program Graduate Attributes	A	B	C	D	E	F	G
GA #1	√	√	√				
GA #2		√	√				
GA #3			√				
GA #4						√	
GA #5	√						
GA #6	√						
GA #7		√		√	√	√	
GA #8		√			√		
GA #9	√					√	
GA #10	√					√	
GA #11				√		√	√
GA #12				√		√	√
GA #13				√	√	√	√
GA #14				√		√	√

Appendix #F

Table [8] The relationship matrix of **"Program's Courses Vs Program's Competences"**

Course Code	Course Name	Program Competences																		
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
EMP101	Engineering Mathematics (1)	√		√																
EMP103	Physics (1)	√	√																	
EMP105	Engineering Chemistry	√	√																	
EMP106	Engineering Mechanics (1)	√		√																
MDP101	Engineering Drawing (1)	√							√											
GEN101	English Language							√	√											
EMP102	Engineering Mathematics (2)	√		√																
EMP104	Physics (2)	√	√			√														
EMP107	Engineering Mechanics (2)	√		√		√														
CPE101	Computer Programming	√	√								√									
MDP102	Engineering Drawing (2)				√				√											
MPD103	Production Technology & Workshops		√		√															
GEN102	Engineering & Society									√	√									
EEC211	Electric Circuits (1)	√	√										√							
MPE101	Fluid and Thermal Systems	√				√						√								
EEC212	Structured Programming		√						√				√							

Course Code	Course Name	Program Competences																	
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
EEC213	Logic Design		√	√											√					
EMP201	Engineering Mathematics (3)	√		√																
GEN201	Technical Report Writing					√		√	√											
EEC221	Electromagnetics (1)	√				√						√								
EEC222	Electric Circuits (2)			√								√			√					
EEC223	Electronics (1)	√	√				√													
EEC224	Signals and Systems			√									√	√						
EMP202	Engineering Mathematics (4)	√		√																
EEC311	Electronics (2)		√	√										√		√				
EEC312	Electric Machines (1)		√	√										√	√					
EEC313	Electric Power Systems (1)			√								√	√						√	
EEC314	Engineering Mathematics (5)	√	√													√				
EEC315	Electronic Measurements		√								√				√	√				
GEN202	Psychology & Organization Behavior									√	√									
EEC321	Automatic Control (1)		√												√		√			
EEC322	Electromagnetics (2)			√									√						√	
EEC323	Electric Machines (2)		√	√										√				√		
EEC324	Communications Systems	√	√												√					

Course Code	Course Name	Program Competences																	
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
EEC325	Engineering Mathematics (6)	√	√													√				
GEN301	Leadership & Management Skills							√		√										
EEC411	High Voltage Engineering (1)		√	√									√							
EEC412	Industrial Controls (1)		√											√		√	√			
EEC413	Power Electronics (1)		√												√		√			
EEC414	Electric Power Systems (2)			√								√	√						√	
EEC415	Automatic Control (2)		√												√		√			
GEN302	Professional Ethics			√	√															
EEC421	Microcontrollers		√											√			√			√
EEC422	Digital Control												√		√				√	
EEC423	Electric Drive Systems (1)						√								√		√			√
EEC424	Power Electronics (2)		√												√		√			
GEN401	Legislations, Contract and Procurement Management				√		√				√									
EEC511	Graduation Project (1)																√	√	√	√
EEC512	Robotics Engineering (1)		√													√	√			
EEC513	Power System Protection (1)														√	√			√	√
EEC521	Graduation Project (2)																√	√	√	√
EEC522	Intelligent Control																√			√

Course Code	Course Name	Program Competences																	
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
GEN402	Human Resources Management						√			√										
EEC380	Field Training (1)		√						√				√		√					
EEC480	Field Training (2)														√	√		√		
ELECTIVE COURSES																				
EEC551	Industrial Controls (2)																√			√
EEC552	Power Electronics (3)														√		√			√
EEC553	Embedded Systems																√			√
EEC554	Smart Grid																	√	√	
EEC555	Power Systems Control		√											√			√			
EEC556	Robotics Engineering (2)		√													√	√			
EEC557	Special Electrical Machines													√				√		
EEC558	Electrical Drive Systems (2)														√		√			√
EEC559	Protection of Power Systems (2)														√	√			√	√
EEC560	Electric Power Plants											√						√		
EEC561	Power Distribution Systems											√						√		
EEC562	Modern Control Systems													√	√				√	
EEC563	High Voltage Engineering (2)												√						√	
EEC564	Utilization of Electric Energy																	√	√	

Course Code	Course Name	Program Competences																	
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4
EEC565	Renewable Energy Systems											√						√		
EEC566	Technology of Electric Power Station															√		√		
EEC567	Selected Topics in Electrical/Control Engineering																√	√	√	√
EEC568	Management of Energy Resources												√			√		√		
EEC569	Operations Research												√				√			√
EEC570	Management of international business							√		√	√									
EEC571	Environmental Impacts of Electric Energy														√			√		
EEC572	Electrical Safety																		√	√

University: Benha University
Faculty: Faculty of engineering at Shoubra
Department: Electrical Engineering Department
***Specification of Communications and Electronics Engineering Program* (B.Sc. Program) 2022-2023**

A- Basic Information

1- Program title: Communications and Electronics Engineering Program
2- Program type: Single
3- Department: Electrical Engineering
4- Coordinator: **Assoc.** Prof. Dr. Mohammed Lotfi Rabeh
5- Internal evaluator: Prof. Dr. Abdelwahab Elsamak, Prof. Dr. Hanaa Elsayad
5- External evaluator: Prof. Dr. Hesham Fathy + Prof. Dr. Elsayed Elrabie
6- Last date of program specifications approval: Faculty Council on / / 2023

B- Professional Information

1. Faculty Message

The Faculty of Engineering at Shoubra is committed to prepare a graduate with competencies and problem-solving skills [1] that qualify each engineer to compete in local and regional labor markets [2], the graduate will be able to innovate and become an entrepreneur [3], the faculty is also committed to the development of engineering sciences [4] and producing internationally distinguished scientific research [5], within the framework of human values and social responsibility [6].

2. Program Message

The Communications and Electronics Engineering program is committed to providing a distinguished educational service[1] that qualifies the graduate to compete in the labor market locally and regionally[2] and helps him to self-learn and conduct scientific research[3] in the fields of communications and electronics engineering, and motivates him to innovate and entrepreneurship[4], within the framework of ethical standards and social responsibility[5].

To judge the compatibility between the program message and faculty message, the following matrix is used.

Key Words of Program Message \ Key Words of Faculty Message	prepare a graduate with competencies and problem-solving skills [1]	compete in local and regional labor markets [2]	innovate and become an entrepreneur [3]	development of engineering sciences [4]	producing internationally distinguished scientific research [5]	human values and social responsibility [6].
a distinguished educational service [1]	√					
compete in the labor market locally and regionally [2]		√				
self-learn and conduct scientific research [3]				√	√	
innovate and entrepreneurship [4]			√			
ethical standards and social responsibility [5]						√

3. Program Educational Objectives

The Communication and Electronics Engineering program delivers an educational program that prepares its graduates to become intellectual leaders in industry. Graduates are grounded in scientific, mathematical, and technical knowledge and relevant technologies that give them ability to analyze, synthesize, and design communication and electronics engineering systems.

The Communication and Electronics Engineering program aims to:

1- Establishing students' understanding of the basics of electrical and electronic circuits engineering, and then giving them the ability to analyze and measure the performance of various electronic systems using appropriate equipment and assess their suitability for a particular application,
2- Providing students with the ability to design, implement and operate various communication systems, such as digital and analog communication systems, mobile communications, as well as antenna, microwave and optical communications systems, and other modern communications systems.
3- Qualifying graduates to work in the field of communications and electronics systems, using the latest technologies in those fields, and competing in the local and regional markets.
4- Qualifying students to practice self-learning strategies, analyze data, and draw conclusions to move forward with advanced research studies in the fields of communications and electronics engineering.
5- Providing an educational environment and teaching methods that support students' abilities for creativity, innovation and entrepreneurship.
6- Providing students with effective communication skills, teamwork and cooperation with different disciplines, which qualifies the graduate to assume responsibility and consider societal values and professional ethics.

To judge the compatibility of program message with its objectives, the following matrix is used:

Key Words of Program Mission / Program Objectives	a distinguished educational service [1]	compete in the labor market locally and regionally [2]	self-learn and conduct scientific research [3]	innovate and entrepreneurship [4]	ethical standards and social responsibility [5]
Objective #1	√				
Objective #2	√				
Objective #3		√			
Objective #4			√		
Objective #5				√	
Objective #6					√

4. Graduate Attributes

According to the National Academic Reference Standard (NARS2018), the graduates of Communications and Electronics Engineering program must satisfy the following attributes:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.
11. Professional integration of knowledge, engineering understanding and feedback to improve product and service design.
12. Create and re-design a component or system process and implement specialized engineering designs
13. Using laboratories and equipment efficiently and safely, monitoring, recording and analyzing data in the lab.
14. Use measurement tools, workshops, and laboratory equipment to design experiments to collect, analyze and interpret results

15. Use the advanced engineering tools for digital and analog communication systems, mobile communication, coding and decoding systems, Optical communication systems, antenna and microwave applications.
16. Preparing and displaying technical reports.

5. Program Competencies

According to the National Academic Reference Standard, the program in Engineering must satisfy the following Competencies:

1- General Engineering NARS Competencies in 2018

Level A (NARS)	A.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A.2	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
	A.3	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

2- Electrical NARS Competencies in 2018

Level B (NARS)	B.1	Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems.
	B.2	Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.
	B.3	Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.
	B.4	Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation, and evaluate its suitability for a specific application.
	B.5	Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

3- Communications and Electronics ARS

Level C (ARS)	C.1	Design and implement the performance of digital and analog communication, mobile communication, coding, and decoding systems
	C.2	Depict, and analyze the performance of antenna and microwave applications
	C.3	Realize and examine the performance of Optical communication systems
	C.4	Resolve embedded systems and analyze signal processing
	C.5	Synthesis and integrate electronic systems for certain specific function using the right equipment

To judge the compatibility of program objectives with its competencies, the following matrix is used:

Program Objectives	Program Competencies																			
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
Objective #1	√	√									√			√			√	√		
Objective #2			√	√								√	√			√	√	√		
Objective #3				√	√										√	√	√	√	√	√
Objective #4					√					√										
Objective #5			√			√			√	√										√
Objective #6							√	√												

6. Academic Standards of Program

The Communications and Electronics Engineering program is adopted exactly **NARS** as reference academic standards for levels A and B and **ARS** for level C of this program as shown above.

7. Curriculum Structure and Contents

a) **Program Duration:** 10 semesters (5-years) based on contact hours system

b) **Program Structure:**

i. No. of Contact hours: 250 — 105 Lectures — 145 Tutorial/Exercises

ii. No. of Contact hours: 250 — 214 Compulsory — 36 Elective

c) Contact Hours of Program Levels:

Year	Contact Hours		
	Compulsory	Elective	**Total**
Preparatory	48	2	50
First	48	2	50
Second	46	4	50
Third	46	4	50
Fourth	26	24	50
Total Contact Hours	214	36	250
Percentage (%)	85.6	14.4	100

d) Indicative Curricula Content by Subject Area

	Requirements	Contact	%	% according to
1	**Humanities and Social Sciences**	**20**	**8**	**8-12%**
2	**Mathematics and Basic Sciences**	**65**	**26**	**25-30%**
3	**Basic Engineering Sciences**	**73**	**29**	**25-30%**
4	**Applied Engineering and Design**	**67**	**27**	**25-30%**
5	**Business Administration**	**8**	**3**	**2-4%**
6	**Engineering Knowledge**	**9**	**4**	**3-6%**
7	**Projects & Training**	**8**	**3**	**3-6%**
		250	100	**Tolerance**

	Subjects	Contact Hours	%	Min. Percentage according to reference framework (%)
1	University Requirements	20	8	8
2	Faculty Requirement	70	28	20
3	Major Specialization Subjects	93	37	35
4	Minor Specialization Subjects	67	27	Maximum 30
Total		250	100	

Course Classification

Humanities & Social Science Subjects (20 Contact Hours)						
1	GEN0x0	Elective - Language requirements List	2	0	0	2
2	GEN011	Computer Skills	1	0	1	2
3	GEN012	History of Engineering & Technology	2	0	0	2
4	GEN9xx	Elective - University Requirements list	1	1	0	2
5	GEN9xx	Elective - University Requirements list	1	1	0	2
6	GEN9xx	Elective - University Requirements list	1	1	0	2
7	GEN9xx	Elective - University Requirements list	1	1	0	2
8	GEN9xx	Elective - University Requirements list	1	1	0	2
9	GEN9xx	Elective - University Requirements list	1	1	0	2
10	GEN9xx	Elective - University Requirements list	1	1	0	2

Business Administration (8 Contact Hours)						
1	ELE125	Management of Engineering Projects	2	1	1	4
2	ELE218	Engineering Economics	2	2	0	4

Mathematics & Basic Sciences (65 Contact Hours)						
1	BAS010	Differential Calculus and Algebra	2	2	0	4
2	BAS011	Statics	2	1	2	5
3	BAS012	Engineering Chemistry	2	1	2	5

4	BAS013	Physics of Materials & Electricity	2	1	3	6
5	BAS014	Integral Calculus & Analytical Geometry	2	2	0	4
6	BAS015	Dynamics	2	1	2	5
7	BAS016	Physics of Light, Heat and Magnetism	2	1	2	5
8	BAS112	Differential Equations	2	2	0	4
9	BAS212	Partial Differential Equations and Numerical Analysis	2	2	0	4
10	BAS213	Statistics and Probability	2	2	0	4
11	BAS113	Special Functions and Transformations	2	2	0	4
12	ELE122	Physics of Semiconductors	2	2	1	5
13	ELE222	Electrical and Magnetic Fields	2	2	1	5
14	ELE323	Electromagnetic Waves	2	0	3	5
Engineering Knowledge Subjects (9 Contact Hours)						
1	MEC011	Principles of Manufacturing Engineering	1	0	2	3
2	ELE126	Mechanical and Civil Engineering	2	2	0	4
3	ELE123	Technical Reports	2	0	0	2
Basic Engineering Science Subjects (73 Contact Hours)						
1	MEC010	Engineering Drawing (1)	0	3	0	3
2	MEC012	Engineering Drawing (2)	0	3	1	4
3	ELE121	Electrical Circuits	2	2	1	5
4	ELE124	Electronics (1)	2	2	1	5
5	ELE131	Computer Programming (1)	2	0	3	5
6	ELE132	Computer Programming (2)	2	0	3	5
7	ELE221	Electronic Measurements	2	2	1	5
8	ELE224	Signal Analysis and Systems	2	2	1	5
9	ELE225	Electronics (2)	2	2	1	5
10	ELE231	Web Programming	2	0	3	5
11	ELE232	Computer Organization	2	2	1	5
12	ELE241	Electrical Power Engineering	2	2	0	4
13	ELE321	Communication Systems	2	0	3	5
14	ELE324	Digital Signal Processing	2	0	2	4
15	ELE334	Embedded Systems	2	0	2	4
16	ELE343	Electrical Machines and Control	2	2	0	4
Applied Engineering and Design Subjects (67 Contact Hours)						
1	ELE133	Design of Logic Circuits	2	2	1	5
2	ELE328	Electronic Circuits	2	0	3	5
3	ELE327	Microwave Engineering	2	0	3	5
4	ELE322	Computer Networks	2	0	3	5
5	ELE325	Digital and Wireless Communications	2	0	3	5
6	ELE338	Information Security	2	0	2	4
7	ELE421	Mobile Communications	2	0	3	5
8	ELE422	Antenna and Wave Propagation	2	0	3	5
9	ELE423	Industrial Electronics	2	0	2	4
10	ELE424	Optical Communications	2	0	2	4
11	ELE4XX	Elective Course (1)	2	0	3	5
12	ELE4XX	Elective Course (2)	2	0	3	5
13	ELE4XX	Elective Course (3)	2	0	3	5
14	ELE4XX	Elective Course (4)	2	0	3	5
Projects and Field Training Subjects (8 Contact Hours)						
1	ELE491	Graduation Project (1)	0	0	3	3
2	ELE492	Graduation Project (2)	0	0	5	5
3	ELE100	Summer Training (1)	0	0	0	0
4	ELE 200	Summer Training (2)	0	0	0	0
5	ELE 300	Field Training (1)	0	0	0	0
6	ELE 400	Field Training (2)	0	0	0	0

e) Practical/Field Training:

* After completing the second year, the student undergoes field training (1) (ELE300) for 4 weeks during the summer vacation, in a factory, company, firm or project site …etc in a related field.

* After completing the third year, the student undergoes field training (2) (ELE400) for 4 weeks during the summer vacation, in a factory, company, firm or project site …etc in a related field.

8. Curriculum Structure and Contents

PREPARATORY YEAR

First Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lecture	Tutorial	Laboratory	Total	Semester Work	Lab./Oral Exam.	Written Exam.	Total	
BAS010	Differential Calculus and Algebra	2	2	0	4	60	0	60	120	3
BAS011	Statics	2	1	2	5	45	30	75	150	3
BAS012	Engineering Chemistry	2	1	2	5	45	30	75	150	3
BAS013	Physics of Materials & Electricity	2	1	3	6	45	45	90	180	3
MEC010	Engineering Drawing (1) ×	0	3	0	3	25	20	45	90	3
GEN0x0	Elective - Language requirements List	2	0	0	2	30	0	30	60	2
		10	**8**	**7**	**25**				**750**	

Second Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lecture	Tutorial	Laboratory	Total	Semester Work	Lab./Oral Exam.	Written Exam.	Total	
BAS014	Integral Calculus & Analytical Geometry	2	2	0	4	60	0	60	120	3
BAS015	Dynamics	2	1	2	5	45	30	75	150	3
BAS016	Physics of Light, Heat and Magnetism	2	1	2	5	45	30	75	150	3
MEC011	Principles of Manufacturing Engineering†	1	0	2	3	25	20	45	90	3
MEC012	Engineering Drawing (2) ×	0	3	1	4	30	30	60	120	3
GEN011	Computer Skills ×	1	0	1	2	15	15	30	60	2
GEN012	History of Engineering & Technology	2	0	0	2	30	0	30	60	2
		10	**7**	**8**	**25**				**750**	

FIRST YEAR

First Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
BAS112	Differential Equations	2	2	0	4	60	0	60	120	3
ELE121	Electrical Circuits *	2	2	1	5	50	25	75	150	3
ELE122	Physics of Semiconductors	2	2	1	5	50	25	75	150	3
ELE131	Computer Programming (1)	2	0	3	5	50	25	75	150	3
ELE126	Mechanical and Civil Engineering	2	2	0	4	30	30	60	120	3
ELE123	Technical Reports	2	0	0	2	30	0	30	60	2
		12	**8**	**5**	**25**				**750**	

Second Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
BAS113	Special Functions and Transformations	2	2	0	4	60	0	60	120	3
ELE124	Electronics (1)	2	2	1	5	50	25	75	150	3
ELE125	Management of Engineering Projects	2	1	1	4	30	30	60	120	2
ELE132	Computer Programming (2)	2	0	3	5	50	25	75	150	3
ELE133	Design of Logic Circuits	2	2	1	5	50	25	75	150	3
GEN9xx	Elective - University Requirements list	1	1	0	2	20	10	30	60	2
		11	**8**	**6**	**25**				**750**	

* Prior to registering in first year, the student should have completed 3 weeks of summer training (1) (ELE100) for 3 weeks in summer, 5 days per week. The daily training is for 5 hours (2 hrs Lecture + 3 hrs tutorial), amounting to a total of 25 hours perweek. A maximum grade of 25 marks is added to the 'semester work' grades of the "electrical circuits" course (ELE121).

SECOND YEAR

First Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
BAS212	Partial Differential Eqs. & Numerical Analysis	2	2	0	4	60	0	60	120	3
ELE221	Electronic Measurements *	2	2	1	5	50	25	75	150	3
ELE222	Electrical and Magnetic Fields	2	2	1	5	50	25	75	150	3
ELE231	Web Programming	2	0	3	5	50	25	75	150	3
ELE241	Electrical Power Engineering	2	2	0	4	30	30	60	120	3
GEN9xx	Elective - University Requirements list	1	1	0	2	20	10	30	60	2
		11	**9**	**5**	**25**				**750**	

Second Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
BAS213	Statistics and Probability	2	2	0	4	60	0	60	120	3
ELE218	Engineering Economics	2	2	0	4	60	0	60	120	2
ELE224	Signal Analysis and Systems	2	2	1	5	50	25	75	150	3
ELE225	Electronics (2)	2	2	1	5	50	25	75	150	3
ELE232	Computer Organization	2	2	1	5	50	25	75	150	3
GEN9xx	Elective - University Requirements list	1	1	0	2	20	10	30	50	2
		11	**11**	**3**	**25**				**750**	

* After completing the first year, the student should have completed 3 weeks of summer training (2) (ELE200) for 3 weeks in summer, 5 days per week. The daily training is for 5 hours (2 hrs Lecture + 3 hrs tutorial), amounting to a total of 25 hours per week. A maximum grade of 25 marks is added to the 'semester work' grades of the “Electronic Measurements” course (ELE221).

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THIRD YEAR

First Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
ELE321	Communication Systems	2	0	3	5	50	25	75	150	3
ELE322	Computer Networks	2	0	3	5	30	30	60	120	3
ELE323	Electromagnetic Waves	2	0	3	5	50	25	75	150	3
ELE334	Embedded Systems	2	0	2	4	60	0	60	120	3
ELE343	Electrical Machines and Control	2	2	0	4	60	0	60	120	3
GEN9XX	Elective-University Requirements list	1	1	0	2	20	10	30	30	2
ELE300	Field Training (1) *	0	0	0	0	15	15	0	30	-
		11	**3**	**11**	**25**				**750**	

Second Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
ELE324	Digital Signal Processing	2	0	2	4	60	0	60	120	3
ELE325	Digital and Wireless Communications	2	0	3	5	50	25	75	150	3
ELE338	Information Security	2	0	2	4	60	0	60	120	3
ELE327	Microwave Engineering	2	0	3	5	50	25	75	150	3
ELE328	Electronic Circuits	2	0	3	5	50	25	75	150	3
GEN9XX	Elective-University Requirements list	1	1	0	2	20	10	30	60	2
		11	**1**	**13**	**25**				**750**	

* After completing the second year, the student undergoes field training (1) (ELE300) for 4 weeks during the summer vacation, ina factory, company, firm or project site …etc in a related field. Every 5 students are supervised by a staff member of the department, (this supervision is not included in the staff member's teaching load).

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FOURTH YEAR

First Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
ELE421	Mobile Communications	2	0	3	5	30	30	60	120	3
ELE422	Antenna and Wave Propagation	2	0	3	5	50	25	75	150	3
ELE4XX	Elective Course (1)	2	0	3	5	50	25	75	150	3
ELE4XX	Elective Course (2)	2	0	3	5	50	25	75	150	3
GEN9XX	Elective-University Requirements list	1	1	0	2	20	10	30	60	2
ELE491	Graduation Project (1)	0	0	3	3	50	40	0	90	-
ELE400	Field Training (2) *	0	0	0	0	15	15	0	30	-
		9	**1**	**15**	**25**				**750**	

Second Semester:

Code	Subject	Contact Hours				Marks				Duration of Final Examination (hours)
		Lec.	Tut.	Lab.	Total	Sem. Work	Lab./Oral Exam	Written Exam	Total	
ELE423	Industrial Electronics	2	0	2	4	60	0	60	120	3
ELE424	Optical Communications	2	0	2	4	60	0	60	120	3
ELE4XX	Elective Course (3)	2	0	3	5	50	25	75	150	3
ELE4XX	Elective Course (4)	2	0	3	5	50	25	75	150	3
GEN9XX	Elective-University Requirements list	1	1	0	2	20	10	30	60	2
ELE492	Graduation Project (2) **	0	0	5	5	30	120	0	150	-
		9	**1**	**15**	**25**				**750**	

* After completing the third year, the student undergoes field training (2) (ELE400) for 4 weeks during the summer vacation, in a factory, company, firm or project site …etc in a related field. Every 5 students are supervised by a staff member of the department, (this supervision is not included in the staff member's teaching load).

** After completing the second semester, the students are divided into groups and continue performing the graduation projectfor 4 weeks.

9. Program Admission Requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics, then after passing the preparatory year and fulfilling the admission requirements the students will be able to attend the department.

10. Regulations for progression and program completion First Year/Level/Semester

a. The student is considered successful if he/she passes the examinations in all courses of his class.
b. The student is promoted to the next higher level if he/she fails in not more than two subjects of his class or from lower classes,
c. The referred student has to sit the examination in the courses in which he/she has failed together with the students studying the same courses. The student gets a pass grade when he/she passes the examination successfully. In case the student was considered absent with acceptable excuse in a course, he/she gets the actual grade,
d. The grades of the successful student in a course and in the general grade are evaluated as follows
   - **Distinction:** from 85% of the total mark and upwards.
   - **Very good:** from 75% to less than 85% of the total mark.
   - **Good:** from 65% to less than 75% of the total mark
   - **Pass:** from 50% to less than 65% of the total mark
   - The grades of a failing student in a course are estimated in one of the following grades:
   - Weak: from 30% to less than 50% of the total mark
   - Very weak: less than 30% of the total mark.
   - The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study. The students are then arranged serially according their cumulative sum.
   - The student is awarded an honor degree if his cumulative sum is distinction or very good provided that he/she gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he/she should have not failed in any examination he/she has sat in any class other than the preparatory year.

11. Teaching and Learning Methods

Program Competencies		Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Presentation	Mini Project	Research and Reporting	Brain Storming
Level A	A1	√	√	√						
	A2				√	√		√		
	A3	√	√	√				√		
	A4	√	√	√				√		
	A5				√		√		√	√
	A6				√	√		√		√
	A7				√	√	√	√	√	√
	A8		√		√		√			√
	A9				√		√		√	
	A10		√		√				√	√
Level B	B1	√	√	√	√					
	B2	√	√	√	√	√	√	√		√
	B3	√	√	√	√	√	√	√		√
	B4			√		√		√		
	B5	√	√	√		√				
Level C	C1	√	√	√		√	√	√	√	
	C2	√	√	√		√	√		√	
	C3	√	√	√		√				
	C4	√	√	√		√	√	√	√	
	C5			√		√		√	√	

12. Assessment Methods

Program Competencies		Assessment Methods										
		Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Level A	A1	√	√		√				√		√
	A2			√		√	√	√	√	√	√
	A3	√	√		√				√	√	
	A4	√	√	√	√						
	A5						√	√	√	√	
	A6					√				√	
	A7								√	√	
	A8			√				√		√	
	A9			√		√		√	√	√	
	A10							√	√	√	√
Level B	B1	√	√	√	√				√		√
	B2	√			√	√		√	√		
	B3	√			√	√		√	√	√	
	B4	√				√		√	√	√	
	B5	√	√	√	√	√		√		√	√
Level C	C1	√		√	√	√		√		√	√
	C2	√	√			√		√			√
	C3	√			√	√		√			
	C4	√	√		√	√			√	√	
	C5			√		√				√	

13. Evaluation of Program

Evaluator	Tool	Sample
1. External Evaluator(s) (External Examiner(s))	Report	1
2. Internal Evaluator(s) (Internal Examiner(s))	Report	1

Coordinator of Program Quality assurance committee	**Dr. Maher Abdelrasool**
Program Coordinator	**Assoc. Prof. Dr. Mohammed Lotfi Rabeh**
Head of Electrical Engineering Department	**Prof Dr. Mahmoud Soliman**

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Appendix: Course Matrix with program Competences:

Course Code	Course Name	Engineering Competencies (2018)										Electrical Engineering Competencies (NARS)					Communications and Electronics Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN0X0	Technical Language							√	√												
GEN011	Computer Skills								√		√										
GEN012	History of Engineering & Technology			√	√																
GEN900	Communication & Presentation Skills					√			√	√											
GEN901	Theory of Sustainability			√				√													
GEN902	Societal Issues			√				√	√												
GEN903	Research & Analysis Skills		√			√															
GEN904	Entrepreneurship			√						√											
GEN905	Professional Ethics			√					√	√											
GEN906	Critical Thinking									√	√										
GEN907	Human Resources Management				√		√														
GEN908	Contracts and Legislation			√	√																
GEN909	Method of Scientific Research and Writing		√			√															
BAS010	Differential Calculus and Algebra	√		√																	
BAS011	Statics	√		√																	
BAS012	Engineering Chemistry	√	√					√													

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2022-2023)

BAS013	Physics of Materials & Electricity	√	√					√													
Course Code	**Course Name**	**Engineering Competencies (2018)**										**Electrical Engineering Competencies (NARS)**					**Communications and Electronics Engineering Competencies (ARS)**				
		A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**
MEC010	Engineering Drawing (1)	√					√		√												
MEC012	Engineering Drawing (2)		√		√				√												
BAS014	Integral Calculus & Analytical Geometry	√		√																	
BAS015	Dynamics	√		√																	
BAS016	Physics of Light, Heat and Magnetism	√	√					√													
MEC011	Principles of Manufacturing Engineering		√				√			√											
BAS112	Differential Equations	✓							✓												
ELE121	Electrical Circuits *	✓	✓			✓			√			✓	✓								
ELE122	Physics of Semiconductors	√	√				√		√		√										
ELE131	Computer Programming (1)	✓			✓		✓	✓		✓	✓			✓		✓					
ELE126	Mechanical and Civil Engineering	✓			✓	✓															
ELE123	Technical Reports					√	√		✓												
BAS113	Special Functions and Transformations	✓							✓												
ELE124	Electronics (1)	✓	✓			✓			✓				✓	✓	✓						
ELE125	Management of Engineering Projects	✓		✓			✓	✓	✓	✓											
ELE132	Computer Programming (2)	✓	✓	✓	✓	✓	✓	✓					✓	✓		✓					

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2022-2023)

ELE133	Design of Logic Circuits	✓	✓	✓		✓		✓			✓	✓	✓							
BAS212	Partial Differential Eqs. & Numerical Analysis	✓							✓											

Course Code	Course Name	Engineering Competencies (2018)										Electrical Engineering Competencies (NARS)					Communications and Electronics Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ELE221	Electronic Measurements *	√	√				√		√				√		√						
ELE222	Electrical and Magnetic Fields	✓				✓			✓						✓						
ELE231	Web Programming		✓	✓		✓	✓			✓				✓	✓						
ELE241	Electrical Power Engineering																				
BAS213	Statistics and Probability	✓							✓												
ELE218	Engineering Economics	✓		✓						✓	✓	✓									
ELE224	Signal Analysis and Systems	✓	✓										✓	✓	✓						
ELE225	Electronics (2)	✓	✓	✓									✓	✓	✓	✓					
ELE232	Computer Organization	✓	✓			✓					✓	✓			✓						
ELE321	Communication Systems	√	√			√							√	√	√		√				
ELE322	Computer Networks		✓	✓				✓					✓	✓	✓	✓	✓		✓		✓
ELE323	Electromagnetic Waves	✓		✓											✓			✓			
ELE334	Embedded Systems		✓							✓			✓				✓			✓	
ELE343	Electrical Machines and Control	✓	✓								✓		✓		✓						
ELE300	Field Training (1) *		✓		✓			✓						✓	✓		✓	✓	✓	✓	✓

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2022-2023)

ELE324	Digital Signal Processing	✓	✓							✓	✓	✓							✓	
ELE325	Digital and Wireless Communications			✓		✓	✓						✓	✓	✓		✓			✓	
ELE338	Information Security	✓			✓	✓		✓	✓					✓	✓	✓	✓	✓		✓	
ELE327	Microwave Engineering	✓	✓						✓		✓		✓		✓			✓			

Course Code	Course Name	Engineering Competencies (2018)										Electrical Engineering Competencies (NARS)					Communications and Electronics Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ELE328	Electronic Circuits	√										√	√				√				√
ELE421	Mobile Communications	✓	✓												✓	✓	✓				
ELE422	Antenna and Wave Propagation	√	√						√		√		√		✓			√			
ELE491	Graduation Project (1)	✓	✓			✓	✓	✓			✓		✓	✓	✓		✓	✓	✓	✓	✓
ELE 400	Field Training (2) *		✓		✓			✓						✓	✓		✓	✓	✓	✓	✓
ELE423	Industrial Electronics	✓		✓	✓		✓						✓	✓	✓			✓		✓	
ELE424	Optical Communications	✓		✓											✓		✓		✓		
ELE492	Graduation Project (2) **	✓	✓			✓	✓	✓			✓		✓	✓	✓		✓	✓	✓	✓	✓
ELE425	Satellite Communications	✓	✓												✓	✓	✓				
ELE426	Radar Systems	✓			✓	✓									✓	✓	✓				
ELE427	Advanced Networks		✓	✓				✓					✓	✓	✓	✓	✓		✓		✓

ELE428	Acoustic Engineering	✓	✓			✓							✓		✓		✓			✓
ELE429	Information Theory	✓			✓	✓		✓	✓					✓	✓	✓	✓	✓		✓	
ELE451	Design of Very Large-Scale Circuits		✓										✓			✓					✓
ELE452	Visible Light Communications	✓		✓											✓		✓		✓		
ELE453	Robotics Systems	✓		✓	✓		✓						✓	✓	✓					✓	✓

Course Code	Course Name	Engineering Competencies (2018)										Electrical Engineering Competencies (NARS)					Communications and Electronics Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ELE454	Microcontrollers Systems	✓	✓			✓	✓		✓		✓		✓	✓		✓					✓
ELE455	Adaptive Signal Processing	✓	✓							✓	✓	✓	✓	✓							✓
ELE456	Selected Topics in Advanced Electronics					✓		✓	✓				✓	✓		✓					
ELE457	Selected Topics in Advanced Communications	✓	✓	✓			✓						✓	✓			✓				

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

University: Benha University
Faculty: Faculty of engineering at Shoubra
Department: Electrical Engineering Department
***Specification of Communications and Electronics Engineering Program* (B.Sc. Program) 2021-2022**

A- Basic Information

1- Program title: Communications and Electronics Engineering Program
2- Program type: Single
3- Department: Electrical Engineering
4- Coordinator: **Assoc.** Prof. Dr. Basem Mamdoh ElHalawany
5- Internal evaluator: Prof. Dr. Abdelwahab Elsamak, Prof. Dr. Hanaa Elsayad
5- External evaluator: Prof. Dr. Hesham Fathy + Prof. Dr. Elsayed Elrabie
6- Last date of program specifications approval: Faculty Council on / / 2020

B- Professional Information

1. Faculty Message

The Faculty of Engineering at Shoubra is committed to prepare a graduate with competencies and problem-solving skills [1] that qualify each engineer to compete in local and regional labor markets [2], the graduate will be able to innovate and become an entrepreneur [3], the faculty is also committed to the development of engineering sciences [4] and producing internationally distinguished scientific research [5], within the framework of human values and social responsibility [6].

2. Program Mission

The Communications and Electronics Engineering program is committed to providing a distinguished educational service[1] that qualifies the graduate to compete in the labor market[2] , helps him to self-learn and conduct scientific research[3] in the fields of communications and electronics engineering, and motivates him to innovate and entrepreneurship[4], within the framework of ethical standards and social responsibility[5].

To judge the compatibility between the program mission and faculty mission, the following matrix is used.

Key Words of Program Mission \ Key Words of Faculty Mission	prepare a graduate with competencies and problem-solving skills [1]	compete in local and regional labor markets [2]	innovate and become an entrepreneur [3]	development of engineering sciences [4]	producing internationally distinguished scientific research [5]	human values and social responsibility [6].
a distinguished educational service [1]	√					
compete in the labor market locally and regionally [2]		√				
self-learn and conduct scientific research [3]				√	√	
innovate and entrepreneurship [4]			√			
ethical standards and social responsibility [5]						√

3. Program aims

The Communication and Electronics Engineering program delivers an educational program that prepares its graduates to become intellectual leaders in industry. Graduates are grounded in scientific, mathematical, and technical knowledge and relevant technologies that give them ability to analyze, synthesize, and design communication and electronics engineering systems.

The Communication and Electronics Engineering program aims to:

1- Establishing students' understanding of the basics of electrical and electronic circuits engineering, and then giving them the ability to analyze and measure the performance of various electronic systems using appropriate equipment and assess their suitability for a particular application,
2- Providing students with the ability to design, implement and operate various communication systems, such as digital and analog communication systems, mobile communications, as well as antenna, microwave and optical communications systems, and other modern communications systems.
3- Qualifying graduates to work in the field of communications and electronics systems, using the latest technologies in those fields, and competing in the local and regional markets.
4- Qualifying students to practice self-learning strategies, analyze data, and draw conclusions to move forward with advanced research studies in the fields of communications and electronics engineering.

5- Providing an educational environment and teaching methods that support students' abilities for creativity, innovation and entrepreneurship.
6- Providing students with effective communication skills, teamwork and cooperation with different disciplines, which qualifies the graduate to assume responsibility and consider societal values and professional ethics.

To judge the compatibility of program mission with its objectives, the following matrix is used:

Key Words of Program Mission / Program Objectives	a distinguished educational service [1]	compete in the labor market locally and regionally [2]	self-learn and conduct scientific research [3]	innovate and entrepreneurship [4]	ethical standards and social responsibility [5]
Objective #1	√				
Objective #2	√				
Objective #3		√			
Objective #4			√		
Objective #5				√	
Objective #6					√

4. Graduate Attributes

According to the National Academic Reference Standard (NARS2018), the graduates of EEC program must satisfy the following attributes:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

11. Professional integration of knowledge, engineering understanding and feedback to improve product and service design.
12. Create and re-design a component or system process and implement specialized engineering designs
13. Using laboratories and equipment efficiently and safely, monitoring, recording and analyzing data in the lab.
14. Use measurement tools, workshops, and laboratory equipment to design experiments to collect, analyze and interpret results
15. Use the advanced engineering tools for digital and analog communication systems, mobile communication, coding and decoding systems, Optical communication systems, antenna and microwave applications.
16. Preparing and displaying technical reports.

5. Program Competencies

According to the National Academic Reference Standard, the program in Engineering must satisfy the following Competencies:

1- General Engineering NARS Competencies in 2018

Level A (NARS)	A.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A.2	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
	A.3	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

2- Electrical NARS Competencies in 2018

Level B (NARS)	B.1	Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems.
	B.2	Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.
	B.3	Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.
	B.4	Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation, and evaluate its suitability for a specific application.
	B.5	Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

3- Communications and Electronics ARS

Level C (ARS)	C.1	Design and implement the performance of digital and analog communication, mobile communication, coding, and decoding systems
	C.2	Depict, and analyze the performance of antenna and microwave applications
	C.3	Realize and examine the performance of Optical communication systems
	C.4	Resolve embedded systems and analyze signal processing
	C.5	Synthesis and integrate electronic systems for certain specific function using the right equipment

To judge the compatibility of program objectives with its competencies, the following matrix is used:

Program Objectives	Program Competencies																			
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
Objective #1	√	√									√			√			√	√		
Objective #2			√	√								√	√			√	√	√		
Objective #3				√	√										√	√	√	√	√	√
Objective #4					√					√										
Objective #5			√			√			√	√										√
Objective #6							√	√												

6. Academic Standards of Program

The Communications and Electronics Engineering program is adopted exactly **NARS** as reference academic standards for levels A and B and **ARS** for level C of this program as shown above.

7. Curriculum Structure and Contents

a) **Program Duration:** 10 semesters (5-years) based on contact hours system

b) **Program Structure:**

i. No. of Contact hours: 298 — 161 Lectures — 137 Tutorial/Exercises

ii. No. of Contact hours: 298 — 266 Compulsory — 32 Elective

c) Contact Hours of Program Levels:

Year	Contact Hours		
	Compulsory	Elective	Total
Preparatory	60	0	60
First	60	0	60
Second	60	0	60
Third	46	14	60
Fourth	40	18	58
Total Contact Hours	266	32	298
Percentage (%)	89.26	10.74	100

d) Indicative Curricula Content by Subject Area

	Subject Area	Hours	%	Tolerance
A	Humanities and Social Sciences (Univ. Req.)	17	5.7*	9-12 %
B	Mathematics and Basic Sciences	65	21.8	20-26 %
C	Basic Engineering Sciences (Faculty/Spec. Req.)	59	19.8	20-23 %
D	Applied Engineering and Design	69	23.2	20-22 %
E	Computer Applications and ICT	34	11.4	9-11 %
F	Projects and Practice	28	9.4	8-10 %
	Subtotal	272	91.3	92-94 %
G	Discretionary (Institution character-identifying) subjects	26	8.7	6-8 %
	Total	298	100	100%

* The current bylaws are accredited on 2003 before the reference percentages have been set. We have new bylaws in the revision process.

e) Practical/Field Training:

The students must carry out **3** weeks of field training after the freshman year and after the sophomore year.

8. Curriculum Structure and Contents

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Year of Program 1 (Preparatory Year) Semester 1

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab.	Total	
EMP001	Mathematics (A)	4	2	-	6	As attached matrix
EMP012	Mechanics (A)	2	2	-	4	
EMP013	Physics (A)	4	1	2	7	
EMP014	Chemistry	4	-	2	6	
MDP001	Engineering Drawing and Isometric	1	4	-	5	
GEN001	Technical Language	-	2	-	2	

Year of Program 1 (Preparatory Year) Semester 2

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab.	Total	
EMP021	Mathematics (B)	4	2	-	6	As attached matrix
EMP012	Mechanics (B)	2	2	-	4	
EMP023	Physics (B)	4	-	2	6	
MDP001	Engineering Drawing and Isometric	-	4	-	4	
ECE006	Introduction to Computers	2	1	-	3	
MET002	Engineering Production	2	-	3	5	
GEN002	History of Engineering Science	2	-	-	2	

Year of Program 2 - (First Year COMMUNICATION AND ELECTRONICS) Semester 1

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab.	Total	
ECE111	Principles of Electronic Engineering	4	2		6	As attached matrix
ECE112	Electrical Circuit (1)	4	2		6	
ECE113C	Computer Programming	4	2		6	
MPE/CVG181	Civil and Mechanical Engineering	3	2		5	
EMP181	Mathematics (2)(A)	3	2		5	
GEN181	Engineering Legislation	2	-		2	

Year of Program 2 - (First Year COMMUNICATION AND ELECTRONICS) Semester 2

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE121	Electronics (1)	4	3		7	As attached matrix
ECE122	Electrical Circuit (2)	3	2		5	
ECE123	Lab (1)	4	-		4	
ECE124C	Computer Applications (1)	3	4		7	
EMP181	Mathematics (2)(B)	3	2		5	
GEN182	English Language (2)	-	2		2	

Year of Program 3 - (Second Year COMMUNICATION AND ELECTRONICS Semester 1

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab.	Total	
ECE211	Electrical and Electronic Measurements	4	2		6	As attached matrix
ECE212	Principles of Electromagnetic	4	2		6	
ECE213C	Computer Organization (1)	3	2		5	
ECE214C	Computer Programming (2)	4	2		6	
EMP281	Mathematics (3)(A)	3	2		5	
GEN28x	Elective Humanities	2	-		2	

Elective Humanities Courses

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
GEN28x	Elective Course Humanities					
GEN281	Industrial Sociology	2	-	-	2	Attached Table
GEN282	Behavior Anizaty	2	-	-	2	
GEN283	Elective Humanities 1	2	-	-	2	

Year of Program 3 - (Second Year COMMUNICATION AND ELECTRONICS) Semester 2

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab.	Total	
ECE221	Signal Analysis	4	2		6	As attached matrix
ECE222	Electronics (2)	4	3		7	
ECE223	Lab (2)	-	4		4	
ECE224C	Logic Circuits	4	2		6	
EMP282	Mathematics (3)(B)	3	2		5	
GEN280	Technical Reporting (1)	-	2		2	

Year of Program 4 - (Third Year COMMUNICATION AND ELECTRONICS) Semester 1

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE311	Communication Systems	4	2		6	As attached matrix
ECE312	Electronic Circuits(A)	4	2		6	
ECE313	Electromagnetic Waves	4	2		6	
ECE314	Lab (3)(A)	-	4		4	
ECE34x	Elective Course (1) from table (1)	4	2		6	
GEN38x	Elective Course Humanities (1)	2	-		2	

Elective Table (1)

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE34x	Elective Course (1) from Table (1)					
ECE341	Introduction in LSI circuits	4	2	-	6	Attached Table
ECE342	Advanced Electronic measurements	4	2	-	6	
ECE343	Computer aided Electronic design	4	2	-	6	

Humanities Courses

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
GEN38x	Elective Course Humanities					

GEN381	Project Management	2	-	-	2	Attached Table
GEN382	Environmental impact	2	-	-	2	
GEN383	Engineering Ethics	2	-	-	2	

Year of Program 4 - (Third Year COMMUNICATION AND ELECTRONICS) Semester 2

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE321	Control System (1)	3	2		5	As attached matrix
ECE322	Electronic Circuit (B)	3	3		6	
ECE323	Communication Networks	3	2		5	
ECE424	Lab (3)(B)	-	4		4	
ECE34x	Elective Course (2) from table (2)	4	2		6	
EPE381	Electrical power and Machines	3	1		4	

Elective Table (2)

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE34x	Elective Course (2) from Table(2)					
ECE344	Microwaves fundamentals	4	2	-	6	Attached Table
ECE345	Optical Semiconductor	4	2	-	6	
ECE346	Transmission Lines	4	2	-	6	

Year of Program 5 - (Fourth Year COMMUNICATION AND ELECTRONICS) Semester 1

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE411	Antenna and wave propagation	3	2		5	As attached matrix
ECE412	Digital Signal Processing	3	2		5	
ECE413	Microprocessor Systems	3	2		5	
ECE414	Project	-	3		3	
ECE44x	Elective Course (3) from table (3)	4	2		6	
ECE44x	Elective Course (4) from table (4)	4	2		6	

Elective Table (3)

Code	Course Title	No. of hours / week				Program Competencies
		Lect.	Tut.	Lab	Total	

						Covered (By no.)
ECE44x	Elective Course (3) From Table (3)					
ECE441	Microwave Electronics	3	2	-	5	Attached Table
ECE442	Principles of medical Engineering	3	2	-	5	
ECE443	Selected Topics (1)	3	2	-	5	

Elective Table (4)

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE44x	Elective Course (4) From Table (4)					
ECE444	Industrial Electronics	3	2	-	5	Attached Table
ECE445	Adaptive Filtering	3	2	-	5	
ECE446	Surface Acoustic wave devices	3	2	-	5	

Year of Program 5 (Fourth Year COMMUNICATION AND ELECTRONICS) Semester 2

Compulsory

Code	Course Title	No. of hours / week				Program Competencies Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE421	Digital Communication	2	2		4	As attached matrix
ECE422	Advanced Electronic Systems	2	2		4	
ECE423	Optical Communication	3	2		5	
ECE424	Lab (4)	-	4		4	
ECE414	Project	-	5		5	
ECE44x	Elective Course (5) from table (5)	4	2		6	

Elective Table (5)

Code	Course Title	No. of hours / week				Program ILOs Covered (By no.)
		Lect.	Tut.	Lab	Total	
ECE44x	Elective Course (5) from Table (5)					
ECE447	Robot Engineering	4	2	-	6	Attached Table
ECE448	Selected Topic (2)	4	2	-	6	
ECE449	Radar Systems	4	2	-	6	

9. Program Admission Requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics, then after passing the preparatory year and fulfilling the admission requirements the students will be able to attend the department.

10. Regulations for progression and program completion First Year/Level/Semester

a. The student is considered successful if he/she passes the examinations in all courses of his class.
b. The student is promoted to the next higher level if he/she fails in not more than two subjects of his class or from lower classes,
c. The referred student has to sit the examination in the courses in which he/she has failed together with the students studying the same courses. The student gets a pass grade when he/she passes the examination successfully. In case the student was considered absent with acceptable excuse in a course, he/she gets the actual grade,
d. The grades of the successful student in a course and in the general grade are evaluated as follows
   - **Distinction:** from 85% of the total mark and upwards.
   - **Very good:** from 75% to less than 85% of the total mark.
   - **Good:** from 65% to less than 75% of the total mark
   - **Pass:** from 50% to less than 65% of the total mark
   - The grades of a failing student in a course are estimated in one of the following grades:
   - Weak: from 30% to less than 50% of the total mark
   - Very weak: less than 30% of the total mark.
   - The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study. The students are then arranged serially according their cumulative sum.
   - The student is awarded an honor degree if his cumulative sum is distinction or very good provided that he/she gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he/she should have not failed in any examination he/she has sat in any class other than the preparatory year.

11. Teaching and Learning Methods

Program Competencies		Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Presentation	Mini Project	Research and Reporting	Brain Storming
Level A	A1	√		√						
	A2				√	√		√		
	A3	√		√				√		
	A4	√		√				√		
	A5				√		√		√	√
	A6				√	√		√		√
	A7				√	√	√	√	√	√
	A8				√		√			√
	A9				√		√		√	
	A10				√				√	√
Level B	B1	√		√	√					
	B2	√		√	√	√	√	√		√
	B3	√		√	√	√	√	√		√
	B4			√		√		√		

	B5	√		√		√				
Level C	C1	√		√		√	√	√	√	
	C2	√		√		√	√		√	
	C3	√		√		√				
	C4	√		√		√	√	√	√	
	C5			√		√		√	√	

12. Assessment Methods

Program Competencies		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Level A	A1	√			√				√		√
	A2			√		√	√	√	√	√	√
	A3	√			√				√	√	
	A4	√		√	√						
	A5						√	√	√	√	
	A6					√				√	
	A7								√	√	
	A8			√				√		√	
	A9			√		√		√	√	√	

	A10					√	√	√	√	
Level B	B1	√	√	√			√		√	
	B2	√		√	√	√	√			
	B3	√		√	√	√	√	√		
	B4	√			√	√	√	√		
	B5	√	√	√	√	√		√	√	
Level C	C1	√	√	√	√	√		√	√	
	C2	√			√	√			√	
	C3	√		√	√	√				
	C4	√		√	√		√	√		
	C5		√		√			√		

10. Evaluation of Program

Evaluator	Tool	Sample
1. External Evaluator(s) (External Examiner(s))	Report	2
2. Internal Evaluator(s) (Internal Examiner(s))	Report	2

Coordinator of Program Quality assurance committee	**Dr. Maher AbdelRasool**
Program Coordinator	**Assoc. Prof. Dr. Basem ElHalawany**
Head of Electrical Engineering Department	**Prof Dr. Mahmoud Soliman**

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Appendix: Course Matrix with program Competences:

Course Code	Course Name	Engineering Competencies (2018)											"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
EPM011	Mathematics (A)		√							√												
EMP012	Mechanics		√							√												
EPM013	Physics (A)		√							√												
EMP014	Chemistry		√							√												
MDP001	Engineering drawing and isometric		√					√		√												
GEN001	Technical language								√	√												
EMP021	Mathematics (B)		√							√												
MPH 012	Mechanics		√							√												
EMP023	Physics (B)		√							√												
MEC 001	Engineering drawing and isometric		√			√				√												
ECE006	Intro. To Computer		√	√		√		√						√	√							

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)										"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN002	History		√		√					√	√											
MDP002	production Engineering		√	√				√		√		√										
ECE111	Principles of Electronic Engineering			√	√			√														
ECE112	Electrical Circuit (1)			✓			✓			√			✓	✓								
ECE 113C	Computer Programming					✓		✓	✓						✓		✓					
MPE/CVG181	Civil and Mechanical Engineering		✓			✓	✓															
EMP181	Math 2 A		✓							✓												
GEN181	Engineering Legislation		✓		✓						✓	✓	✓									
ECE121	Electronics (1)	2nd	✓	✓										✓	✓	✓						
ECE122	Electrical Circuit (2)	2nd	✓	✓								✓	✓	✓								

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)										"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ECE123	Lab (1)	2nd		✓		✓								✓		✓	✓					
ECE 124C	Computer Applications	2nd		✓	✓			✓							✓	✓						
EMP182	Math 2 B	2nd	✓							✓												
GEN182	English language	2nd							✓	✓												
ECE211	Electrical and Electronic Measurements		√	√										√		√		√				
ECE212	Principles of Electromagnetic		✓				✓			✓						✓						
ECE213C	Computer Organization		✓	✓								✓	✓			✓						
ECE214C	Computer Programming 2		✓	✓	✓				✓						✓							
EMP281	Math 3 A		✓							✓												
GEN281	Industrial Sociology							✓	✓	✓	✓											

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)											"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN282	Behavior Anizaty		✓		✓						✓	✓	✓									
GEN283	Elective Humanities (1)		✓		✓	✓							✓	✓								
ECE221	Signal Analysis	2nd		✓										✓	✓	✓					✓	
ECE222	Electronics (2)	2nd		✓										✓								✓
ECE223	Lab (2)	2nd												✓	✓	✓			✓	✓		
ECE224C	Logic	2nd		✓	✓								✓	✓								
EMP282	Math 3 B	2nd	✓							✓												
GEN280	Technical reporting	2nd					√	√		✓												
ECE311	Communication Systems													√	√	√		√				
ECE312	Electronic Circuits(A)												√	√				√				√
ECE313	Electromagnetic Waves															✓			✓			
ECE314	Lab (3)(A)													✓		✓	✓					✓

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)											"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN381	Project Management				✓			✓	✓	✓	✓											
GEN382	Environmental impact			✓	✓	✓	✓			✓												
GEN383	Engineering Ethics			✓	✓		✓		✓								✓					
ECE341	Introduction in Large Scale Integration Circuits													✓			✓					✓
ECE342	Advanced electronic measurements													√		√		√				
ECE343	Computer aided Electronic design													√	√	√		√			√	
ECE321	Control System (1)	2nd												✓		✓						
ECE322	Electronic Circuit (B)	2nd											✓	✓	✓							✓

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)											"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ECE323	Communication Networks	2nd														✓	✓	✓				
ECE324	Lab (3)(B)	2nd												✓		✓	✓					✓
EPE381	Power and Electrical Machines	2nd												✓		✓						
ECE344	Microwaves Fundamentals	2nd												✓					✓			
ECE345	Optical Semiconductor	2nd												✓		✓				✓		
ECE346	Transmission Lines Techniques and Theory	2nd												✓		✓			✓			
ECE411	Antenna and wave propagation													√		✓			√			
ECE412	Digital Signal Processing															✓	✓				✓	

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)											"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ECE413	Microprocessor Systems													✓	✓		✓					✓
ECE414	Project	2nd	✓	✓			✓	✓	✓			✓		✓	✓	✓						✓
ECE441	Microwaves Electronics													✓		✓			✓			✓
ECE442	Principles of Medical Engineering													✓	✓	✓	✓				✓	✓
ECE443	Selected Topics (1)													✓	✓		✓					
ECE444	Industrial Electronics													✓	✓	✓			✓		✓	
ECE445	Adaptive filtering												✓	✓	✓							✓
ECE446	Surface acoustic wave devices													✓		✓		✓				✓
ECE421	Digital Communication	2nd												✓	✓	✓		✓			✓	

SPECIFICATIONS OF COMMUNICATIONS AND ELECTRONICS ENGINEERING PROGRAM (2021-2022)

Course Code	Course Name	Engineering Competencies (2018)											"Department" Electrical Engineering Competencies (NARS)					"Discipline" Communications and Electronics Engineering Competencies (ARS)				
		Semester	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ECE422	Advanced Electronic Systems	2nd														√	√	√				
ECE423	Optical Communication	2nd														√		√		√		
ECE424	Lab (4)	2nd												√		√		√			√	√
ECE447	Robot Engineering	2nd												✓	✓	✓					✓	✓
ECE448	Selected Topics (2)	2nd												✓	✓			✓				
ECE449	Radar Systems	2nd														✓	✓	✓				
ECE450	Space communication															✓	✓	✓				
ECE451	High Frequencies Electronics															√	✓	✓				
ECE452	Mobile phones communication															✓	✓	✓				

		منسق برنامج الماجستير في الطاقة المتجددة وكفاءة الطاقة المشتركة بين جامعه القاهرة وجامعه كاسل بألمانيا
1	[redacted] صبحى عياد	أستاذ متفرغ بكلية الهندسة بشبرا جامعه بنها - مدير الشركة المصرية لأنظمة الطاقة الشمسية
2	أ.د/ أحمد رضا الشامى	أستاذ بقسم الهندسة الميكانيكية ومنسق البرنامج
3	أ.د/ رمضان يوسف صقر	رئيس قسم الهندسة الميكانيكية
4	أ.د/ أحمد عطيه عبد اللطيف	أستاذ بقسم الهندسة الميكانيكية ومدير وحدة الجودة

مجلس الكلية رقم (٤) بتاريخ ٢٠١٩/١/٢٩
القرار
أمين المجلس

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

4

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6-بشأن توفيرخدمة الإنترنت لأنه من متطلبات استيفاء المعيار الرابع.

القرار: يتم مخاطبة الإدارة المختصة لتسريع إجراءات التوصيل وزيادة السعه والسرعه

7-بخصوص اعتماد مواصفات الخريج وفقا لمعايير الهيئه 2018

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

8-بشأن اعتماد توصيف برنامج هندسة الطاقة والطاقة المستدامه للعام الجامعى 2020 - 2021

القرار: الموافقة والإعتماد طبقا للقواعد والقوانين المعمول بها .

Energy and Sustainable Energy Engineering Department (ESE)
With the credit hours system
2020 - 2021

A-Basic Information

Department Offering the Program: Mechanical Engineering Department.

Study System: Credit Hours System.

Program Total Credit Hours: 175 credits.

Program Duration: 5-Years (10 Levels).

Program Coordinator: Prof. Ahmed Reda El Shami

Students Supervisor(s): Dr. Eng. Khaled el Naggar & Dr. Eng. Mohamed Emam

B- Professional Information

1. Faculty Mission

The mission of Faculty of Engineering at Shoubra is: "The faculty of Engineering at Shoubra is committed to prepare a graduate with competencies and problem-solving skills that qualify each engineer to compete in local and regional labor markets, the graduate will be able to innovate and become an entrepreneur. The faculty also committed to the development of engineering sciences and producing internationally distinguished scientific research, with the framework of human values and social responsibility "

2. Program mission

The program is committed to qualify students for successful careers in the areas of energy and sustainable energy by providing graduates with a comprehensive knowledge of the latest technologies of green power generation, solar cells, wind energy, bio-energy, bio-products and natural gas and design of traditional and non-conventional power plants.

To judge the compatibility between the program mission and faculty mission, the following matrix is used.

Key Words of Faculty Mission / Key Words of Program Mission	prepare a graduate with competencies and problem-solving skills	compete in local and regional labor markets	innovate and become an entrepreneur	development of engineering sciences	producing internationally distinguished scientific research	human values and social responsibility
Qualify students for successful careers in the areas of energy and sustainable energy	√		√			
comprehensive knowledge of the latest technologies of green power generation, solar cells, wind energy, bioenergy, bio-products and natural gas	√	√			√	√
Design of traditional and non-conventional power plants.				√	√	

3. Program Objectives

The Energy and Sustainable Energy Engineering program aims to develop the necessary skills, design, problem solving ability that meet the professional requirements of traditional, new and renewable technologies.

The graduates of the Energy and Sustainable Energy Engineering Program should be able to:

1. **Deepening students' knowledge backgrounds** in materials science, design and manufacturing techniques, circuit design, energy resources and their impact on the environment so that students have a strong theoretical background, enabling them to come up with a range of innovative approaches to generate efficient and clean energy.

2 - Preparation of a graduate who has the ability to understand the basics of energy engineering and analysis of electricity generation systems to maintain the life of the original equipment to reach the best efficiency.

3. Supply the labor market with quality specialists in the fields of mechanical and electrical engineering, physics and chemistry of electricity generation from **solar, wind energy** or other alternative energies.

4. Prepare a creative graduate who has the ability to design, construct and operate equipment that transforms this energy and is used to generate electricity without any adverse effect on the surrounding environment.

5 - Supervising the power generating units and the ability to operate and shut down the various power units in normal and emergency conditions.

6- Develop solutions to the technical and administrative problems that power plants may face.

7 - Follow-up maintenance work for all equipment and maintenance of power units.

8- Evaluation of the thermal performance of thermal power plants and assessment of energy sources used and provide technical advice.

9 - Provide the students with the fundamentals knowledge of energy system analysis, principles of economical science and engineering economy.

10 - Acquire the knowledge and skills necessary for energy conservation, transportation, storage and save of energy systems.

11 **- Knowledge of** different types of new and renewable traditional energies.

12 - Provide students to be able to design and construct energy systems in order to function effectively in any of the Conventional Energy and Sustainable Energy Engineering roles after graduation, you will need to ensure, with our help, that you have developed the following attributes, which we believe capture the qualities that all competent engineers should possess.

To judge the compatibility of program mission with its objectives, the following matrix is used:

Key Words of Program Mission / Program Objectives	*Qualify students for successful careers in the areas of energy and sustainable energy*	*Comprehensive knowledge of the latest technologies*	*Green power generation*	Design of traditional and non-conventional power plants.
Objective #1	√	√	√	
Objective #2	√			√
Objective #3	√	√		√
Objective #4		√	√	
Objective #5				√
Objective #6		√		√
Objective #7				√
Objective #8		√	√	√
Objective #9	√			
Objective #10	√			√
Objective #11		√	√	
Objective #12	√	√	√	√

4. Graduate Attributes

According to the National Academic Reference Standard (NARS2018), the graduates of ESE program must satisfy the following attributes:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations;
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation;
3. Behave professionally and adhere to engineering ethics and standards;
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance;
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles;
7. Use techniques, skills and modern engineering tools necessary for engineering practice;
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies;
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner;
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

In addition to the general attributes of the engineer according to NARS 2018, The ESE engineer should be able to:

11. Demonstrate increased depth and coverage of knowledge and understanding of energy and sustainable energy technologies and resources management;
12. Carry out preliminary designs of fluid transmission and energy and power systems, investigate their performance and solve their essential operational problems;
13. Use energy efficiently, operate and maintain energy systems;
14. Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in industries and power stations ;
15. Lead or supervise a group of engineers or technicians and other work force;
16. Design, operate and maintain sustainable energy systems;
17. Evaluate the sustainability and environmental issues related to energy systems and apply industrial safety;
18. Use the computer graphics for design, communication and visualization.

5. Program Competencies

According to the National Academic Reference Standard, the EEC program must satisfy the following Competencies:

1- General Engineering NARS Competencies in 2018		
Level A (NARS)	A.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A.2	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
	A.3	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi- cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

2- Sustainable Energy NARS Competencies in 2018		
Level B (NARS)	B.1	Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations
	B.2	Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field support to energy and sustainable energy
	B.3	Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems
	B.4	Carry out preliminary designs of sustainable energy sources including solar, wind, and geothermal energy, and biotechnology and solve their operational problems.

3- - Sustainable Energy ARS (The University of Edinburgh Benchmark)		
Level D (ARS)	D.1	Model, Analyze, design and operate internal combustion engines, pumps, turbines, and compressors according to current developments and technologies
	D.2	Apply quantitative methods and computer software relevant to energy and sustainable energy engineering, in order to solve engineering problems.
	D.3	Carry out preliminary designs of sustainable energy sources including solar, wind, and geothermal energy, and biotechnology and solve their operational problems.
	D.4	Work in a variety of energy systems operations, maintenance and overhaul

To judge the compatibility of program objectives with its competencies, the following matrix is used:

Program Objectives	Program Competencies																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
Objective #1	√		√	√							√				√			
Objective #2	√	√	√							√	√							√
Objective #3						√	√						√		√			√
Objective #4			√			√			√			√	√					√
Objective #5				√		√		√				√				√		
Objective #6					√				√					√	√			
Objective #7						√		√							√			√
Objective #8		√			√			√			√				√	√	√	
Objective #9	√	√	√								√				√			
Objective #10										√			√					
Objective #11					√									√				√
Objective #12			√	√	√		√					√		√			√	

6. Academic standards

6.a Nationally: National Academic References Standards (NARS 2018)

6.b External references for standards (Benchmarks): (The University of Edinburgh)

The external references for standards considered in the development of this program were the National Academic Reference Standards (NARS) prepared by the engineering education sector of the supreme council of universities in Egypt and those of the University of Edinburgh, Institution of Mechanical Engineers (MEng (Hons)).

7. Attributes of program graduates as per NARS Requirements for engineering programs, in general

The graduates of the engineering programs should be able to:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations;

2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation;

3. Behave professionally and adhere to engineering ethics and standards;

4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance;

5. Recognize his/her role in promoting engineering field and contribute in the development of the profession and the community;

6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles;

7. Use techniques, skills and modern engineering tools necessary for engineering practice;

8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies;

9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner;

10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

In addition to

11. Demonstrate increased depth and coverage of knowledge and understanding of energy and sustainable energy technologies and resources management;

12. Carry out preliminary designs of fluid transmission and energy and power systems, investigate their performance and solve their essential operational problems;

13. Use energy efficiently, Operate and maintain energy systems;

14. Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in industries and power stations;

15. Lead or supervise a group of engineers or technicians and other work force;

16. Design, operate and maintain sustainable energy systems;

17. Evaluate the sustainability and environmental issues related to energy systems and apply industrial safety;

18. Use the computer graphics for design, communication and visualization.

8. Curriculum Structure and Contents

8a. Program duration: 10 semesters

8b. Program structure: Contact hours system

No. of credit hours: 175

(Contact Lectures: 122, contact tutorial /Exercises: 60, contact lab: 69)

8c. Indicative curricula Content by Subject Area

	Subject Area	CR	%	NARS Requirements
A	Humanities and Social Sciences (Univ. Req.)	16	9.14	9-12%
B	Mathematics and Basic Sciences	38	21.71	20-26%
C	Basic Engineering Sciences (Faculty/Spec. Req.)	39	22.29	20-23%
D	Applied Engineering and Design	38	21.71	20-22%
E	Computer Applications and ICT	16	9.14	9-11%
F	Projects and Practice	16	9.14	8-10%
G	Electives subjects	12	6.86	6-8%
		175	100	

Practical/Field Training: the students must carry out 3 weeks of the first field training after studying 80 CR and the second field training after studying 120 CR.

9. Program Levels and Courses

The B.Sc. degree in Energy and Sustainable Energy Engineering consists of total 175

List of Elective Courses (12 Credit Hours)

"Student has to choose four of the following courses"

Electives subjects			CR
1	ESE410	Hydraulic and Pneumatic systems	3
2	ESE411	Selected topics in sustainable energy	3
3	ESE412	Air Conditioning & Refrigeration and Environmental Control	3
4	ESE413	Internal Combustion Engines	3
5	ESE510	Energy Management	3
6	ESE511	Marine Energy Systems	3
7	ESE512	Geothermal Energy	3
8	ESE513	Dynamic Uninterruptable Power Supply System	3

First Year (Preparatory Year / Zero Level of Program)

First Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
EMP101	Engineering Mathematics (1)	3	2	2	-	4	100	---	As attached matrix
EMP103	Physics (1)	3	2	-	3	5	100	---	
EMP105	Engineering Chemistry	3	2	-	3	5	100	---	
EMP106	Engineering Mechanics (1)	3	2	2	-	4	100	---	
MDP101	Engineering Drawing (1)	3	2	-	3	5	100	---	
GEN101	English Language	2	2	-	-	2	100	---	
		17	12	4	9	25	600		

Second Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
EMP102	Engineering Mathematics (2)	3	2	2	-	4	100	EMP101	As attached matrix
EMP104	Physics (2)	3	2	-	3	5	100	EMP103	
EMP107	Engineering Mechanics (2)	3	2	2	-	4	100	EMP106	
CPE101	Computer Programming	3	2	-	3	5	100	---	
MDP103	Production Technology & Workshops	3	2	-	3	5	100	---	
MDP102	Engineering Drawing (2)	3	2	-	3	5	100	MDP101	
GEN102	Engineering & Society	2	2	-	-	2	100	---	
		20	14	4	12	30	700		

Second Year (First Level of Program)

First Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
EMP201	Engineering Mathematics (3)	3	2	2	-	4	100	EMP102	As attached matrix
MPE201	Thermodynamics	3	2	-	3	5	100	EMP103	
MDP201	Materials Science	3	2	-	3	5	100	EMP105	
MDP212	Manufacturing Technology	2	1	-	3	4	100	MDP103	
MDP203	Computer Aided Mechanical Drawing	3	2	-	3	5	100	MDP102	
GEN201	Technical Report Writing	2	2	-	-	4	100	GEN101	
		16	11	2	12	25	600		

Second Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
EMP202	Engineering Mathematics (4)	3	2	2	-	4	100	EMP201	As attached matrix
EMP203	Physics (3)	3	2	2	-	4	100	EMP104	
MPE202	Fluid Mechanics	3	2	-	3	5	100	EMP103	
MDP204	Mechanics & Testing of Materials	3	2	-	3	5	100	MDP201	
EPM201	Electrical Engineering I	3	2	2	-	4	100	EMP103	
GEN202	Psychology & Organization Behavior	2	2	-	-	2	100	---	
		17	12	6	6	24	600		

Third Year (Second Level of Program)

First Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
MPE301	Heat & Mass Transfer	3	2	-	3	5	100	MPE201	As attached matrix
MPE302	Applied Fluid Mechanics	3	2	2	-	4	100	MPE202	
ELC301	Electronic Engineering	3	2	2	-	4	100	EPM301	
EMP311	Organic Chemistry	2	1	2	-	3	100	EMP105	
MDP311	Machine Components Design	2	1	2	-	3	100	MDP204	
EPM302	Electrical Engineering II	2	1	2	-	3	100	EPM201	
GEN301	Leadership and Management skills	2	2	-	-	2	100	---	
		17	11	10	3	24	700		

Second Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
MPE303	Measurements & instrumentation Systems	3	2	-	3	5	100	EMP104	As attached matrix
ESE380	Field Training I	1	1			1			
MPE304	Applied Thermodynamics	3	2	2	-	4	100	MPE201	
EPM301	Electrical Power Engineering	3	2	2	-	4	100	EPM201	
MDP312	Theory of Machines	2	1	2	-	3	100	EMP107	
MPE305	Numerical Methods for Engineers	3	2	-	3	5	100	EMP202	
GEN302	Professional Ethics	2	2	-	-	2	100	-	
		17	12	6	6	24	600		

After completion of this semester, student performs Industrial Training (1) course (**ESE380**) for six weeks during summer corresponding to 1 Credit Hour.

Fourth Year (Third Level of Program)

First Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
ESE411	Selected topics in Sustainable Energy	2	1	2	-	3	100	MPE201	As attached matrix
MDP401	Vibration & Dynamics	3	2	-	3	5	100	MDP302	
EPM401	Electrical Machines	3	2	-	3	5	100	EPM301	
ESE402	Fuel & Advanced Combustion	3	2	-	3	5	100	MPE304	
ESE4XX	Elective (1)	3	2	2		4	100	---	
GEN401	Legislations, contract and procurement management	2	2	-	-	2	100	---	
		16	11	4	9	24	600		

Second Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
ESE403	Energy & Conservation Management	3	2	2	-	4	100	ESE411	As attached matrix
MPE401	Applied Heat & Mass Transfer	3	2	-	3	5	100	MPE301	
ESE404	Bioenergy	3	2	2	-	4	100	EMP301	
ESE405	Solar Energy	3	2	2	-	4	100	ESE401	
ESE4XX	Elective (2)	3	2	2	-	4	100	---	
ESE480	Field Training II	1	1			1			
GEN402	Human Resources Management	2	2	-	-	2	100	---	
EPM402	Power System Analysis	3	2	2	-	4	100	EPM301	
		21	15	10	3	28	700		

After completion of this semester, student performs Industrial Training (2) course (**ESE480**) for six weeks during summer corresponding to 1 Credit Hour.

Fifth Year (Fourth Level of Program)

First Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
ESE511	Energy Economics	2	1	2	-	3	100	ESE411	As attached matrix
ESE502	Wind Energy	3	2	2	-	4	100	MPE302	
MDP501	Control Systems analysis & Design	3	2	-	3	5	100	MDP401	
ESE503	Solar Cells Fundamentals	3	2	2	-	4	100	ESE405	
ESE5XX	Elective (3)	3	2	2	-	4	100	---	
ESE591	Project (1)	3	3	-	-	3	100	120 CR	
		17	12	8	3	23	600		

Second Semester:

Code	Subject	Credit Hours	Contact Hours				Marks	Prerequisites	Program NARS Covered
			Lec.	Tut	Lab	Total			
ESE504	Power Stations	3	2	2	-	4	100	MPE304	As attached matrix
ESE525	Computer Applications in Fluid Mechanics	2	1	-	3	4	100	MPE305, MPE302	
ESE506	Energy Storage & Transmission	3	2	2	-	4	100	ESE403, ESE511	
EPM501	Power Electronics	3	2	-	3	5	-	ELC301	
ESE5XX	Elective (4)	3	2	2	-	4	100	---	
ESE592	Project (2)	3	3	-	-	3	100	ESE591	
		17	12	6	6	24	500		

Total Number of Subjects: **65** Total Number of Credit Hours:**175 Hrs**

10. Program admission requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics, then after fulfilling the admission requirements the students will be able to attend the Program.

11. Regulations for progression and program completion First Level/Semester

a. The student is considered successful in a certain level if he completes at least 36 credit hours in this level.

b. The referred student has to study the courses in which he has failed again with actual grade when he passes successfully. In case the student was considered absent with acceptable excuse in a course, he gets the actual grade,

c. The grades of the successful student in a course and in the general grade are evaluated as follows:-

Grade	Student percentage	Grade	No.Points
Excellent	more than 97%	A^+	4.00
	from 93% to less than 97%	A	4.00
	from 89% to less than 93%	A^-	3.70
Very good	from 84% to less than 89%	B^+	3.30
	from 80% to less than 84%	B	3.00
Good	from 76% to less than 80%	B^-	2.70
	from 73% to less than 76%	C^+	2.30
	from 70% to less than 73%	C	2.00
Pass	from 67% to less than 70%	C^-	1.70
	from 64% to less than 67%	D^+	1.30
	from 60% to less than 64%	D	1.00
Fail	less than 60%	F	0.00

The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study. The students are then arranged serially according their cumulative sum (not less than 2).

12. Teaching and Learning Methods

Program Competencies		Teaching and Learning Methods									
		Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Site Visit	Presentation	Mini Project	Research and Reporting	Brain Storming
Level A	A1	√	√	√							
	A2				√	√			√	√	
	A3	√	√	√							√
	A4	√	√	√			√				
	A5									√	√
	A6				√	√	√		√		
	A7							√		√	√
	A8				√			√			
	A9				√			√		√	
	A10				√					√	√
Level B	B1	√	√	√						√	√
	B2	√	√	√					√		
	B3	√	√			√		√	√		
	B4		√						√	√	
Level D	D1	√	√		√				√	√	
	D2	√			√	√			√	√	
	D3	√			√	√			√	√	
	D4	√	√		√		√		√	√	

13. Assessment Methods

Program Competencies		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Level A	A1	√	√		√			√	√		√
	A2			√		√		√	√		√
	A3	√	√		√				√	√	
	A4	√	√		√				√		
	A5						√	√			√
	A6					√		√	√	√	√
	A7							√	√	√	
	A8			√				√	√	√	
	A9			√				√	√		
	A10						√		√	√	√
Level B	B1	√	√	√	√		√	√	√		
	B2	√	√		√	√		√	√		
	B3	√	√	√	√			√	√		
	B4	√	√		√	√		√	√		
Level D	D1	√	√		√		√		√	√	
	D2	√	√				√		√	√	
	D3	√	√				√		√	√	
	D4	√	√			√			√	√	

14. Evaluation of Program Competencies

Evaluator	Tool	Sample
1. Senior students	Evaluation sheet	25%
2. Alumni	Evaluation sheet & interview	5%
3. Stakeholders (Employers)	Evaluation sheet & interview	5
4. External Evaluator(s) (External Examiner(s))	Report	1
5. Internal Evaluator(s) (Internal Examiner(s))	Report	2

Coordinator of
Program Quality assurance committee

Dr. Khaled El Naggar
Date 3 / 1 / 2021

Program Coordinator

Prof. Dr. Ahmed Reda
Date 3 / 1 / 2021

Appendix: Course Matrix with program Competences:

Course Code	Course Name	Engineering Competencies (2018)										"Department" Sustainable Energy Competencies (NARS)				"Discipline" Sustainable Energy Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
EMP101	Engineering Mathematics (1)	√		√															
EMP103	Physics (1)	√	√					√											
EMP105	Engineering Chemistry	√	√					√											
EMP106	Engineering Mechanics (1)	√		√															
MDP101	Engineering Drawing (1)	√					√		√										
GEN101	English Language							√	√										
EMP102	Engineering Mathematics (2)	√		√															
EMP104	Physics (2)	√	√					√											
EMP107	Engineering Mechanics (2)	√		√															
CPE101	Computer Programming	√			√		√	√		√	√								
MDP103	Production Technology & Workshops		√				√			√									
MDP102	Engineering Drawing (2)		√		√				√		√								
GEN102	Engineering & Society			√	√														
EMP201	Engineering Mathematics (3)	√							√										
MPE201	Thermodynamics	√				√					√	√				√			√

Course Code	Course Name	Engineering Competencies (2018)										"Department" Sustainable Energy Competencies (NARS)				"Discipline" Sustainable Energy Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
MDP201	Materials Science	√	√	√							√		√				√		
MDP212	Manufacturing Technology	√		√							√	√							√
MDP203	Computer Aided Mechanical Drawing			√						√	√	√	√				√	√	
GEN201	Technical Report Writing							√	√										
EMP202	Engineering Mathematics (4)	√							√										
EMP203	Physics (3)	√							√										
MPE202	Fluid Mechanics	√	√						√			√							
MDP204	Mechanics & Testing of Materials	√		√							√	√	√						
EPM201	Electrical Engineering I	√									√	√		√					√
GEN202	Psychology & Organization Behavior			√				√	√	√									
MPE301	Heat & Mass Transfer	√	√									√							
MPE302	Applied Fluid Mechanics	√	√	√		√						√							
ELC301	Electronic Engineering	√		√		√													
EMP311	Organic Chemistry	√			√										√				√
MDP301	Machine Components Design			√	√							√	√						
EPM302	Electrical Engineering II	√									√	√		√					√

Course Code	Course Name	Engineering Competencies (2018)										"Department" Sustainable Energy Competencies (NARS)				"Discipline" Sustainable Energy Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
GEN301	Leadership and Management skills			√			√		√	√	√								
MPE303	Measurements & instrumentation Systems	√	√	√							√								√
ESE380	Field Training I			√	√			√	√	√			√		√	√			
MPE304	Applied Thermodynamics	√							√		√	√		√		√			
EPM301	Electrical Power Engineering					√	√				√			√	√	√			√
MDP312	Theory of Machines	√				√						√							
MPE305	Numerical Methods for Engineers	√	√			√			√		√		√				√	√	
GEN302	Professional Ethics						√	√		√									
ESE411	Selected topics in Sustainable Energy			√		√									√				
MDP401	Vibration & Dynamics	√		√								√							√
EPM401	Electrical Machines	√	√	√										√	√				√
ESE402	Fuel & Advanced Combustion	√		√									√			√			√
ESE410	Elective (1)			√	√					√		√	√			√			√
GEN401	Legislations, contract and procurement management						√			√	√								
ESE403	Energy & Conservation Management		√		√			√				√				√			√
MPE401	Applied Heat & Mass Transfer	√	√	√								√							

Course Code	Course Name	Engineering Competencies (2018)										"Department" Sustainable Energy Competencies (NARS)				"Discipline" Sustainable Energy Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
ESE404	Bioenergy	√		√	√										√				√
ESE405	Solar Energy	√	√	√		√						√	√				√		√
ESE412	Elective (2)	√			√	√						√							√
ESE480	Field Training II			√	√			√	√	√			√		√	√			
GEN402	Human Resources Management				√	√	√	√	√	√	√								
EPM402	Power System Analysis	√	√	√								√		√		√	√		√
ESE501	Energy Economics				√		√				√							√	
ESE502	Wind Energy			√	√					√		√			√	√			√
MDP501	Control Systems analysis & Design	√					√			√		√	√	√					√
ESE503	Solar Cells Fundamentals	√		√		√						√	√		√		√		√
ESE510	Elective (3)			√	√					√		√	√			√			√
ESE591	Project (1)	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	
ESE504	Power Stations	√		√									√			√			√
ESE525	Computer Applications in Fluid Mechanics		√		√	√					√	√	√				√	√	
ESE506	Energy Storage & Transmission	√	√	√										√					√
EPM501	Power Electronics	√	√	√										√	√				
ESE512	Elective (4)			√	√					√		√	√			√			√

Course Code	Course Name	Engineering Competencies (2018)										"Department" Sustainable Energy Competencies (NARS)				"Discipline" Sustainable Energy Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
ESE592	Project (2)	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	

تصميم البرنامج

مرفق 2-2/1/5

Specifications of Mechanical Power Engineering Program (2022/2023)

2021 Bylaw

University: Benha University
Faculty: Faculty of engineering at Shoubra
Department: Mechanical Engineering Department
Specification of Mechanical Power Engineering (B.Sc. Program) 2022/2023

A- Basic Information

1- Program title: Mechanical Power Engineering Program
2- Program type: Single
3- Department: Mechanical Engineering
4- Coordinator: Assoc. Prof. Dr. Mohamed Reda Salem
5- External evaluator: Prof. Dr. Mohamed Watani Mohamed El-Sayed, Faculty of engineering, Mataria, Helwan University
6- Last date of program specifications approval: 2021

B- Professional Information

1. Faculty Mission:

The faculty of Engineering at Shoubra is committed to prepare a graduate with competencies and problem-solving skills that qualify each engineer to compete in local and regional labor markets, the graduate will be able to innovate and become an entrepreneur. The faculty also committed to the development of engineering sciences and producing internationally distinguished scientific research, with the framework of human values and social responsibility.

2. Program Mission:

The mechanical power engineering program is committed to graduating engineers who are able to understand the continuous development in scientific technologies and competition at the local and regional levels, equipped with basic and applied science foundations, able to produce innovative solutions to the needs of all sectors of society in the fields of mechanical power engineering, and are aware of the ethical and professional values and requirements of environmental protection. In addition to developing research and scientific studies and upgrading their quality in line with the needs of society.

To judge the compatibility between the program mission and faculty mission, both are divided to keywords and the matrix given in **Appendix A** is used.

3. Program Educational Objectives:

The mechanical power engineering program objectives are:

3.1. Apply and integrate knowledge and understanding of mathematics, physics, engineering sciences and skills to solve engineering problems in various topics and computer programs available to solve real problems in industries, heating, ventilation and air conditioning systems, and power plants to meet the required needs within realistic constraints.

3.2. Identify, formulate, and solve basic engineering problems and use appropriate engineering techniques, skills and tools necessary for engineering practice and project management.

3.3. Evaluating the sustainability and environmental issues related to mechanical energy systems and considering the impact of engineering solutions on society and the environment.

3.4. Use energy efficiently, demonstrate knowledge of contemporary engineering issues, and engage in self-learning and lifelong learning.
3.5. Apply industrial security, display professional and ethical responsibilities, understand context, and communicate effectively.
3.6. Work effectively within multi-disciplinary engineering teams and lead or supervise a group of engineers, technicians, and workforce.
3.7. Design, operation and maintenance of fluid and energy transmission systems, heating, ventilation and air conditioning systems, internal combustion engines and steam engines, verifying their performance and solving their basic operational problems.

To judge the compatibility of program mission with its Educational Objectives, the matrix given in **Appendix B** is used.

4. Graduate Attributes

According to the National Academic Reference Standard (NARS2018), the graduates of any engineering program must satisfy the following attributes:

1) Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2) Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3) Behave professionally and adhere to engineering ethics and standards.
4) Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5) Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6) Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7) Use techniques, skills and modern engineering tools necessary for engineering practice.
8) Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9) Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10) Demonstrate leadership qualities, business administration and entrepreneurial skills.

Besides the above-mentioned general attributes of all engineering graduates, the Mechanical Power Engineering graduates must satisfy the following attributes:

11) Evaluate the sustainability and environmental issues related to mechanical power systems.
12) Use energy efficiently.
13) Apply industrial safety.
14) Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in industries and HVAC systems and power stations.
15) Lead or supervise a group of engineers, technicians, and work force.
16) Carry out preliminary designs of fluid transmission and power systems, investigate their performance and solve their essential operational problems.
17) Design, operate and maintain HVAC systems, internal combustion engines and steam engines.

To judge the compatibility of program mission as well as its Educational Objectives with the graduate attributes, the two matrices given in **Appendix C** are used.

5. Academic Standards of Program

5.1. Program Competencies

According to the National Academic Reference Standard, the program in Mechanical Power Engineering must satisfy the following Competencies:

5.1. General Engineering NARS Competencies in 2018		
Level A (NARS)	**A.1**	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A.2	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
	A.3	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi- cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

5.2. Mechanical Engineering NARS		
Level B (NARS)	**B.1**	Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
	B.2	Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.

5.2. Mechanical Engineering NARS		
	B.3	Select conventional mechanical equipment according to the required performance.
	B.4	Adopt suitable national and international standards and codes, integrate legal, economic, and financial aspects to design, build, operate, inspect and maintain mechanical equipment and systems.

5.3. Mechanical Power ARS		
Level C (ARS)	**C.1**	Prepare, supervise the implementation of engineering drawings, computer graphics and write, present technical reports.
	C.2	Plan, schedule and use workshop equipment according to the appropriate codes and standards.
	C.3	Prepare, supervise and carry out plans for operation and maintenance of power mechanical systems (fluid transmission networks, internal combustion engines, Refrigeration, HVAC, power plant equipment,,,,,,).
	C.4	Design, evaluate mechanical power and energy for engineering systems, process performance and propose, conduct improvements.

6. National Academic References Standards (NARS)

The program is adopted exactly **NARS** as reference academic standards for levels A and B and **ARS** for level C of this program (*National Academic Reference Standards (NARS) for Engineering 2nd edition, issued in 2018*).

7. Curriculum Structure and Content

7. 1. Program Duration: 10 semesters (5-years)

The academic year is divided into two semesters as follows (or according to the decisions of the Supreme Council of Universities):

- First semester (fall-semester): starts at the beginning of the third week of September for a period of 15 weeks.
- Second semester (spring-semester): starts at the beginning of the second week of February for a period of 15 weeks.

7. 2. Program Structure: Contact Hours System

- **No. of Contact Hours:** 250 99 Lectures 151 Tutorial/Lab.
- **No. of Contact Hours:** 250 220 Compulsory 30 Elective
- **No. of Contact Hours of Basic Science:** 64 Hours = 25.6%
- **No. of Contact Hours of Social Science and Humanities:** 20 Hours = 8%
- **No. of Contact Hours of Specialized Courses:** 160 Hours = 64%

7. 3. Indicative Curricula Content by Subject Area

NO	Subject Area	Contact Hours	%	% According to Reference Framework
1	Humanities & Social Science	20	8	8-12
2	Mathematics & Basic Sciences	64	25.6	20-26
3	Basic Engineering Science	67	26.8	25-30
4	Applied Engineering and Design	71	28.4	25-30
5	Business Administration	11	4.4	2-4
6	Engineering Knowledge	7	2.8	3-6
7	Projects &Training	10	4	3-6
		250	**100**	**100**

NO	Subjects	Contact Hours	%	Min. Percentage According to Reference Framework (%)
1	University Requirements	20	8	8
2	Faculty Requirements	70	28	20
3	Major Specialization Subjects	98	39.2	35
4	Minor Specialization Subjects	62	24.8	Maximum 30
		250	**100**	

7. 4. Program Levels (Years):

Preparatory Year: It is required to pass 50 hours distributed as follows:
48 compulsory 2 Elective

First Year Mechanical Power: It is required to pass 50 hours distributed as follows:
48 compulsory 2 Elective

Second Year Mechanical Power: It is required to pass 50 hours distributed as follows:
46 compulsory 4 Elective

Third Year Mechanical Power: It is required to pass 50 hours distributed as follows:
46 compulsory 4 Elective

Fourth Year Mechanical Power: It is required to pass 50 hours distributed as follows:
34 compulsory 16 Elective

Year	Hours		
	Compulsory	Elective	Total
Preparatory	48	2	50
First	48	2	50
Second	46	4	50
Third	46	4	50
Fourth	34	16	50
Total Hours			250

7. 5. Program Levels and Courses

Year of Program 1 - Preparatory Year (Semester 1) - Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
BAS010	Differential Calculus and Algebra	2	2	0	4	As Attached Matrix
BAS011	Statics	2	1	2	5	
BAS012	Engineering Chemistry	2	1	2	5	
BAS013	Physics of Materials & Electricity	2	1	3	6	
MEC010	Engineering Drawing (1) ×	0	3	0	3	
GEN0x0	Elective - Language requirements List	2	0	0	2	
		10	**8**	**7**	**25**	

Year of Program 1 - Preparatory Year (Semester 2) - Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
BAS014	Integral Calculus & Analytical Geometry	2	2	0	4	As Attached Matrix
BAS015	Dynamics	2	1	2	5	
BAS016	Physics of Light, Heat and Magnetism	2	1	2	5	
MEC011	Principles of Manufacturing Engineering†	1	0	2	3	
MEC012	Engineering Drawing (2) ×	0	3	1	4	
GEN011	Computer Skills ×	1	0	1	2	
GEN012	History of Engineering & Technology	2	0	0	2	
		10	**7**	**8**	**25**	

Year of Program 2 - First Year Mechanical Power (Semester 1) – Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC110	Mechanical Drawing *×	1	3	0	4	As Attached Matrix
ELE170	Electrical Engineering	2	2	0	4	
MEC111	Materials Science	1	1	3	5	
BAS110	Statistics & Theory of Probability	2	2	0	4	
BAS111	Engineering Mechanics	1	3	0	4	
MEC112	Manufacturing Technology (1)†	2	1	1	4	
		9	**12**	**4**	**25**	

Year of Program 2 - First Year Mechanical Power (Semester 2) - Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC120	Thermodynamics	2	2	1	5	As Attached Matrix
BAS112	Differential Equations	2	2	0	4	
MEC121	Fluid Mechanics (1)	2	1	2	5	
MEC113	Mechanics & Testing of Materials	2	1	2	5	
MEC102	Computer Aided Engineering Mathematics	1	0	3	4	
GEN9XX	Elective from University Requirements	1	1	0	2	
		10	**7**	**8**	**25**	

Year of Program 3 - Second Year Mechanical Power (Semester 1) - Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC210	Engineering Economy & Accounting	2	2	0	4	As Attached Matrix
MEC201	Theory of Measurements & Sensors	1	1	3	5	
BAS211	Numerical & Complex Analysis	2	2	0	4	
MEC211	Kinematics & Dynamics of Rigid Bodies	2	2	1	5	
MEC212	Manufacturing Technology (2)†	2	1	2	5	
GEN9XX	Elective from University Requirements	1	1	0	2	
		11	**8**	**6**	**25**	

Year of Program 3 - Second Year Mechanical Power (Semester 2) - Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC213	Mechanical Design (1)	2	4	0	6	As Attached Matrix
MEC220	Heat Transfer	2	1	2	5	
MEC214	Mechanical Vibrations	2	2	0	4	
ELE270	Electrical Machines	2	1	1	4	
MEC221	Fluid Mechanics (2)	2	1	1	4	
GEN9XX	Elective from University Requirements	1	1	0	2	
		11	**10**	**4**	**25**	

Year of Program 4 - Third Year Mechanical Power (Semester 1) – Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC310	Engineering Project Management	2	2	0	4	As Attached Matrix
MEC320	Hydraulic & Pneumatic Systems	2	0	3	5	
MEC330	System Dynamics	2	2	0	4	
MEC321	Applied Thermodynamics	1	2	2	5	
MEC322	Heat & Mass Transfer	1	2	2	5	
GEN9XX	Elective from University Requirements	1	1	0	2	
MEC300	Field Training (1)	0	0	0	0	
		9	**7**	**9**	**25**	

Year of Program 4 - Third Year Mechanical Power (Semester 2) – Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC331	Automatic Control	2	2	0	4	As Attached Matrix
MEC324	Computer App. in Energy Field	1	0	3	4	
MEC325	Gas Dynamics	2	2	1	5	
MEC326	Fuel & Combustion	2	2	1	5	
MEC327	Renewable Energy& Environ. Prot.	2	1	2	5	
GEN9XX	Elective from University Requirements	1	1	0	2	
		11	**7**	**7**	**25**	

Year of Program 5 - (Fourth Year Mechanical (Power)) (Semester 1) - Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC420	Internal Combustion Engines (ICE)	2	2	1	5	As Attached Matrix
MEC421	Turbomachines	2	2	1	5	
MEC422	Refrigeration & Air Conditioning	2	2	1	5	
MEC4xx	Elective (1)	1	2	1	4	
MEC4xx	Elective (2)	1	2	1	4	
GEN9XX	Elective from University Requirements list	1	1	0	2	
MEC400	Field Training (2)	0	0	0	0	
		9	**11**	**5**	**25**	

Year of Program 5 - Fourth Year Mechanical Power (Semester 2) – Compulsory

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MEC414	Feasibility Study of Eng. Projects	1	2	0	3	As Attached Matrix
MEC423	Power Stations	2	2	0	4	
MEC4xx	Elective (3)	2	1	0	3	
MEC4xx	Elective (4)	2	1	0	3	
GEN9XX	Elective from University Requirements	1	1	0	2	
MEC490	Graduation Project *	0	0	10	10	
		9	**6**	**10**	**25**	

List of Technical Languages Elective Courses (Selected by students)

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
GEN010	English Language	2	0	0	2	As Attached Matrix
GEN020	German Language	2	0	0	2	
GEN030	French Language	2	0	0	2	

List of Elective Courses from University Requirements (Selected by Students)

Code	Course Title	No. of Hours/Week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
GEN900	Communication & Presentation Skills	1	1	0	2	As Attached Matrix
GEN901	Theory of Sustainability	1	1	0	2	
GEN902	Societal Issues	1	1	0	2	
GEN903	Research & Analysis Skills	1	1	0	2	
GEN904	Entrepreneurship	1	1	0	2	
GEN905	Professional Ethics	1	1	0	2	
GEN906	Critical Thinking	1	1	0	2	
GEN907	Human Resources Management	1	1	0	2	
GEN908	Contracts and Legislation	1	1	0	2	
GEN909	Method of Scientific Research and Writing	1	1	0	2	

List Of Elective Courses (Selected by Students)

Code	Subject	Contact Hrs			
		Lec.	Tut.	Lab.	Total
List (1) of Elective Courses					
MEC450	Water Desalination & Wastewater Treatment	1	2	1	4
MEC451	Pipeline Networks	1	2	1	4
List (2) of Elective Courses					
MEC452	Thermal Equipment	1	2	1	4
MEC453	Aerodynamics Engineering	1	2	1	4
MEC454	Computational Fluid Mechanics (CFD)	1	2	1	4
List (3) of Elective Courses					
MEC455	Numerical Methods in Energy Science	2	1	0	3
MEC456	Energy Management Systems	2	1	0	3
MEC457	Fire Fighting and Safety Systems	2	1	0	3
List (4) of Elective Courses					
MEC458	Advanced Refrigeration & Air Conditioning	2	1	0	3
MEC459	Vehicle Engineering	2	1	0	3

8. Program Admission Requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics, then after passing the preparatory year and fulfilling the admission requirements the students will be able to attend the program.

9. Regulations for progression and program completion First Year/Level/Semester

a) The student is considered successful if he/she passes the examinations in all courses of his class. The student is promoted to the next higher level if he/she fails in not more than two subjects of his class or from lower classes,

b) The referred student has to sit the examination in the courses in which he/she has failed together with the students studying the same courses. The student gets a pass grade when he/she passes the examination successfully. In case the student was considered absent with acceptable excuse in a course, he/she gets the actual grade,

c) The grades of the successful student in a course and in the general grade are evaluated as follows

- **Distinction:** From 85% of the total mark and upwards.
- **Very good:** From 75% to less than 85% of the total mark.
- **Good:** From 65% to less than 75% of the total mark
- **Pass:** From 50% to less than 65% of the total mark
- The grades of a failing student in a course are estimated in one of the following grades:
  - Weak: From 30% to less than 50% of the total mark
  - Very weak: Less than 30% of the total mark.

Grade	Percentage	
	From	Up to
Distinction	85%	100%
Very good	75%	85%
Good	65%	75%
Pass	50%	65%
The grades of a failing student in a course are estimated in one of the following grades:		
Weak	30	50%
Very weak		Less than 30%

- The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study. The students are then arranged serially according to their cumulative sum.
- The student is awarded an honor degree if his cumulative sum is distinction or very good provided that he/she gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he/she should not have failed in any examination he/she has sat in any class other than the preparatory year.

10. Teaching and Learning Methods

Considering that the program competences illustrate a wholistic status that would be achieved through a journey involves many different courses within different levels, and the final competence achievement can only be assessed at the end of its journey, each single competence is broken-down into measurable Learning Outcomes LOs that should be achieved in different courses. Thus, the program graduate competence may be considered as the final goal, while the courses LOs may be considered as the procedural aims/objectives. Hence, different teaching and learning methods are applied in program courses to cover the three domains given by the following table. For more details, please refer to the course specifications.

- **Teaching and Learning Methods**
  - Face-to-face Lecture
  - Online Education
  - Tutorial / Exercise
  - Group Discussions
  - Laboratory
  - Site Visit
  - Presentation
  - Collaborate Learning (Team Project)
  - Research and Reporting
  - Class Activity
  - Case Study
  - Assignments/homework
  - Brain Storming

Teaching & Learning Methods	Learning Outcomes Domains (Courses LOs)		
	Cognitive	Psychomotor	Affective
Face-to-face Lecture	√	√	√
Online Education	√		√
Tutorial / Exercise		√	√
Group Discussions	√		
Laboratory	√	√	
Site Visit			√
Presentation	√		√
Collaborate Learning (Team Project)	√		√
Research and Reporting		√	√
Class Activity	√	√	
Case Study	√	√	
Assignments/homework		√	√
Brain Storming	√	√	

11. Assessment Methods of Program Intended Learning Outcomes:

Different assessment methods are applied in the program courses to assess these Learning Outcomes. The following table illustrates the assessment methods and what they assess in most cases. For further detail, refer to the courses' specifications

- Written Exams
- Online Exams
- Oral Exam
- Quizzes
- Lab Exam
- Take-Home Exam
- Research Assignments
- Reporting Assignments
- Project Assignments
- In-class Questions
- Class activities

Formative Assessment	Learning Outcomes Domains (Courses LOs)		
	Cognitive	Psychomotor	Affective
Quizzes	√	√	√
Research Assignments	√		√
In-class Questions	√	√	√
Class activities	√	√	√

Summative Assessments	Learning Outcomes Domains (Courses LOs)		
	Cognitive	Psychomotor	Affective
Written Exams	√	√	√
Online Exams	√	√	
Oral Exam	√	√	√
Lab Exam	√	√	
Take-Home Exam	√	√	√
Reporting Assignments	√		√
Project Assignments	√	√	√

12. Evaluation of Program Intended Learning Outcomes (200)

No.	Evaluator	Tool	Sample
1.	Senior students	Evaluation sheet	50%
2.	Alumni	Evaluation sheet & interview	15%
3.	Stakeholders (Employers)	Evaluation sheet & interview	15%
4.	External Evaluator(s) (External Examiner(s))	Report	20%
5.	Other	None	-

Coordinator of
Program Quality Assurance Committee

Assoc. Prof. Dr. Mohamed Reda Salem

Head of
Mechanical Engineering Department

Prof. Dr. Sameh Shawky Habib

Appendix A

To judge the compatibility between the program mission and faculty mission, the following matrix is used.

Key Words of Program Mission \ Key Words of Faculty Mission	prepare a graduate with competencies and problem-solving skills	compete in local and regional labor markets	innovate and become an entrepreneur	development of engineering sciences	producing internationally distinguished scientific research	human values and social responsibility
Development of scientific technologies	√			√		
Competition at the local and regional levels		√				
Basic and applied science foundations					√	
Produce innovative solutions			√			
Ethical and professional values and requirements of environmental protection						√
Developing research and scientific studies		√		√		

Appendix B

To judge the compatibility of program mission with its objectives, the following matrix is used:

Key Words of Program Mission / Program Objectives	Development of scientific technologies	Competition at the local and regional levels	Basic and applied science foundations	Produce innovative solutions	Ethical and professional values and requirements of environmental protection	Developing research and scientific studies
Objective #1	√		√	√		√
Objective #2	√		√	√		√
Objective #3	√	√	√		√	
Objective #4	√			√		
Objective #5	√				√	
Objective #6		√		√	√	
Objective #7	√	√	√	√		√

Appendix C

To judge the compatibility of graduate attributes with program objectives, the following matrix is used:

Program Objectives / Graduate Attributes	Objective #1	Objective #2	Objective #3	Objective #4	Objective #5	Objective #6	Objective #7
Attribute #1	√						
Attribute #2		√					
Attribute #3						√	
Attribute #4					√		
Attribute #5	√		√				
Attribute #6			√				
Attribute #7		√					
Attribute #8				√			
Attribute #9					√	√	
Attribute #10					√	√	
Attribute #11			√				
Attribute #12				√			
Attribute #13					√		
Attribute #14	√						
Attribute #15		√			√	√	
Attribute #16							√
Attribute #17							√

Appendix D

To judge the compatibility of program objectives with its competencies, the following matrix is used:

Program Objectives	Program Competencies																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
Objective #1	√	√		√						√	√				√		√	
Objective #2	√		√		√				√		√	√					√	√
Objective #3		√	√	√						√		√	√		√			√
Objective #4				√			√							√		√		
Objective #5						√	√		√							√		
Objective #6			√													√		
Objective #7		√	√								√	√					√	√

Appendix E

To judge the compatibility of program's graduate attributes with its competencies, the following matrix is used:

Graduate Attributes	Program Competencies																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
Attribute #1	√																	
Attribute #2	√								√									
Attribute #3	√		√	√														
Attribute #4						√	√											
Attribute #5			√	√		√			√									
Attribute #6			√	√														
Attribute #7		√																
Attribute #8					√					√								
Attribute #9								√										
Attribute #10									√									
Attribute #11			√															
Attribute #12	√	√		√							√		√					
Attribute #13				√								√				√		
Attribute #14											√	√		√			√	
Attribute #15							√								√			
Attribute #16														√				√
Attribute #17														√				√

Appendix F

Course Matrix with Program Competences

The following matrix is used to judge the compatibility between the program competences and program courses

Course Code	Course Name	Engineering Competencies (2018)										"Department" Mechanical Engineering Competencies (NARS)				"Discipline" Mechanical Power Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
GEN0X0	Technical Language							√	√										
GEN011	Computer Skills								√		√								
GEN012	History of Engineering & Technology			√	√														
GEN900	Communication & Presentation Skills					√			√	√									
GEN901	Theory of Sustainability			√				√											
GEN902	Societal Issues			√				√	√										
GEN903	Research & Analysis Skills		√			√													
GEN904	Entrepreneurship			√						√									
GEN905	Professional Ethics			√					√	√									
GEN906	Critical Thinking									√	√								
GEN907	Human Resources Management				√		√												
GEN908	Contracts and Legislation			√	√														
GEN909	Method of Scientific Research and Writing		√			√													
BAS010	Differential Calculus and Algebra	√		√															
BAS011	Statics	√		√															
BAS012	Engineering Chemistry	√	√					√											
BAS013	Physics of Materials & Electricity	√	√					√											

Course Code	Course Name	Engineering Competencies (2018)										"Department" Mechanical Engineering Competencies (NARS)				"Discipline" Mechanical Power Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MEC010	Engineering Drawing (1)	√					√		√										
MEC012	Engineering Drawing (2)		√		√				√										
BAS014	Integral Calculus & Analytical Geometry	√		√															
BAS015	Dynamics	√		√															
BAS016	Physics of Light, Heat and Magnetism	√	√					√											
MEC011	Principles of Manufacturing Engineering		√				√			√									
MEC110	Mechanical Drawing *×			√					√		√								
ELE170	Electrical Engineering	√							√			√							
MEC111	Materials Science	√	√	√		√					√	√	√						
BAS110	Statistics & Theory of Probability	√							√	√									
BAS111	Engineering Mechanics	√									√	√							
MEC112	Manufacturing Technology (1) †												√	√					
MEC120	Thermodynamics	√						√				√							
BAS112	Differential Equations	√						√											
MEC121	Fluid Mechanics (1)	√	√						√			√							
MEC113	Mechanics & Testing of Materials	√	√	√	√							√							
MEC102	Engineering Math. Using Computer	√	√					√											
MEC210	Engineering Economy & Accounting	√		√					√	√									
MEC201	Theory of Measurements & Sensors	√	√			√						√			√				
BAS211	Numerical Analysis	√	√			√						√							
MEC211	Kinematics & Dynamics of Rigid Bodies	√						√				√							
MEC212	Manufacturing Technology (2) †												√	√	√				
MEC213	Mechanical Design (1)			√								√	√		√				
MEC220	Heat Transfer	√	√			√						√							
MEC214	Mechanical Vibrations	√		√								√							

Course Code	Course Name	Engineering Competencies (2018)										"Department" Mechanical Engineering Competencies (NARS)				"Discipline" Mechanical Power Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
ELE270	Electrical Machines							√			√	√							
MEC221	Fluid Mechanics (2)	√	√			√						√							
MEC310	Engineering Project Management						√			√				√			√		
MEC320	Hydraulic & Pneumatic Systems										√	√		√	√	√		√	√
MEC330	System Dynamics	√										√		√				√	
MEC321	Applied Thermodynamics								√			√	√			√		√	√
MEC322	Heat & Mass Transfer						√					√	√			√		√	√
MEC300	Field Training (1)													√	√	√	√		
MEC331	Automatic Control											√	√			√		√	√
MEC324	Computer App. in Energy Field		√						√				√			√		√	√
MEC325	Gas Dynamics					√						√							√
MEC326	Fuel & Combustion											√				√		√	√
MEC327	Renewable Energy & Environ. Prot.					√						√		√		√		√	√
MEC420	Internal Combustion Engines (ICE)		√										√			√	√	√	√
MEC421	Turbomachines	√		√		√							√	√		√		√	√
MEC422	Refrigeration & Air Conditioning										√		√	√	√	√	√	√	√
MEC400	Field Training (2)							√			√						√		
MEC414	Feasibility Study of Eng. Projects			√			√												
MEC423	Power Stations											√	√			√		√	√
MEC490	Graduation Project *	√	√	√		√		√		√	√	√	√	√	√	√	√	√	√
Elective Courses																			
MEC450	Water Desalination & Wastewater Treatment												√	√		√		√	√
MEC451	Pipeline Networks												√		√	√		√	√
MEC452	Thermal Equipment											√			√	√		√	√
MEC453	Aerodynamics Engineering											√				√		√	√

Course Code	Course Name	Engineering Competencies (2018)										"Department" Mechanical Engineering Competencies (NARS)				"Discipline" Mechanical Power Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MEC454	Computational Fluid Mechanics (CFD)		√		√								√					√	√
MEC455	Numerical Methods in Energy Science					√						√	√						
MEC456	Energy Management Systems											√			√			√	√
MEC457	Fire Fighting and Safety Systems														√	√		√	√
MEC458	Advanced Refrigeration & Air Conditioning														√	√	√	√	√
MEC459	Vehicle Engineering															√	√	√	√

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Electrical Engineering and Control Program

1- Course Data (Basic Information)

Course Code & Title: EEC321 Automatic Control (1) **Semester/Year:** Second / 2020-2021
Prerequisite Course(s): EEC224 Signals and Systems **Core or Elective:** Core Course
Credit Hours: 3 **Weekly Contact Hours**: **Lecture:** 2 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with the basic knowledge and skills to model different physical electrical and/or mechanical systems and obtain their transfer functions. Moreover, employ time domain analysis to diagnose transient performance parameters of 2nd order system. Finally, identify the needs for different types of controllers to ascertain the required response and stability.

3- Course Contents (As indicated in the program Bylaw)

Introduction to control systems: Open loop systems, closed loop systems, transfer function and concept of poles and zeros. Block diagram reduction techniques. Signal flow graph techniques. Modeling of some electrical, mechanical and thermal systems. Time response of first and second order systems, PID controllers. Steady-state error. Concept of stability: Routh's stability criterion. Root locus method. State- space representation: State model of linear systems using physical variables, State, space representation using phase variables. Properties of transition matrix and solution of state equation.

4- Program Competences Served by The Course (A2, B4 and C1)

Level (A) General Engineering Competences

A.2 Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

Level (B) Electrical Engineering Competences

B.4 Estimate and measure the performance of an electrical system and circuit under specific input excitation and evaluate its suitability for a specific application.

Level (C) Electrical Engineering & Control Competences

C.1 Demonstrate additional abilities to model, design and integrate computer-operated systems including analog, digital and intelligent systems.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Apply the block-diagram algebra to obtain the system transfer function.
LO2	Construct signal flow graph to calculate system transfer function using Mason's formula
LO3	Create a model of physical system & its mechanical network to write its differential equations.
LO4	Check the control system performance by its transient response and steady-state error.
LO5	Discuss the system stability by Routh-Hurwitz criterion
LO6	Analyze the performance of the control system by root locus method
Psychomotor Domain	
LO7	Select the proper state variables to obtain the dynamic equation of LTI system and its state transition matrix and/or state transition equation.
LO8	Design the proper PID controller to meet specific time-domain specifications of LTI system
Affective Domain	

	None

6- Mapping Learning Outcomes (LO's) with competences

LO's \ NARS	A2	B4	C1
Cognitive Domain			
LO1			■
LO2			■
LO3		■	
LO4		■	
LO5		■	
LO6	■		
Psychomotor Domain			
LO7	■		
LO8			■
Affective Domain			

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes							
			LO1 C1-1	LO2 C1-2	LO3 B4-3	LO4 B4-4	LO5 B4-5	LO6 A2-6	LO7 A2-7	LO8 C1-8
W1	- Quality requirements for the course - Introduction to control systems	4	■		■		■			
W2	-Laplace Transform and its properties, -Inverse Laplace Transform, -Pole-Zero Map,	4							■	
W3	-Block Diagram Representation, -Calculation of the system Transfer Function (TF), -Multi Input Single Output (MISO) systems	4	■							
W4	-Convert block diagram to signal flow graph -Signal Flow Graph Representation -Mason's formula to calculate T.F.	4		■						
W5	-Modeling of Linear physical systems -Modeling of Rotary physical systems - Modeling of Electrical circuits -Obtaining the system mechanical network	4			■					
W6	- Modeling of Electromechanical systems - Modeling of DC machines	4			■					
W7	- State and output equations from T.F & Diff. Eqns. - Direct, cascade and parallel decomposition -T. F. from the dynamic equation	4							■	
W8	- State Transition Matrix - State Transition Equation -Characteristic Equation and Eigen values	4							■	
W9	-Transient Response of 1st order Systems -Transient Response of 2nd order Systems -Parameters calculation of transient response	4				■				
W10	-P, PD, PI and PID controllers -PID controller using Matlab	4				■				■
W11	-Error coefficients at step, ramp and parabolic inputs -Calculation of Steady-State Error for unity & non-unity feedback systems	4				■				

Week	Topics	Planned Hours	Learning Outcomes							
			LO1 C1-1	LO2 C1-2	LO3 B4-3	LO4 B4-4	LO5 B4-5	LO6 A2-6	LO7 A2-7	LO8 C1-8
W12	-The Concept of Stability -The Routh–Hurwitz Stability Criterion -Design the range of system gain for stability	**4**					■			
W13	-The Root Locus (R.L.) Concept -Steps required to draw R. L.	**4**						■		
W14	-Effect of adding pole and zero on R.L. -Design the system gain to give certain performance	**4**						■		

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖						❖	❖
	LO2	❖		❖	❖					❖	❖
	LO3	❖	❖	❖							
	LO4		❖	❖	❖						
	LO5	❖		❖	❖						❖
	LO6		❖	❖						❖	
Psychomotor Domain	LO7		❖	❖			❖			❖	
	LO8	❖		❖	❖		❖	❖	❖	❖	
Affective Domain											

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.

- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- A WhatsApp group as well as Microsoft Team group are created where students can attend online lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●			●				●		●
	LO2	●				●			●		●
	LO3		●		●	●			●		
	LO4	●							●		
	LO5	●			●						●
	LO6	●							●		
Psychomotor Domain	LO7		●					●			
	LO8	●				●				●	
Affective Domain											

*There is one formative assessment (writing Exam), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment Tools	Week	Weight
First Midterm Examination	7	20 %
Second Midterm Examination	12	20%
Final Examination	(As Scheduled)	40 %
Quizzes (3 times)	3, 5, 9	5 %
Home assignments	3,4,5,8,10,11	10%
Matlab Mini Project	8	5 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF
http://www.bu.edu.eg/staff/ahmedhussein3-courses/15061/files (Last access: June 1st, 2021)

b- Books

1. Nise, N. S. "Control System Engineering", 7th edition, John Wiley & Sons Ltd., UK, 2016.
2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall, 5th Edition.
3. F. Golnaraghi and B. C. Kuo, "Automatic control Systems", 10th ed., John Wiley & Sons, Inc. 2017.
4. Andrea Bacciotti, "Stability and Control of Linear Systems" Volume 185, Springer, 2019

c- Recommended Books

1. R. C. Dorf and R. H. Bishop, "Modern Control Systems", Addison-Wesley, 11th Edition, 2014.
2. Liuping Wang, "PID Control System Design and Automatic Tuning Using Matlab/Simulink" Wiley Online Liberary, February 2020. https:// onlinelibrary-wileycom.mplbci.ekb.eg/doi/10.1002/9781119469414

c- Course website (Microsoft Teams)

https://teams.microsoft.com/_#/school/conversations/General?threadId=19:9d8b1c2c62684c1ca76992fb65922fd0@thread.tacv2&ctx=channel

- Course Coordinator: Dr. Ahmed M. Hussein **Signature:**

- Program Coordinator: Assoc. Prof. Mohamed Anwar **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Electronics and Communications Eng. Program

1- Course Data

Course Code: ECE112 **Course Title:** Electric Circuits (1)
Semester/Year: First / 2020-2021 **Specialization:** Electronics and Communications Eng.
Credit Hours: 4+2 **Lecture:** 4 **Tutorial:** 2 **Lab:** 0

2- Course Objectives

For students undertaking this course, they will be able to:

1. Define concepts and theories of sciences, appropriate to the electrical circuit analysis.
2. Know the main components to design an electric circuit.
3. Apply different techniques of solving electric circuits that operate with DC sources.
4. Know the relation between voltages and currents in time domain for each component.
5. Apply Network theorems to simplify complicated electric circuit.
6. Understand phasor concepts and be able to transform a circuit with a sinusoidal source into the frequency domain using these concepts.
7. Use the various circuit analysis techniques to solve a circuit in the frequency domain.
8. Understand the various ac power concepts (Instantaneous power, Average power, Reactive power, Complex power, and Power factor), their relationships to one another, and how to calculate them in a circuit.
9. Understand the condition for maximum average power delivered to a load in an ac circuit.

3- Course Competencies (NARS)

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.1 Identify, formulate, and solve electric circuits problems by applying engineering fundamentals, basic science, and mathematics, appropriate to the electrical circuit analysis.

A.2 Develop and conduct appropriate simulation (using MATLAB or PSpice), analyze and interpret data, and assess and evaluate findings to draw conclusions.

A.5 Practice research techniques and methods of investigation as an inherent part of learning.

Level (B) Electrical Engineering Competencies

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

B.1 Select, model, and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems.

B.2 Design, model and analyze DC and AC electric circuits for various applications like phase shifter; and optimize these designs using PSpice simulation program.

Level (C) Electrical Engineering & Control Competencies

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

This course is a preliminary course, and it does not serve any specific competencies of Electronics and Communications Eng. Program.

4- Course Contents

a) Course Description (As indicated in program Bylaw)

The wave behavior - passive electric circuits - Kirchhoff's laws - different techniques for solving electrical circuits - node voltage technique - mesh current technique - the power in alternating current circuits - the effective and average value of sinusoidal waves - compound power - maximum power Factor - Electric circuits behavior - nonlinear resistance - the effect of temperature on resistances and changing its value with temperature.

b) Topics to be Covered weekly & Matrix of Competencies

Week	Topics	Course Competencies				
		A1	A2	A5	B1	B2
1	• Introduction to DC circuits • Voltage, Current and Resistance	√	√			
2	• Ohm's Law, Energy, and Power • Kirchhoff's laws	√	√			
3	• Resistors in Series and in Parallel • Voltage Division and Current Division • Delta-to-Wye (Pi-to-Tee) Equivalent	√	√			
4	• The Node-Voltage Method • The Mesh-Current Method • Source Transformations	√	√			
5	• Thévenin and Norton Equivalents • Maximum Power Transfer • Superposition Theorem	√	√			
6	• Capacitors and Inductors in DC circuits	√	√	√	√	
7	• Midterm I	√	√			√
8	• Sinusoids, Phasors • Phasor Relationships for Circuit Elements	√	√			
9	• Impedance and Admittance • Kirchhoff's Laws in the Frequency Domain • Applications Phase-Shifters	√	√	√	√	√
10	• Nodal Analysis in the Frequency Domain • Mesh Analysis in FD • Source Transformation in FD	√	√			
11	• Thevenin and Norton in FD • Superposition Theorem for AC circuits	√	√			
12	• Midterm II	√	√			√
13	• Instantaneous and Average Power • Maximum Average Power Transfer • Effective or RMS Value • Apparent Power and Power Factor	√	√		√	√
14	• Complex Power • Conservation of AC Power • Power Factor Correction • Applications: Electricity Consumption Cost	√				√
15	• Final Exam	√	√			√

5- a) Teaching and Learning Methods

Course Competencies		Teaching and Learning Methods									
		Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Site Visit	Presentation	Mini Project	Research and Reporting	Brain Storming
Level A	A1	√	√	√							
	A2			√	√				√	√	√
	A5				√					√	
Level B	B1	√	√	√					√	√	
	B2	√	√	√					√	√	

5- b) Teaching and Learning Methods of Disables

None

6- Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Teaching staff will be available for students for two hours a week as indicated on their timetable declared for students from the beginning of the semester.

7- Student Assessment

a- Student Assessment Methods

Course Competencies	Assessment Methods									
	Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions

Level A	A1	√			√					√
	A2				√			√	√	√
	A5							√	√	√	
Level B	B1	√			√			√	√		
	B2	√			√			√	√		

b- Assessment Schedule and Weight

Assessment	Week	Degrees
Final Exam	15	90
Mid-Term Exam1	7	20
Mid-Term Exam2	12	20
Assignments	2, 4, 8, 11	10
Quizzes	3,5, 10,13	10
Total		**150**

8- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other:
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

9- List of References

a- Course Notes

Lectures Notes in PDF and video lectures
http://www.bu.edu.eg/staff/ayahossam-courses/files

https://fengbuedu-my.sharepoint.com/:f:/g/personal/saidemam_feng_bu_edu_eg/EiU4WKJHjWNCisJiax7FgLkBod-FuRZETwwrz20kotiVyg?e=QxJ0ea

b- Books

1. NILSSON, James William; RIEDEL, Susan A. "*Electric circuits*". Pearson Education Limited, 10th Edition, 2015.
2. CHARLES, K. Alexander; MATTHEW, N. O. "*Fundamentals of electric circuits*". McGraw-Hill Education, 5th Edition, 2013.

3. FLOYD, Thomas L. "*Principles of Electric Circuits Conventional Current Version*". Pearson Education Limited, 8th Edition, 2007.
4. SVOBODA, James A.; DORF, Richard C. "*Introduction to electric circuits"*. John Wiley & Sons, 2006.

c- Recommended Books

1. ROBBINS, Allan H.; MILLER, Wilhelm. "*Circuit analysis: Theory and practice"*. Nelson Education, 4th edition, 2012..

d- Web Sites

http://www.bu.edu.eg/staff/ayahossam-courses/files

10- Matrix of Course Objectives and Competencies

Course Objectives	Course Competencies				
	A1	A2	A5	B1	B2
Course Objective #1	√	√			
Course Objective #2	√	√			
Course Objective #3	√	√			
Course Objective #4	√	√	√	√	
Course Objective #5	√	√			
Course Objective #6	√	√			√
Course Objective #7	√	√		√	
Course Objective #8	√	√	√	√	√
Course Objective #9	√	√			

- Course Coordinator: **Dr. Said Emam** **Signature:**
Dr. Aya Hossam El-Deen Mahmoud

- Program Coordinator: **Prof. Assoc. Basem Alhalawany** **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering department
Department offering the course: Engineering Mathematics & physics department

1- Course Data

Course Code: EMP 181 **Course Title:** Mathematics (2A)
Semester/Year: First / 2020-2021 **Specialization:** Engineering Mathematics
Total Hours: 5 **Lecture:** 3 **Tutorial:** 2 **Lab:** 0

2- Course Objectives

For students undertaking this course, they will be able to:

1- Recognize the essential information as introduction about partial derivatives, also about basic information related to the applications in the Engineers including function in two variables Jacobean, Series expansion in two variables envelope, maxima and minima.
2- Express the Curvature and Evolutes with the radius of curvature in Cartesian, polar, parametric forms.
3- Solve first order ordinary differential equations.
4-Recognize the homogenous and particular parts of higher order ordinary differential equations.
5-Interpret the methods of testing convergence.
6-Recognize the basic concepts of line and double integrals with their applications.

3- Course Competencies (NARS)

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.1) Identify, formulate, and solve complex engineering problems by applying engineering fundamentals in mathematics by studying theories for partial derivatives, multiple integral, and solving ordinary differential equations.

A.8) Communicate effectively verbally and in writing by performing a power point presentation or writing a report about selected topic decided at the middle of the semester.

4- Course Contents

a) Course Description (As indicated in program Bylaw)

Infinite series, Functions expansion, Differentiation applications, Maximum and minimum limits, Lagrange multiplications, Restricted maximum and minimum limits applications, High order differential equations, Complex variable functions, Vectors analysis, Standards and vector fields, Vector diversion, Standard fields talus, Vector field alignment, Gauss's theory, Green's theory, Stocke's theory

b) Topics to be Covered weekly & Matrix of Competencies

Week	Topics	Course Competencies	
		A1	A8
1	Infinite series (Test of convergence)		
2	Partial derivatives (chain rule of parametric equation-homogeneous function – Euler theorem)	√	
3	Partial derivatives (chain rule of parametric equation-homogeneous function – Euler theorem)	√	
4	Applications in partial derivatives (Taylor expansion-Envelope – Maxima and Minima)	√	√
5	Vector analysis (Dot and vector products- vector operations)	√	
6	Vector analysis (Stoke, Divergence and Green theorems)	√	√
8	Solving first order ordinary differential equations	√	
9	Solving first order ordinary differential equations	√	√
10	Solving higher order ordinary differential equations	√	
11	Solving higher order ordinary differential equations	√	
12	Complex variables	√	√
13	Complex variables	√	
14	Curvature	√	

5- a) Teaching and Learning Methods

Course Competencies		Teaching and Learning Methods									
		Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Site Visit	Presentation	Mini Project	Research and Reporting	Brain Storming
Level A	A1	√	√	√							
	A8				√			√			

5- b) Teaching and Learning Methods of Disables

None

6- Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, I will be available for students for two hours a week as indicated on my time table declared for students from the beginning of the semester.

7- Student Assessment

a- Student Assessment Methods

Course Competencies		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Level A	A1	√	√		√						√
	A8							√	√		

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	7	20 %
Final Examination	(As Schedule)	64%
Quizzes	3, 5, 13	12%
Home assignments, and Reports	4, 6, 9	4%
Total		**100** %

8- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

9- List of References

a- Course Notes

Lecture notes and training sheets

b- Books

1. Alan Jeffrey, "Advanced engineering Mathematics", University of new castle – upon-Tyne, 2002.
2. Robert C. Wrede Murray R. Spiegel "Schaums Outlines Advanced Calculus", 2nd edition

c- Recommended Books

-

d- Web Sites

www.Google.com
https://drive.google.com/drive/my-drive

10- Matrix of Course Objectives and Competencies

Course Objectives	Course Competencies	
	A1	A8
Course Objective #1	√	√
Course Objective #2	√	
Course Objective #3	√	√
Course Objective #4	√	√
Course Objective #5	√	√
Course Objective #6	√	√

- Course Coordinator: Dr. Mahmoud Abd El Mawla **Signature:**

- Program Coordinator: Assoc. Prof. Lamiaa elRefaei **Signature:**

ECE121 Electronics (1)

Course Specifications (2021/2022)

University:	Benha University
Faculty:	Faculty of Engineering at Shoubra
Department offering the program:	Electrical Engineering Department
Department offering the course:	Electronics and Communications Eng. Program

1- Course Data

Course Code: ECE121 **Course Title:** ECE121 Electronics (1)
Semester/Year: Second / 2021-2022 **Specialization:** Electronics and Communications Eng.
Credit Hours: 4+3 **Lecture:** 4 **Tutorial:** 3 **Lab:** 0

2- Course Objectives

For students undertaking this course, they will be able to:

1. Develop a clear understanding of the various applications of the diode (Half wave rectifier, full wave rectifier, clippers, clampers, and voltage multipliers)
2. Describe the operation, characteristics, and applications of zener diode, varactor diode, LED, photodiode, photocells, and laser diodes.
3. Understand the basic structure, operation, and characteristics of the BJT, and how it is used as a voltage amplifier and as an electronic switch.
4. Perform small signal analysis for the BJT.
5. Become familiar with the various applications of the BJT.
6. Describe the basic structure, operation, and applications of the various types of thyristors
7. Become familiar with the construction and operating characteristics of Unijunction transistor (UJT).
8. Discuss the integrated circuits technology-the crystal growing-oxidation-film predeposition - Diffusion-and circuit printing and etching techniques

3- Course Competencies (NARS)

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.1 Identify, formulate, and solve electronics engineering problems by applying fundamentals of modeling of electronic devices such as diodes, transistors, and thyristors.

A.2 Develop and conduct appropriate experimentations and simulation, analyze and interpret data, and assess and evaluate findings to draw conclusions.

A.5 Practice research techniques and methods of investigation as an inherent part of learning.

A.8 Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools, by performing presentations about a selected topic decided during the semester.

Level (B) Electrical Engineering Competencies

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

B.2 Design, model and analyze a power supply circuit as an application for rectifier diodes and an audio amplifier circuit as an application of transistors; and optimize these designs using Proteus program or other simulation and PCB design tools.

B.3 Design and implement: the above-mentioned applications using technological and professional tools

B.4 Estimate and measure the performance of diodes and transistors circuits under DC and AC input excitation and evaluate its suitability for a specific application.

Level (C) Electrical Engineering & Control Competencies

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

This course is a preliminary course, and it does not serve any specific competencies of Electronics and Communications Eng. Program.

4- Course Contents

a) Course Description (As indicated in program Bylaw)

Bipolar junction applications-Transistor theory of operation-transistor dynamic and static characteristics-Thyristor-Unijunction devices-the basic characteristics-light emitting devices principles-Laser from semiconductors- light detectors-photocells-Laser characteristics and applications-the integrated circuits technology-the crystal growing-oxidation-film predeposition - Diffusion-and circuit printing and etching

b) Topics to be Covered weekly & Matrix of Competencies

Week	Topics	Course Competencies						
		A1	A2	A5	A8	B2	B3	B4
1	Diode Applications • Half-Wave Rectifiers • Full-Wave Rectifiers • Power Supply Filters and Regulators • Application Activity (power supply circuit design and implementation)	√	√	√	√	√	√	
2	Diode Applications • Diode Limiters and Clampers • Voltage Multipliers • The Diode Datasheet • Troubleshooting	√	√					√
3	Special purpose diodes • The Zener Diode • Zener Diode Applications • The Varactor Diode	√	√					
4	Special purpose diodes • Light Emitting Diodes • Photodiode • Photocell • Laser Diodes	√	√	√	√			
5	• Bipolar Junction Transistor (BJT) Structure • Basic BJT Operation, Characteristics and Parameters • BJT Configurations	√	√					

6	BJT DC-Biasing • The DC Operating Point • Fixed Bias, Emitter Bias • Voltage-Divider Bias • Collector feedback bias	√	√					
7	• Midterm I	√				√		
8	BJT Applications • Multiple BJT Networks (The R–C coupling- The Darlington config. - The Cascode config. -The Feedback Pair) • The Direct Coupled amplifier	√	√	√	√	√	√	√
9	BJT Applications • Current Mirrors • Current Source Circuits • Transistor Switching Networks	√	√	√	√	√	√	√
10	BJT AC analysis • Transistor r_e Model • The Common-Emitter Amplifier	√	√	√	√	√	√	
11	BJT AC analysis • The Common-Base Amplifier • Emitter-follower configuration • Application Activity (audio amplifier circuit design and implementation)	√	√	√	√	√	√	
12	• Midterm II	√				√		
13	• The Four-Layer Diode • The Silicon-Controlled Rectifier (SCR) • SCR Applications • The Diac and Triac	√	√	√				
14	• Revision and project evaluation	√				√	√	

5- a) Teaching and Learning Methods

Course Competencies	Teaching and Learning Methods									
	Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Site Visit	Presentation	Mini Project	Research and Reporting	Brain Storming

Level A	A1	√	√	√						
	A2			√	√				√	√	√
	A5				√					√	
	A8				√			√		√	
Level B	B2			√	√			√	√	√	
	B3			√	√			√	√	√	
	B4	√	√	√					√	√	√

5- b) Teaching and Learning Methods of Disables

None

6- Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Teaching staff will be available for students for two hours a week as indicated on their timetable declared for students from the beginning of the semester.

7- Student Assessment

a- Student Assessment Methods

Course Competencies		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Level A	A1	√			√			√	√		√
	A2				√			√	√		√
	A5							√	√	√	
	A8							√	√	√	√

Level B	B2				√			√	√	√	
	B3	√			√			√	√		
	B4	√			√			√	√		√

b- Assessment Schedule and Weight

Assessment	Week	Grades
Final Exam	7, 12	100
Mid-Term Exam1	(As Schedule)	30
Mid-Term Exam2	3, 5, 9, 13	15
Assignments	2, 4, 8, 11	15
Project	6, 10	15
Total		**175**

8- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other:
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

9- List of References

a- Course Notes

Lectures Notes in PDF and video lectures
https://fengbuedu-my.sharepoint.com/:f:/g/personal/saidemam_feng_bu_edu_eg/EiU25G4sStlOpZsCA2rF6woBuelX_NDs3bojApG5lPQMiQ?e=fMNVYc

b- Books

1. FLOYD, Thomas L. "Electronic devices: conventional current version". Pearson, 9th Edition, 2012.
2. BOYLESTAD, Robert L.; NASHELSKY, Louis. "Electronic devices and circuit theory". Pearson, 11th Edition, 2013.

c- Recommended Books

1. SEDRA, Adel S., et al. "Microelectronic circuits". New York: Oxford University Press, 7th Edition, 2016.

d- Web Sites

10- Matrix of Course Objectives and Competencies

Course Objectives	Course Competencies						
	A1	A2	A5	A8	B2	B3	B4
Course Objective #1	√	√	√	√	√	√	√
Course Objective #2	√	√	√	√			
Course Objective #3	√	√					
Course Objective #4	√	√					
Course Objective #5	√	√	√	√	√	√	√
Course Objective #6	√	√					
Course Objective #7	√	√					
Course Objective #8	√		√				

- Course Coordinator: **Dr. Said Emam** **Signature:**

- Program Coordinator: **Assoc. Prof. Dr. Basem Alhalawany** **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE122 Electrical Circuit (2) **Semester/Year:** Second / 2021-2022
Prerequisite Course(s): ECE112 Electrical Circuit (1) **Core or Elective:** Core Course
Credit Hours: 3 **Weekly Contact Hours**: **Lecture:** 3 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with the basic concepts and theories of sciences, appropriate to the advanced electrical circuit analysis. Moreover, recognize the broad classifications of various theorems & laws related to the course of electrical circuits. Also, analyze and evaluate responses of circuits containing resistance and capacitance or inductance elements according to fundamental circuit laws. Finally, demonstrate methodologies of data collection interpretation and solving engineering problems to analyze electric circuits using the computer program Proteus.

3- Course Contents (As indicated in the program Bylaw)

Three phase system-loads in three phase systems. The unbalanced operation in electric circuits. The transit and steady state in electric circuits. The electric circuits' analysis using the computer program PSPICE.

4- Program Competences Served by The Course (A1, A2 and B1)

Level (A) General Engineering Competences

A.1 Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.

A.2 Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions

Level (B) Electrical Engineering Competences

B.1 Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of generation, transmission and distribution of electrical power systems.

Level (C) Electrical Engineering & Control Competences

This course is a preliminary course, and it does not serve any specific competencies of Communications and Electronics Eng. Program.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Identify the broad classifications of various theorems & laws related to the course of electrical circuits.
LO2	Construct the responses of circuits containing resistance and capacitance or inductance.
LO3	Discuss the system stability at resonance.
LO4	Check the electric circuit performance by its transient response and steady-state error.
LO5	Analyze the performance of the magnetically coupled circuit and three phase circuits.
Psychomotor Domain	
LO6	Select the proper parameters values to analyze an electric circuit using the computer program (Proteus).
Affective Domain	

	None

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	A1	A2	B1
Cognitive Domain			
LO1	■		
LO2	■		
LO3		■	
LO4		■	
LO5			■
Psychomotor Domain			
LO6			■
Affective Domain			

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 A1-1	LO2 A1-2	LO3 A2-1	LO4 A2-2	LO5 B1-1	LO6 B1-2
W1	Filters.	**4**	■		■		■	
W2	Series Resonant circuits.	**4**		■				
W3	Parallel Resonant circuits	**4**			■			
W4	Magnetically Coupled circuits	**4**					■	
W5	Transient Circuits	**4**				■		
W6	Steady state in Electric circuits	**4**				■		
W7	Three phase system	**4**					■	
W8	Mid-term Exam	**4**						
W9	Applications of three phase systems	**4**					■	
W10	Unbalanced operation in electric circuits	**4**			■			
W11	Electric circuit's analysis using the computer program(Proteus).	**4**						■
W12	Design an electric circuit using Proteus.	**4**						■
W13	Assignments delivery and Course closeout	**4**						
W14	Final Exam	**4**						

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

	Teaching and Learning Methods

		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖						❖	❖
	LO2	❖		❖	❖					❖	❖
	LO3	❖	❖	❖							
	LO4		❖	❖	❖						
	LO5	❖		❖	❖						❖
Psychomotor	LO6		❖	❖			❖			❖	
Affective Domain											

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- A WhatsApp group as well as Microsoft Team group are created where students can attend online lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes	Assessment Methods*									
	Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●			●				●		●
	LO2	●				●			●		●
	LO3		●		●	●			●		
	LO4	●							●		
	LO5	●			●						●
Psychomotor	LO6		●					●			
Affective Domain											

b- Assessment Schedule and Weight

Assessment Tools	Week	Weight
Midterm Examination	8	30 %
Final Examination	(As Schedule)	40 %
Quizzes (4 times)	3, 5, 9, 12	10 %
Home assignments, and Reports	2, 4, 8, 11	10%
Mini Project	13	10 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF
http://www.bu.edu.eg/staff/ayahossam-courses/files

b- Books

1. Floyd, "*Principles of Electric Circuits* ",Pearson; 10th edition (February 1, 2019)
2. Alexander and Sadiku , "*Fundamentals of Electric Circuit"* , McGraw-Hill Education, 6th edition, (January 13, 2016)

c- Recommended Books

1. Robinson, and Miller. " *Circuit Analysis – Theories and Practice"*, Cenage Learning, 5th Edition, 2013.

d- Course website (Microsoft Teams)

http://www.bu.edu.eg/staff/ayahossam-courses/files

- Course Coordinator: **Dr. Aya Hossam El-deen Mahmoud** **Signature:**

- Program Coordinator: **Prof. Assoc. Basem Alhalawany** **Signature:**

University: Benha University
Faculty: Faculty of Engineering Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Computer Engr. Program

Course Data (Basic Information -1)

Course Code&Title: ECE212 Electromagnetic Fundamentals **Semester/Year:** First / 2021-2022
Core or Elective: Core Course

Contact Hours: 6 **Lecture:** 2 **Tutorial:** 4 **Lab:** 0

2- Course Aims

The aim of this course is to provide students with the basic knowledge and skills to apply the different methods used to determine the electric field and describe the methodologies for these methods. Moreover, analysis the different application in which knowing the Electric Fields is necessary.

Course Contents

Vector analysis, Electrostatic fields: Coulomb's law and electric field intensity, electric flux density, Gauss's law and divergence, energy and potential, conductors, dielectrics and capacitance, Poisson and Laplace equations. Steady magnetic fields: Magnetostatic fields: Biot-Savart's law, Ampere's law, curl .and Stokes's theorem, magnetic flux density, magnetic forces, Lorentz force, materials and inductance

4- Program Competencies Served by The Course

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.3 Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.

Level (B) Electrical Engineering Competencies

B.2 Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

Level (C) Electrical Engineering & Control Competencies

C.3 Apply advanced digital techniques for modeling and analyzing electrical power systems while maintain their protection.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Identify the different applications in which knowing the Electric Fields is necessary
LO2	List the broad classifications of Electromagnetic Fields
LO3	Demonstrate Faraday's law and Ampere's law
Psychomotor Domain	
LO4	Recognize the proper dielectric material
LO5	Show the effect of Electromagnetic shielding to block electromagnetic radiation
Affective Domain	
LO6	Differentiate between Electric and Magnetic Fields

6- Mapping Learning Outcomes (LO's) with Competencies

LO's \ NARS	A3	B2	C3
Cognitive Domain			
LO1	■		
LO2	■	■	
LO3		■	
Psychomotor Domain			
LO4		■	■
LO5			■
Affective Domain			
LO6	■		

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes					
			LO1	LO2	LO3	LO4	LO5	LO6
W1	Vector analysis and usage of coordinate systems in EM fields		☑					
W2	Vector analysis and usage of coordinate systems in EM fields			☑				
W3	Divergence theorem, electro-static energy			☑				
W4	Conductors and Boundary Conditions for electrostatic fields					☑		
W5	Dielectrics and Boundary Conditions							☑
W6	capacitance of different structures							☑
W7	relations of static magnetic fields							☑
W8	Magnetic induction Faraday's law							☑
W9	analogy between electric & magnetic field							☑
W10	.Ampere's law and Ohm's law				☑			
W11	self-inductance of different structures				☑			
W12	magnetic Boundary conditions				☑			
W13	Maxwell's equations of electromagnetics				☑			
W14	Oral exam						☑	

b) Additional private study/learning hours expected for students per week is 2 hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1		☑								
	LO2		☑								
	LO3		☑				☑			☑	
Psychomotor Domain	LO4		☑								☑
	LO5		☑		☑						
Affective Domain	LO6		☑		☑					☑	

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods									
		Written Exams	Midterm Exams	Oral Exam	Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	◆	◆						◆		◆
	LO2	◆					◆				◆
	LO3		◆					◆	◆		
Psychomotor Domain	LO4	◆					◆				◆
	LO5							◆			
Affective Domain	LO6	◆									◆

b- Assessment Schedule and Weight

Assessment Tools	Week	Weight
Midterm Examination	7	30 %
Final Examination	(As Schedule)	40 %
Second Midterm Examination	12	15 %
Research Assignments, Home assignments, Seminar and Reports	All	15 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- □ Classroom
- □ Lecture Hall
- ■ Sound and Microphone
- □ Other: ……
- □ Smart Board
- □ White Board
- □ Data Show
- ■ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF
Electromagnetic fields by Dr Hanaa M. Raafat and Dr. Sherif Hekal

b- Books

1. Clayton R Paul, Introduction to Electromagnetic fields, McGraw-Hill, 1987
2. William H Hayt, Engineering Electromagnetic, McGraw-Hill, 2001

c- Recommended Books

1. David K. Cheng, Field and Wave Electromagnetics, Addison-Wesley; 2nd edition,1989

Course Coordinator: **Dr. Hanaa Mohamed Rafat** **Signature:**
Dr.Sherif Hekal

Program Coordinator: **Prof. Dr. Hala abdelkader** **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Computer Engineering

1- Course Data (Basic Information)

Course Code: ECE211 **Course Title:** Electrical and Electronic Measurements
Semester/Year: First / 2021-2022 **Specialization:** Electronics and Communications Eng.
Credit Hours: 3 **Lecture:** 4 **Tutorial:** 2 **Lab:** 0

2- Course Aims

For students undertaking this course, they will be able to recognize and write the resultant error for various calculations involving instrument and component error combinations. Evaluate the basic concepts of electrical measurements as oscilloscopes, graphical instruments, and electromechanical instruments. Describe principles of analog measuring instrument design and analyzing and design of digital electronic circuits. Demonstrate characteristics of engineering materials related to oscillators and signal generators. Moreover, analyze and design the basic types of signal generators and basic transducer circuits.

3- Course Contents (As indicated in the program Bylaw)

Classification, Categories, Parameters. Fundamentals of Electrical and Electronic Measurements. Types of different measurements and parameter measured for each type. Analog multimeter, digital multimeter, Oscilloscopes, and signal generators. Electric units, Error in measurements, Measurements of DC voltage and currents- Measurements of AC voltage and currents.

4- Program Competences Served by the Course (A1, A2, B2)

Level (A) General Engineering Competences

A.1 Identify and define concepts of electrical measurements, appropriate to oscilloscopes, graphical instruments, Electromechanical, Electro-Dynamic instruments. solve electrical and electronic measurements problems by applying engineering fundamentals, basic science and mathematics.

A.2 Develop and conduct appropriate experimentation. Then analyze and evaluate findings using engineering judgment to draw conclusions about the measurement systems stability and performance.

Level (B) Electrical Engineering Competences

B.2 Design, model and analyze electrical and electronic measurements system and analog electronic circuits.

Level (C) Communications and Computer Engineering Competences

None.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Define concepts of electrical measurements, sensors, appropriate to oscilloscopes, graphical instruments, and Electromechanical instruments

LO2	Demonstrate characteristics of engineering materials related to oscillators and signal generators.
LO3	Describe principles of analog measuring instrument design
LO4	Describe principles of analyzing and design of digital electronic circuits
Psychomotor Domain	
LO5	Think in a creative and innovative way in solving and design of different analog electronic circuits.
LO6	Combine, exchange, and assess different ideas, views, and knowledge from a range of sources to design analog and digital voltmeters
LO7	Synthesize and integrate electronic systems for voltage and current measurements using the right equipment.
Affective Domain	
LO8	Use oscilloscope and multimeters to measure system performance
LO9	Write technical reports and presentation

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	A1	A2	B2
Cognitive Domain			
LO1	■		
LO2		■	
LO3	■		
LO4	■		
Psychomotor Domain			
LO5		■	
LO6		■	
LO7			■
Affective Domain			
LO8			■
LO9			■

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes								
			LO1 A1-1	LO2 A2-1	LO3 A1-2	LO4 A1-3	LO5 A2-2	LO6 A2-3	LO7 B2-1	LO8 B2-2	LO9 B2-3
W1	• Measurement Systems, Units, and Standards, • Types of Measurement Errors,	**4**	■				■				

Week	Topics	Planned Hours	Learning Outcomes								
			LO1 A1-1	LO2 A2-1	LO3 A1-2	LO4 A1-3	LO5 A2-2	LO6 A2-3	LO7 B2-1	LO8 B2-2	LO9 B2-3
	• Absolute and Relative Errors, • Measurements Characteristics, • Measurement Error Combinations										
W2	•Introduction to Electromechanical Instruments, •Permanent Magnet Moving Coil (PMMC), •Galvanometer, •DC Ammeters and Voltmeters, •Ohmmeters,	**4**	■		■		■				
W3	•AC Ammeters •AC Voltmeters, •Electro-Dynamic Instruments, •Analog Electronic Voltmeters •Multimeter Probes	**4**			■		■				
W4	•Introduction to Digital Voltmeters (DVM) •Types of Digital Voltmeters. •Range Changing and accuracy of DVM, •Types of Digital Multi-meters.	**4**	■						■	■	
W5	• Basic Digital Frequency Meters (DFM). • Frequency Range Changing. • Frequency Meter Accuracy. • Reciprocal Digital Frequency Meters (DFM).	**4**	■	■							
W6	• Introduction to Sensors and Transducers. • Analog vs. Digital Sensors. • Signal Conditioning and Smart Sensors. • Displacement, Position and Proximity Sensors.	**4**		■					■	■	■
W7	• Velocity Sensors. • Force Sensors. • Liquid Level Sensors. • Temperature Sensors.	**4**		■					■	■	■
W8	• Midterm	**4**	■	■	■		■				
W9	• Cathode Ray Tube (CRT), • Analog Oscilloscope, • Digital Oscilloscope	**4**	■	■						■	■
W10	• Special Oscilloscope • Triggering-Distortion, • Pulse measurements	**4**		■						■	
W11	• Sweep Generators	**4**	■	■			■				

Week	Topics	Planned Hours	Learning Outcomes								
			LO1 A1-1	LO2 A2-1	LO3 A1-2	LO4 A1-3	LO5 A2-2	LO6 A2-3	LO7 B2-1	LO8 B2-2	LO9 B2-3
	• Power Amplifiers Realization Techniques • Instrument Calibration										
W12	• Introduction to Graphical instruments, • Printers and Plotters. • LF function Generators	**4**	■					■	■		
W13	• Square/Triangle Generator • Pulse Generator	**4**	■						■		
W14	• Sweep Frequency Generator • RF Oscillators				■						
W15	• Miscellaneous Instruments	**4**	■	■			■				■

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖							
	LO2	❖		❖							
	LO3	❖		❖							
	LO4	❖		❖							
Psychomotor Domain	LO5	❖		❖							
	LO6	❖		❖							
	LO7	❖		❖							
Affective Domain	LO8			❖	❖						
	LO9			❖	❖			❖			❖

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- A WhatsApp group as well as Microsoft Team group are created where students can attend online lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●		●							●
	LO2	●		●							●
	LO3	●	●	●							●
	LO4	●		●							
Psychomotor Domain	LO5	●		●							●
	LO6	●		●							
	LO7	●		●							
Affective Domain	LO8							●		●	
	LO9							●		●	

*There is one formative assessment (writing Exam), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	8&12	20 %
Final Examination	(As Schedule)	60 %
Quizzes (2 times)	3, 5, 9, 12	5 %
Home assignments, and Reports	2, 4, 8, 11	5%
Mini Project	7&14	10 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- ■ Lecture Hall
- □ Sound and Microphone
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access
- □ Other: ……

11- List of References

a- Course Notes

Lectures Notes in PDF
https://bu.edu.eg/staff/islam.mansour-courses/17759/files
https://teams.microsoft.com/_#/school/files/General?threadId=19:351b420cd342456ebc70cc576ae986d0@thread.tacv2&ctx=channel

b- Books

1. David A. Bell "Electronic Instrumentation and Measurements", Oxford Higher Education/Oxford University Press, Third edition, 2013.
2. Ian Hickman, "Digital Storage Oscilloscopes", First edition, 1997
3. Waldemar Nawrocki, "Measurement Systems and Sensors", Second edition, 2015.
4. W. Bolton, "Mechatronics: Electronic Control Systems in Mechanical Engineering", seventh edition, 2019.

c- Recommended Books

1. Robert B Northrop, "Introduction to instrumentation and Measurements", Taylor & Francis, Third edition, 2014.

d- Web Sites

https://bu.edu.eg/staff/islam.mansour-courses/17759/files
https://teams.microsoft.com/_#/school/files/General?threadId=19:351b420cd342456ebc70cc576ae986d0@thread.tacv2&ctx=channel

- Course Coordinator: **Assoc. Prof. Mohamed Tarek Elewa** **Signature:**

Dr. Islam Mansour **Signature:**

- Program Coordinator: **Assoc. Prof. Basem ElHalawany** **Signature:**

EMP 282: Mathematics 3B

University:	Benha University
Faculty:	Faculty of Engineering at Shoubra
Department offering the program:	Electrical Engineering – Communications
Department offering the course:	Basic Science Department

1- Course Data (Basic Information)

Course Code and Title: EMP 282: Mathematics 3B

Semester/Year: Second / 2021-2022 **Specialization:** 2nd Year Electrical Eng. Communications

Contact Hours: 5 Lecture : 3 Tutorial : 2 Practical : 0

2- Course Aims

The objective of the course is to provide the students the concepts of numerical analysis, graph theory, the concepts of probability and statistics. Also, teach the students methods for solving partial differential equations, integral equations and numerical methods for solving systems of linear equations.

3- Course Contents (As indicated in the program Bylaw)

Partial differential equations – Wave equation and separation method – Laplace equation – Integral equations – Numerical analysis – Finite differences – Newton's method of interpolation – Numerical differentiation and numerical integration – Least squares method – Probability theory and statistics – Random variables – Probability density function – Moments – Gauss distribution – Poison distribution – Analysis of matrices.

4- Program Competencies

Level (A) Engineering Competencies

On completing this course, the student will be able to:

A.1.1 Solve partial differential equations and integral equations.
A.1.2 Recognize the basic concepts of numerical analysis and numerical methods.
A.1.3 Explain the graph theory and its applications.
A.1.4 Identify numerical methods for solving systems of linear equations.
A.1.5 Describe Newton's method of interpolation.
A.1.6 Define the statistical measures.
A.1.7 Collocate and analyze the data.
A.1.8 Verify the conditions of the probability density function and the probability function.
A.1.9 Apply the discrete and continuous probability distributions for treating real problems.
A.8 Communicate effectively verbally and in writing by performing a power point presentation or writing a report about selected topic decided at the middle of the semester.

5-Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Use the properties of matrices in studying the directed graphs.
LO2	Find numerical solution to systems of linear equations.
LO3	Verify the conditions of the probability density function and the probability function.
Psychomotor Domain	
LO4	Select the suitable curve to fit discrete data.
LO5	Chose the appropriate method for solving partial differential equations.
Affective Domain	
LO6	Collocate and analyze the data and discuss the random events via the probability theory.

6- Mapping Learning Outcomes (LO's) with Competencies

LO's \ NARS	A1	A8
Cognitive Domain		
LO1	√	
LO2	√	
LO3	√	
Psychomotor Domain		
LO4	√	
LO5	√	
Affective Domain		
LO6		√

7- Lecture Plan

Topics to be Covered weekly and Matrix of LO's

Week	Topics	Hours	Learning Outcomes					
			LO1	LO2	LO3	LO4	LO5	LO6
W1	First order partial differential equations	5					√	
W2	Second order P.D.E, Wave equation	5					√	
W3	Integral equations	5					√	
W4	Analysis of matrices, Symmetric, Orthogonal, Positive and negative matrices	5	√				√	
W5	Graph theory	5		√				
W6	Numerical methods for solving systems of linear equations.	5		√				
W7	Numerical differentiation, Numerical integration			√				
W8	Newton's method of interpolation, Curve fitting, Linear regression, Correlation coefficient.	5				√		

Week	Topics	Hours	Learning Outcomes					
			LO1	LO2	LO3	LO4	LO5	LO6
W9	Statistical measures, Data analysis.	5						√
W10	Random variable, Probability density function of one variable, Probability function. Expectation, Variance, Standard deviation.	5			√			
W11	Probability density function of two variables (Discrete, continuous), Covariance	5			√			
W12	Moment generating function	5			√			
W13	Gauss distribution, Poison distribution	5			√			√
W14	Binomial distribution, Normal distribution.	5			√			√

8- Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	√		√							
	LO2	√		√			√				
	LO3	√		√				√			
Psychomotor Domain	LO4	√		√							√
	LO5	√		√							
Affective Domain	LO6	√		√						√	

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.

9- Student Assessment

a- Student Assessment Methods

Learning Outcomes		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	√			√	√		√			
	LO2	√			√	√					
	LO3	√	√		√	√		√			√
Psychomotor Domain	LO4	√		√	√	√					√
	LO5	√			√	√					
Affective Domain	LO6						√	√			√

b- Assessment Schedule and Weight

Methods of Assessment	Grading / Marks	Weighting %	Outline Details
Quizzes and assignments	15	12 %	Week: 3, 5, 10, 12
Mid-Term Exam	30	24 %	Week: 8 1 hour
Final Exam	80	64 %	Week : 15 3 hours
Total		100 %	

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

Course Notes	Lectures Notes (PDF)
Required Books	• Numerical Analysis, R.L.Burden & J.D. Faires, Brooks/Cole Cengage Learning, U.S.A, 2005. • Probability And Statistics For Engineers and Scientists, R.E. Walpole, R.H. Myers, S.L. Myers & Keying Ye, Pearson Education Inc., 2012.
Recommended Books	"Advanced Engineering Mathematics", E. Kreyszig, John Wiley and Sons, New York, 1999.

Course Coordinator: Dr. Mohamed Hussein Eid

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE312 Electronic Circuits (A)
Semester/Year: First / 2021-2022
Prerequisite Course(s): NA **Core or Elective:** Core
Weekly Contact Hours: **Lecture:** 3 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with the basic knowledge and skills to analyze BJT biasing circuits, design BJT biasing circuit for certain application, and to analyze and design BJT amplifier circuits regarding given specification. Moreover, identify power amplifier classes and tuned amplifiers with their applications. Finally, recognize the operation of harmonic oscillators, mixers, and modulators.

3- Course Contents (As indicated in the program Bylaw)

Hybrid parameters-high frequency amplifiers impedance-Tuned and intermediate amplifiers-Bode plot and the frequency response-Matched oscillators-Mixing and modulation circuits-Power amplifiers.

4- Program Competences Served by the Course (A2, B2 and C5)

Level (A) General Engineering Competences

A.2 Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

Level (B) Electrical Engineering Competences

B.2 Design model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

Level (C) Electrical Engineering & Control Competences

C.5 Synthesis and integrate electronic systems for certain specific function using the right equipment

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Describe the basic BJT transistor biasing techniques and configurations.
LO2	Analyze and design BJT biasing circuit for certain application.
LO3	Analyze and design BJT amplifier circuits using different models and specifications.
LO4	Identify different amplifier properties and describe each BJT biasing configuration capabilities as an amplifier.
LO5	Analyze BJT transistor circuits at low, medium and high frequencies using bode plots and frequency response.
LO6	Investigate the effect of cascading different amplifiers on the total system specifications.
LO7	Explain the operation of power amplifiers and tuned amplifier and discuss their applications.
LO8	Explain the operation of harmonic oscillators, mixers and modulators.
Psychomotor Domain	
LO9	Practice BJT electronic circuits' simulation and practical implementation.
Affective Domain	
	None

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	A2	B2	C5
Cognitive Domain			
LO1		■	
LO2		■	
LO3		■	
LO4		■	
LO5		■	
LO6			■
LO7			■
LO8			■
Psychomotor Domain			
LO9	■		
Affective Domain			

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes								
			LO1 B2-1	LO2 B2-2	LO3 B2-3	LO4 B2-4	LO5 B2-5	LO6 C5-1	LO7 C5-2	LO8 C5-3	LO9 A2
W1	• Introduction to Bipolar Junction Transistor • BJT structure and operation • BJT characteristics and parameters • BJT Maximum ratings	**4**	■								
W2	• Operating Point • BJT DC Bias Configurations • Design Operation • Introduction to LTspice	**4**		■							■
W3	• Various BJT Circuits • Troubleshooting Techniques • BJT Practical Applications • Analysis of BJT circuits using LTspice simulator • Mini-Project discussion	**4**	■								■
W4	• Basic Concepts of amplifiers • Important Characteristics of amplifiers • Amplification in the AC Domain • BJT transistor Modeling • The re Transistor Model (small signal analysis)	**4**			■						
W5	• Effect of RL and Rs (System approach) • Determining the Current Gain • Two-Port Systems Approach • Cascaded Systems	**4**			■			■			
W6	• The Hybrid Equivalent Model • Approximate h-model • Project delivery	**4**			■						■
W7	• Midterm Exam										
W8	• Complete h-model • Hybrid π Model • Variations of Transistor Parameters • Troubleshooting and Practical Applications	**4**			■						
W9	• Logarithms and Decibels • General Frequency	**4**				■					

Week	Topics	Planned Hours	Learning Outcomes								
			LO1 B2-1	LO2 B2-2	LO3 B2-3	LO4 B2-4	LO5 B2-5	LO6 C5-1	LO7 C5-2	LO8 C5-3	LO9 A2
	Considerations • Normalization Process										
W10	• Low Frequency Analysis- Bode Plot • Low Frequency Response – BJT Amplifier with RL • Impact of RS on the BJT Low Frequency Response	**4**					■				
W11	• Miller Effect Capacitance • High Frequency Response – BJT Amplifier • Multistage Frequency Effects • Square-Wave Testing	**4**					■	■			
W12	• Introduction to power amplifiers • Class A Amplifier • Class B Amplifier • Class C Amplifier • Class D Amplifier	**4**							■		
W13	• Introduction to tuned amplifiers • Class C basic Operation • Tuned Operation • Class C power efficiency	**4**							■		
W14	• Matched Oscillators • Mixers • Modulation Circuits	**4**								■	

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖							
	LO2	❖		❖							
	LO3	❖		❖							
	LO4	❖		❖							
	LO5	❖		❖							
	LO6	❖		❖							
	LO7	❖		❖							
	LO8	❖		❖							
Psychomotor Domain	LO9								❖	❖	
Affective Domain											

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructors and TA will be available three hours a week as indicated on the time table declared for students from the beginning of the semester.
- A Microsoft Team group is created where students can share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●									
	LO2	●				●					
	LO3	●			●	●					
	LO4	●									
	LO5	●									
	LO6	●									
	LO7	●									
	LO8	●									
Psychomotor Domain	LO9							●	●	●	●
Affective Domain											

*There is one formative assessment (writing Exam), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	7	15 %
Quizzes	3, 9,	5 %
Mini Project and Oral Exam	6,12	20 %
Final Examination	(As Schedule)	60 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

■ Classroom	□ Smart Board	■ Computer with software
□ Lecture Hall	■ White Board	■ MIS system
■ Sound and Microphone	■ Data Show	■ Internet Access

□ Other: ……

11- List of References

a- Course Notes

Lectures Notes in PDF
On Microsoft teams (need access permission)
https://teams.microsoft.com/l/team/19%3aBCRP5W8nuVh1DBkIvBjqT-Cx0ZFGR1SVuMsWJfIPQx01%40thread.tacv2/conversations?groupId=8eb62671-a775-4859-afc9-77a2dfd4dd30&tenantId=49fec46f-5c8a-405f-8772-a755acd6364a

b- Books

1. Boylestad, Robert L., and Louis Nashelsky. "Electronic Devices and Circuit Theory, 11th edition, Prentice Hall, 2018.
2. T. Floyd, Electronic Devices (Electron Flow Version), Pearson, 2017 .

c- Recommended Books

1. Mohindru, Pooja, and Pankaj Mohindru. "Electronic Circuit Analysis using LTspice XVII Simulator: A Practical Guide for Beginners." (2021)

d- Web Sites

http://www.bu.edu.eg/staff/ sawsanelsayed3
http://www.bu.edu.eg/staff/mahersalem3
https://www.youtube.com/channel/UCh0Ry_HfI63sqEFvhZp6RwQ

- Course Coordinator: Dr. Maher Abdelrasoul Mohammed **Signature:**

Dr. Sawsan Abdellatif **Signature:**

- Program Coordinator: Assoc. Prof. Basem ElHalawany **Signature:**

- Electrical Eng. Department Head: Prof. Mahmoud Soliman **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE313 Electromagnetic Waves **Semester/Year:** First / 2021-2022
Prerequisite Course(s): - **Core or Elective:** Core Course
Contact Hours: 6 **Weekly Contact Hours**: **Lecture:** 4 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with the basic knowledge of electromagnetic wave propagation, reflection, transmission and guiding. To satisfy the appropriate boundary conditions at electromagnetic discontinuities for the transverse electric and transverse magnetic polarizations. Moreover, to solve the wave equation in a basic and elementary wave-guiding structure like the parallel plate waveguide and be familiar with elementary dispersion relation and the concept of guided modes

3- Course Contents (As indicated in the program Bylaw)

Time varying fields-wave propagation in different media- wave propagation in lossless and lossy media- polarized materials-wave transmission and reflection at a planar boundary -waveguide fundamentals applied to parallel-plate waveguides.

4- Program Competencies Served by The Course (C2)

Level (C) Communications and Computer Engineering Competences

C.2 Depict, and analyze the performance of antenna and microwave applications

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Apply vector calculus to electromagnetic vector fields and define various vector fields' types
LO2	Apply Maxwell's equations in its differential form and integral form to solve related electromagnetic problems
LO3	Describe plane waves in unbounded space and explain propagation of wave in different media lossless, lossy dielectric and good conductors.
LO4	Formulate the appropriate boundary conditions to obtain the reflection and transmission coefficients across the surfaces of electromagnetic discontinuities
Psychomotor Domain	
LO5	Select the proper solutions of the wave equation to obtain the reflection, transmission and guiding characteristics of electromagnetic waves in different media.

6- Mapping Learning Outcomes (LO's) with Competencies

LO's \ NARS	C2
Cognitive Domain	
LO1	■
LO2	■
LO3	■
LO4	■
Psychomotor Domain	
LO5	■

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes				
			LO1 C2-1	LO2 C2-2	LO3 C2-3	LO4 C2-4	LO5 C2-5
W1	- Quality requirements for the course - Introduction to Electromagnetics and its applications; how do electromagnetic waves differ. -Vector and scalar quantities. - Introduction: Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area, and volume in different coordinate systems.	**6**	■				
W2	-Introduction of time varying electromagnetics and maxwell equations -Faraday's law -Continuity equations and displacement currents - Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Stocke's theorem.	**6**	■	■			
W3	- Classification of vector fields (Conservative, solenoid, uniform and general). - Guass Law and Guass' magnetic law - Potential functions and wave equation	**6**	■	■			
W4	- Electromagnetic wave equation in free space - Propagation constant and formed fields	**6**			■		
W5	Electromagnetic wave propagation: -Plane waves in loss less dielectric -Wave equation, Wave propagation in lossy dielectric and definition of loss tangent, Propagation constant, phase constant and attenuation.	**6**			■		
W6	- Continue Wave propagation in dielectric -Wave propagation in good conductors, skin depth -Equivalent circuit for coaxial cable, source of losses	**6**			■		
W7	- Poynting theorem and Poynting vector - Group velocity and phase velocity	**6**			■		
W8	- Reflection and transmission at normal incidence on a planar interface.	**6**					■
W9	Reflection and transmission coefficient	**6**				■	
W10	- Oblique incidence of TE and TM waves.	**6**					■
W11	- Critical angle, Brewster angle, and evanescent waves	**6**					■
W12	- Standing waves at normal and oblique incidence	**6**					■
W13	- Standing wave ratio at conducting and general interfaces	**6**				■	■
W14	- Parallel-plate waveguide, TE and TM modes, dispersion relation and cutoff.	**6**					■

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	●		●							
	LO2	●		●							
	LO3	●		●			●	●		●	
	LO4	●		●						●	●
Psychomotor Domain	LO5	●		●						●	

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- Microsoft Team group are created where students can access pdf lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●			●						
	LO2	●									●
	LO3	●						●			

Learning Outcomes		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
	LO4	●			●				●		●
Psycho motor Domain	LO5	●				●			●		●

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	8	20 %
Final Examination	(As Schedule)	60 %
Quizzes (1times)	4	3.3 %
Home assignments	9	10 %
Reporting Assignment	7	6.7 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- ■ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF

https://teams.microsoft.com/l/channel/19%3aPVqzBijeIM34j4BK53IRAGm1CrwVr8KNOpPifv9cNzk1%40thread.tacv2/General?groupId=389cdce3-7af8-44d9-93a4-53983e87aeca&tenantId=49fec46f-5c8a-405f-8772-a755acd6364a

https://teams.microsoft.com/l/team/19%3a2e70d40ac8c046a5b0facf07809052d8%40thread.tacv2/conversations?groupId=1e29e7a7-a3b5-4c15-9055-448ef6d41f0b&tenantId=49fec46f-5c8a-405f-8772-a755acd6364a

b- Books

1. David K. Cheng: "Field and Wave Electromagnetics", Addison-Wesley. 2nd Edition, Addison Wesley, Inc., Boston, 1989.

2. William Hayt: "Engineering Electromagnetics", 9th edition , New York, NY : McGraw-Hill Education, 2019.
3. Robert Collin: "Foundations for Microwave Engineering", McGraw-Hill, 2001

c- Recommended Books

1. Maxwell's Equations and the Principles of Electromagnetism", Richard Fitzpatrick, Jones & Bartlett Publishers, 2008.
2. "A Student's Guide to Maxwell's Equations", Daniel Fleisch, Cambridge University Press, 2008

d- Recommended Web Sites

1- https://www.ece.rutgers.edu/~orfanidi/ewa/
2- https://www.mnl-airport.com/lets/134db8a6/13.-maxwell's-equations-and-electromagnetic-waves---mit
3- http://www.docdatabase.net/more-chapter-9-electromagnetic-waves-mit-opencourseware-1265591.html
4- https://www.lej4learning.com.pk/courses_search/?cat_id=10703
5- http://pastpapers.org/pdf/what-is-an-electromagnetic-wave

- Course Coordinator: Prof. Dr.M. Lotfy Rabeh, Dr.Gehan Samy **Signature:**

- Program Coordinator: Assoc. Prof. Basem Elhalawany **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Electronics and Communications Eng. Program

1- Course Data

Course Code: ECE314 **Course Title:** Lab (3)(A)
Semester/Year: Second / 2020-2021 **Specialization:** Electronics and Communications Eng.
Contact Hours: 0+4 **Lecture:** 0 **Tutorial:** 0 **Lab:** 4

2- Course Objectives

For students undertaking this course, they will be able to:

1. Identify the theoretical concepts and characteristics of Single stage, multistage, and feedback transistor amplifier circuits.
2. Discuss amplifiers frequency response and bandwidth.
3. Describe and Analyze the characteristics and applications of operational amplifiers.
4. Understand the AM and FM Modulation/Demodulation techniques.

3- Course Competencies (NARS)

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.2 Conduct appropriate experimentation and interpret data, assess the experimental measurements, and use objective engineering judgment to draw conclusions.

A.5 Practice research techniques and methods of investigation as an inherent part of learning.

A.8 Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools, by performing presentations about a selected topic decided during the semester.

Level (B) Electrical Engineering Competencies

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

B.2 Analyze electronics/communications circuits for amplification/ modulation applications and identify the requirements to optimize these circuits.

B.3 Design and implement: amplifiers/modulation circuits using technological and professional tools.

Level (C) Electrical Engineering & Control Competencies

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

C.1 Analyze the performance of analog communication AM and FM modulation techniques.

C.4 Analysis of signal processing systems.

4- Course Contents

a) Course Description (As indicated in program Bylaw)

Single stage and multistages transistor amplifier circuits - feedback amplifiers - amplifiers frequency response and bandwidth – operational amplifiers

b) Topics to be Covered weekly & Matrix of Competencies

Week	Topics	Course Competencies						
		A2	A5	A8	B2	B3	C1	C4
1	• Single stage transistor amplifier circuits	√		√	√	√		√
2	• Multistage transistor amplifier circuits	√		√	√	√		√
3	• Feedback amplifiers	√		√	√	√		√
4	• Amplifiers frequency response and bandwidth.	√	√	√	√	√		√
5	• Operational amplifiers Applications	√		√	√	√		√
6	• Operational amplifiers Applications	√		√	√	√		√
7	• Amplitude Modulation (AM)	√		√	√	√	√	
8	• Double Sideband (DSB) modulation	√		√	√	√	√	
9	• Amplitude (AM) Demodulation	√		√	√	√	√	
10	• Double Sideband (DSB) Demodulation	√		√	√	√	√	
11	• Single Sideband (SSB) Modulation and Demodulation	√		√	√	√	√	
12	• FM Modulation	√	√	√	√	√	√	
13	• FM Demodulation	√		√	√	√	√	
14	• Laboratory exam (experimental and oral)	√		√	√			
15	• Final exam	√		√	√			

5- a) Teaching and Learning Methods

Course Competencies		Teaching and Learning Methods									
		Face-to-face Lecture	Online Education	Tutorial / Exercise	Group Discussions	Laboratory	Site Visit	Presentation	Mini Project	Research and Reporting	Brain Storming
Level A	A2				√	√			√	√	
	A5				√	√		√	√	√	
	A8					√		√	√	√	
Level B	B2				√	√			√	√	
	B3				√	√			√	√	
Le	C1					√				√	

	C4					√				√	

5- b) Teaching and Learning Methods of Disables

None

6- Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, teaching staff will be available for students for two hours a week as indicated on their timetable declared for students from the beginning of the semester.

7- Student Assessment

a- Student Assessment Methods

Course Competencies		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Quizzes	Lab Exam	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Level A	A2	√	√			√					√
	A5				√			√	√	√	
	A8							√	√		√
Level B	B2	√	√								√
	B3					√				√	
	B4	√	√			√					
Level C	C2	√	√								
	C3							√		√	

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	7	20 %
Final Examination	(As Schedule)	50 %
Class activity	Every week	10 %
Home assignments, and Reports	2, 4, 8, 11	10%
Experimental and oral exam	14	10 %
Total		**100** %

8- Facilities

The following facilities are needed for this course:

- ■ Laboratory
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- □ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

9- List of References

a- Course Notes

- Course notes prepared by instructor

b- Books

1. Barry Duncan, “Emona 101 Trainer Lab Manual, Further Experiments in Modern Analog & Digital Telecommunications”, vol (1)
2.

c- Recommended Books

d- Web Sites

Course: Lab (3)(A) (bu.edu.eg)

10- Matrix of Course Objectives and Competencies

Course Objectives	Course Competencies						
	A2	A5	A8	B2	B3	C2	C4
Course Objective #1	√			√	√		√
Course Objective #2	√	√	√	√			√
Course Objective #3	√			√	√		√
Course Objective #4	√		√	√	√	√	

- Course Coordinator: Dr. Emad Zewar, Dr. Said Emam **Signature:**

- Program Coordinator: Assoc. Prof. Dr. Basem ElHalawany **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Computer Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE343 Computer Aided Electronic Design
Semester/Year: First / 2021-2022
Prerequisite Course(s): NA **Core or Elective:** Elective
Weekly Contact Hours: **Lecture:** 3 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to provide students with the basic knowledge computer aided electronic design tools. Moreover, apply some software tools (e.g., Matlab, Simulink) for analysis, designing, and simulation of different electronic and communication systems. Finally, employ FPGA for digital electronic design and optimization.

3- Course Contents (As indicated in the program Bylaw)

The electronic systems-the standard components in electronics and communication-schematics and printed circuits design-using the programming packages

4- Program Competences Served by the Course (A2, B2, and C5)

Level (A) General Engineering Competences

A.2 Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

Level (B) Electrical Engineering Competences

B.2 Design model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

Level (C) Electrical Engineering & Control Competences

C.5 Synthesis and integrate electronic systems for certain specific function using the right equipment.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Recognize CAD process and automation
LO2	Demonstrate Matlab codes for solving mathematical problems using numerical and symbolic methods.
LO3	Apply Matlab software for modeling and simulating circuits and systems.
LO4	Apply Simulink as graphical-based programming tool for different communication and signal processing systems modeling and simulation.
LO5	Describe building blocks that are available to digital designer
LO6	Apply VHDL tool with FPGA architecture for modeling and simulating various digital circuits
Psychomotor Domain	
LO7	Design and implement of various digital electronic circuits by interfacing VHDL with FPGA kits.
Affective Domain	

	None

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	A2	B2	C5
Cognitive Domain			
LO1	■		
LO2		■	
LO3		■	
LO4		■	
LO5	■		
LO6		■	
Psychomotor Domain			
LO7			■
Affective Domain			

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes						
			LO1 A2-1	LO2 B2-1	LO3 B2-2	LO4 B2-3	LO5 A2-2	LO6 B2-4	LO7 C5
W1	• Introduction to CAD process and tools • Introduction to Matlab software • Scalars and vectors in Matlab.	4	■						
W2	• Arrays in Matlab • Functions in Matlab	4		■					
W3	• Conditional statements in Matlab • Loop statements in Matlab	4		■					
W4	• Matlab Vectorization • Matlab Debugging • Common Matlab Commands	4		■					
W5	• Structures in Matlab • Cell Arrays in Matlab	4		■					
W6	• Some Applications on Matlab • Symbolic Toolbox	4			■				
W7	• Introduction to Simulink graphical programming • Simulink Basic common Libraries	4				■			
W8	• Simulate Fourier series using Simulink • Frequency filtering using Simulink	4				■			
W9	• Simulate AM modulation and demodulation using Simulink	4				■			

Week	Topics	Planned Hours	Learning Outcomes						
			LO1 A2-1	LO2 B2-1	LO3 B2-2	LO4 B2-3	LO5 A2-2	LO6 B2-4	LO7 C5
	• Simulate BPSK and QPSK modulation and demodulation using Simulink								
W10	• Introduction to FPGA design flow, VHDL tool • Digital Design Review	**4**					■		
W11	• VHDL Basic design methodology	**4**					■		
W12	• Behavioral & Structural VHDL • Modeling	**4**						■	
W13	• Programming and Simulation with Xilinx ISE	**4**						■	
W14	• Programming through JTAG on Xilinx Spartan 3E Board	**4**							■

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖							
	LO2	❖		❖					❖		
	LO3	❖		❖					❖		
	LO4	❖		❖					❖		
	LO5	❖		❖					❖		
	LO6	❖		❖					❖		
Psychomotor	LO7	❖		❖					❖		

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Affective Domain											

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- A Microsoft Team group is created where students can attend online lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Lab Exam	Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●									
	LO2	●			●					●	●
	LO3				●					●	●
	LO4	●			●					●	●

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Lab Exam	Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
	LO5	●			●					●	
	LO6	●			●					●	●
Psychomotor Domain	LO7									●	
Affective Domain											

*There is one formative assessment (writing Exam), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	7	20
Final Examination	(As Schedule)	100
Quizzes (4 times)	3, 9	5
Home assignments, and Reports	2, 4, 8, 11	10
Mini Project	12	15
Total		**150**

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Smart Board
- ■ White Board
- ■ Data Show
- ■ Computer with software
- ■ MIS system
- ■ Internet Access
- □ Other: ……

11- List of References

a- Course Notes

Lectures Notes in PDF
https://teams.microsoft.com/l/channel/19%3asyXFZA5RdqzF1TnhTN-N1e-NKtsvR1hq-6c1OXoCYBQ1%40thread.tacv2/General?groupId=a4a567a1-eea7-461e-8f39-375e8bdeae88&tenantId=49fec46f-5c8a-405f-8772-a755acd6364a

b- Books

1. Gdeisat, Munther, and Francis Lilley, "MATLAB® by Example: Programming Basics". Newnes, 2013.
2. Hahn, Brian, and Daniel Valentine, "Essential MATLAB for engineers and scientists". Academic Press, 7th Edition, 2019.
3. ARTHUR A. GIORDANO & ALLEN H. LEVESQUE , "MODELING OF DIGITAL COMMUNICATION SYSTEMS USING SIMULINK", FIRST EDITION, 2015
4. *Circuit Design and Simulation with VHDL, Second edition*, by Volnei A. Pedroni
5. *Advanced FPGA Design: Architecture, Implementation, and Optimization* by Steve Kilts

c- Recommended Books

1. Attaway, Stormy, "Matlab: a practical introduction to programming and problem solving, Butterworth-Heinemann, 5th Edition, 2018.
2. *Quick Start Guide to VHDL* by Brock J. LaMeres

d- Web Sites

https://bu.edu.eg/staff/sawsanelsayed3-courses/14020/files

- Course Coordinator: Dr. Sawsan Abdellatif, **Signature**

Dr. Mahaba Saad **Signature:**

- Program Coordinator: Assoc. Prof. Basem ElHalawany **Signature:**

- Electrical Eng. Department Head: Prof. Mahmoud Soliman **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE322 Electronic Circuits (B)
Semester/Year: Second / 2021-2022
Prerequisite Course(s): NA **Core or Elective:** Core
Weekly Contact Hours: **Lecture:** 3 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

For students undertaking this course, they will be able to state basic principles of electronic circuits for communication engineering, Demonstrate the electronic circuits that are efficiently used in many systems and applications (Function generators – Filters – Voltage Regulators - PLL), Implement and design electronic circuits. Use CAD packages in analyzing and designing the electronic circuits.

3- Course Contents (As indicated in the program Bylaw)

Operational amplifier circuits - Differential amplifiers - signal generators - voltage regulators - active filters - phase locked loop circuits - using programming packages in analyzing and designing the electronic circuits

4- Program Competences Served by the Course (A9, A10, B2 and C5)

Level (A) General Engineering Competences

A.9 Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.

A.10 Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

Level (B) Electrical Engineering Competences

B.2 Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

Level (C) Electrical Engineering & Control Competences

C.5 Synthesis and integrate electronic systems for certain specific function using the right equipment

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Describe principles of design including elements design and process for Operational Amplifier, Signals generators, Filters, Voltage regulators and Phase locked loop circuits
LO2	Being familiar of using different CAD packages in analyzing and designing the electronic circuits.
LO3	Combine, exchange, and assess different ideas, views, and knowledge for design of electronic circuits
LO4	Evaluate the characteristics and performance of components used in operational amplifier circuits and its applications
LO5	Identify appropriate specifications for Function generators, Signals generators Filters, Voltage regulators and Phase locked loop circuits
Psychomotor Domain	
LO6	Create and/or re-design a process or component carry out specialized designs of Operational Amplifier circuits
Affective Domain	
	None

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	A9	A10	B2	C5
Cognitive Domain				
LO1			■	
LO2	■			
LO3			■	
LO4				■
LO5		■		
Psychomotor Domain				
LO6				■
Affective Domain				

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 B2-1	LO2 A9-1	LO3 B2-2	LO4 C5-1	LO5 A10-1	LO6 C5-2
W1	• Basic Internal Arrangement of an Op-Amp • Differential Amplifier Circuit • DC Biasing • AC Operation • Common Mode Operation	**4**	■					
W2	• Introduction to Operational Amplifiers • Ideal and practical Op-Amps • Op-Amp modes of operation • Feedback in Op-Amps	**4**	■			■		■

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 B2-1	LO2 A9-1	LO3 B2-2	LO4 C5-1	LO5 A10-1	LO6 C5-2
W3	• Non inverting amplifiers • Voltage follower • Inverting amplifiers • Effect of negative feedback on input and output impedances for Op-Amp	**4**	■			■		■
W4	• Comparators • Summing Amplifiers • Integrators & Differentiators • Non inverting Integrators	**4**	■			■		■
W5	• Instrumentation Amplifiers • Isolation Amplifiers • Operational Transconductance Amplifiers (OTAs) • Log and Antilog Amplifiers • Converters and Other Op-Amp Circuits	**4**	■			■		■
W6	• CAD Fundamentals • Trend in microelectronics • The design challenges • Different design paradigms • The test problems • Intro. to the IDE	**4**		■				
W7	• VHDL Basics • Basic language concepts Basic design methodology	**4**		■				
W8	• Programming the Spartan-3E FPGA Board • Spartan-3E Example on Spartan-3E	**4**		■				
W9	• Structural VHDL Modeling • Modeling the Structure way • Structural Example • Behavioral & Structural Example	**4**		■				
W10	• Basic Filter Responses • Filter Response Characteristics • Active LPF, HPF, BPF & BSF • Filter Response Measurements	**4**	■		■		■	
W11	• Introduction to Oscillators • Feedback oscillators principle • Types of Oscillators • RC feedback oscillators • Conditions of oscillation	**4**	■		■		■	
W12	• Relaxation Oscillators • Triangular wave oscillator • Square wave generator • 555 timer as an oscillator • 555 timer as a VCO	**4**	■		■		■	

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 B2-1	LO2 A9-1	LO3 B2-2	LO4 C5-1	LO5 A10-1	LO6 C5-2
W13	• Voltage Regulation • Basic Linear Series Regulators • Basic Linear Shunt Regulators • Intro. to Switching Regulators	**4**	■		■		■	
W14	• Introduction to Phase-locked Loop (PLL) • Basic Operation Applications	**4**	■		■		■	

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖						❖	
	LO2	❖		❖							❖
	LO3	❖		❖						❖	❖
	LO4	❖		❖							❖
	LO5	❖		❖						❖	❖
Psychomotor Domain	LO6	❖		❖							❖
Affective Domain											

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.

- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●		●					●		●
	LO2	●				●					●
	LO3	●		●		●			●		●
	LO4	●				●					●
	LO5	●		●					●		●
Psychomotor Domain	LO6	●						●			
Affective Domain											

*There is one formative assessment (writing Exam), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment	Week	Weight/ marks
Midterm Examination	7	20
Final Examination	(As Schedule)	90
Home assignments, and Reports	2, 6,10	10
Oral Exam	12	30
Total		**100**

10- Facilities

The following facilities are needed for this course:

■ Classroom	□ Smart Board	□ Computer with software
□ Lecture Hall	■ White Board	■ MIS system
□ Sound and Microphone	■ Data Show	■ Internet Access

□ Other: ……

11- List of References

a- Course Notes

Lectures Notes in PDF

https://bu.edu.eg/staff/esraasoliman3-courses/18324

b- Books

1. Robert L. Boylestad, "Electronic devices and circuit theory", 11th Edition , Prentice hall
2. Thomas L. Floyd, "Electronic devices", 9th Edition, Pearson Education

c- Recommended Books

1. Kenneth Carless Smith, Adel S. Sedra, "Microelectronic Circuits",6 thedition,Oxford University Press, Incorporated, 2010

d- Web Sites

- Course Coordinator: Dr. Mahaba Saad , Dr. Esaraa Mosleh Signature:

- Program Coordinator: Assoc. Prof. Basem ElHalawany Signature:

- Electrical Eng. Department Head: Prof. Mahmoud Soliman Signature:

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE344 Microwave Fundamentals **Semester/Year:** Second / 2021-2022
Prerequisite Course(s): - **Core or Elective:** Elective Course
Contact Hours: 6 **Weekly Contact Hours**: **Lecture:** 4 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

The aim of this course is to introduce students to microwave transmission line analysis as well as microwave network analysis. Use graphical solution (smith chart) to solve transmission line problems and design matching networks with microstrip lines. Finally analyze the behavior of some passive microwave devices as power dividers and couplers.

3- Course Contents (As indicated in the program Bylaw)

Cylindrical and rectangular wave guides-main passive elements-microstrip

4- Program Competencies Served by The Course (B2 and C2)

Level (B) Electrical Engineering Competencies

B.2 Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

Level (C) Communications and Electronics Competencies

C.2 Depict, and analyze the performance of antenna and microwave applications

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Explain the fundamentals of transmission lines and propagation of signals inside it.
LO2	Design matching networks using smith chart.
LO3	Analyze the wave propagation in TE, TM or TEM modes, in a rectangular waveguide.
LO4	Design some passive microwave components such as power dividers and couplers
Psychomotor Domain	
LO5	Perform Scattering parameter analysis of RF Component using Advanced Design System Simulation (ADS)
LO6	Design microwave matching networks as L section, single and stub and quarter wave transformer using ADS.

6- Mapping Learning Outcomes (LO's) with Competencies

LO's / NARS	B2	C2
Cognitive Domain		
LO1	■	
LO2	■	
LO3	■	
LO4	■	
Psychomotor Domain		
LO5		■
LO6		■

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes					
			LO1 B2-1	LO2 B2-2	LO3 B2-3	LO4 B2-4	LO5 C2-5	LO6 C2-6
W1	- Quality requirements for the course - Introduction to Electromagnetic fields	6	■					
W2	-General Transmission Line Theory -Circuit Model of Transmission lines	6	■					
W3	-General Transmission Line Equations -Properties of standing Wave -Reflection on terminated transmission line	6	■					
W4	-Simulate Transmission line problems using ADS	6					■	
W5	- Design Matching circuit using quarter wavelength transformer - Understand Smith chart	6		■				■
W6	- Practice impedance and transformation on smith chart -Design matching L network using smith chart	6		■				■
W7	- Design single stub matching using smith chart	6		■				■
W8	- General wave behaviors along uniform guiding structures, TE, TM and TEM modes - Guided waves in rectangular waveguides, TE and TM modes.	6			■			
W9	Microwave network analysis -Scattering Matrix [S_{ij}] -Impedance matrix [Z_{ij}]	6				■		
W10	-Tee and Pi equivalent circuits - Transmission [ABCD] networks	6				■		
W11	- Discuss basic properties of dividers and couplers	6				■		
W12	-Analyze and design three port T junction power divider	6				■	■	
W13	-Analyze and design four port Network: Quadrature 90° Hybrid coupler	6				■	■	
W14	-Review and Discuss Selected Topics	6				■		

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	●	●	●							
	LO2	●		●							

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
	LO3	●		●							
	LO4	●		●			●			●	
Psychomotor Domain	LO5	●	●							●	
	LO6	●	●								

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- Microsoft Team group are created where students can attend online lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●			●						
	LO2	●				●					●
	LO3	●									
	LO4	●						●			

Learning Outcomes		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Psychomotor Domain	LO5					●		●		●	
	LO6					●					

b- Assessment Schedule and Weight

Assessment Tools	Week	Weight
Midterm Examination	7	10 %
Final Examination	(As Scheduled)	67 %
Quizzes (2 times)	8,12	6 %
Home assignments	7,13	7%
ADS simulation for selected topic	14	10 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- ■ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF
https://bu.edu.eg/staff/sherifsalah3-courses/14139
https://bu.edu.eg/staff/jehanshehata3-courses/18363/files

b- Books

1. Microwave Engineering, 4th edition, David Pozar, Wiley 2011.

c- Recommended Books

1. Fundamentals of Microwave and RF Design, 3rd Edition, Michael Steer, 2019

- Course Coordinator: Dr. Sherif Hekal, Dr. Gehan Sami **Signature:**

- Program Coordinator: Assoc. Prof. Basem Elhalawany **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code: ECE411 **Course Title:** Antenna and wave propagation
Prerequisite Course(s): **Semester/Year:** First / 2021-2022 .
Contact Hours: 5 **Lecture:** 3 **Tutorial:** 2 **Lab:** -

2- Course Aims

For students undertaking this course, they will be able to explain how antenna radiates, determine fields radiated from antenna, demonstrate different radiation parameters for different antenna types. Moreover, design and identify applications for common antenna types such as linear antennas and microwave antennas. Apply the Friis transmission expression to predict the receive power in a system consisting of transmit and receive antenna. Understand image theory, design and analyze uniformly excited equally spaced arrays. Apply pattern multiplication principle. Describe function of butler matrix as a feeding network to antenna array. Finally simulate linear antenna-array and find their radiation parameters and radiation pattern.

3- Course Contents (As indicated in the program Bylaw)

Transmitting and receiving antennas fundamentals-linear antennas- array antennas- microwave antennas

4- Program Competences Served by the Course (B2, B4 and C2)

Level (B) Electrical Engineering Competences

B.2 Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

B.4 Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation and evaluate its suitability for a specific application.

Level (C) Communications and Computer Engineering Competences

C.2 Depict, and analyze the performance of antenna and microwave applications

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Describe the radiation from linear wire antennas.
LO2	Calculate antenna parameters (field pattern, directivity, gain, beam width, efficiency, radiation resistance)
LO3	Define polarization and master basic definition of Friis expression in a system consists of transmit and receive antennas
LO4	Design and analyze antenna above ground plane.
LO5	Design wire antenna array with specific required beam pattern.
LO6	Explore beamforming concept through array feed circuit.
Psychomotor Domain	
LO7	Design basic dipole array antenna using HFSS software
Affective Domain	

LO8	Explore a recent trend of research in specific antenna type, Write a report and present.

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	B2	B4	C2
Cognitive Domain			
LO1	■		
LO2	■		■
LO3			■
LO4			■
LO5			■
LO6		■	■
Psychomotor Domain			
LO7		■	
Affective Domain			
LO8			■

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes									
			LO1 B2-1	LO2 C2-2	LO2 B4-2	LO3 C2-3	LO4 C2-4	LO5 C2-5	LO6 B4-6	LO6 C2-6	LO7 B4-7	LO8 C2-8
W1	• Maxwell equation and potential vector • Introduction to Antennas • Types of Antennas, • Antenna Basics and radiation mechanism. • Introduction to Fundamental Parameters of Antennas	2	■									
W2	• Antenna Radiation Pattern, Radiation Power Density, and Radiation Intensity. • Beamwidth, Directivity, Efficiency, and Gain and Radiation resistance of Antenna.	2		■								
W3	• Numerical Techniques to estimate radiation pattern of antenna • Bandwidth and Polarization of antenna • Antenna input impedance and equivalent circuit.	2			■	■						

Week	Topics	Planned Hours	Learning Outcomes									
			LO1 B2-1	LO2 C2-2	LO2 B4-2	LO3 C2-3	LO4 C2-4	LO5 C2-5	LO6 B4-6	LO6 C2-6	LO7 B4-7	LO8 C2-8
W4	• Antenna Radiation Efficiency • Maximum Directivity and Maximum Effective Area • Friis Transmission Equation and Radar Range Equitation.	**2**		■	■	■						
W5	• Radiation Integrals and Auxiliary Potential Function. • Introduction to linear wire antenna	**2**	■									
W6	• Infinitesimal Dipole, small dipole • Finite length dipole • $\lambda/2$ dipole	**2**	■	■								
W7	• Midterm											
W8	• Review plotting Radiation pattern, nulls, and maximums. • Linear antenna rotated on x, and y axes.	**2**	■									
W9	• Image theory electrical and magnetic source • Vertical electrical dipole • Horizontal electrical dipole	**2**	■				■					
W10	• Two isotropic point sources • Principle of pattern multiplication	**2**						■		■		
W11	• Linear array of n-element Point Sources • Broadside and end-fire arrays • Grating lobe conditions • Radiation patterns and directivity for antenna arrays	**2**	■	■				■		■		
W12	• Planar array • Array factor and beamforming	**2**	■	■				■	■	■	■	

Week	Topics	Planned Hours	Learning Outcomes									
			LO1 B2-1	LO2 C2-2	LO2 B4-2	LO3 C2-3	LO4 C2-4	LO5 C2-5	LO6 B4-6	LO6 C2-6	LO7 B4-7	LO8 C2-8
	• Butler matrix											
W13	• Discussion on microstrip antennas for medical applications	**2**										■

b) Additional private study/learning hours expected for students per week is Three hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	❖		❖							
	LO2	❖		❖							
	LO3	❖		❖							
	LO4	❖		❖							
	LO5	❖		❖							
	LO6	❖		❖							
Psychomotor Domain	LO7									❖	
Affective Domain	LO8						❖	❖		❖	

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.

- A WhatsApp group as well as Microsoft Team group are created where students can ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●									
	LO2	●									
	LO3	●			●						●
	LO4	●									
	LO5	●			●						●
	LO6	●									●
Psychomotor Domain	LO7									●	
LAffective Domain	LO8							●	●		

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	7&14	20 %
Final Examination	(As Schedule)	60 %
Quizzes (1 times)	5	5 %
Home assignments	4,10	5%
Report Assignment	12	10%

Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- ■ Lecture Hall
- □ Sound and Microphone
- □ Smart Board
- ■ White Board
- ■ Data Show
- ■ Computer with software
- ■ MIS system
- ■ Internet Access
- □ Other: ……

11- List of References

a- Course Notes

Lectures Notes in PDF
https://bu.edu.eg/staff/islam.mansour-courses/17759/files

https://teams.microsoft.com/l/team/19%3a4Rtle3alc7tkqUjOx04xvzQKzLneMR7DocmXJdz0DPc1%40thread.tacv2/conversations?groupId=d2b09b7a-22e2-40ae-abc5-d97c197bb799&tenantId=49fec46f-5c8a-405f-8772-a755acd6364a

b- Books

1. Antenna theory: Analysis and design, Wiley 4th edition (2016), Constantine A. Balanis.

c- Recommended Books

2. Antenna theory: Analysis and design, Wiley 4th edition (2016), Constantine A. Balanis.
3. Antenna theory and design, Wiley 3rd edition (2012), Warren L.Stutzman and Gray A.Thiele.

d- Web Sites

https://bu.edu.eg/staff/islam.mansour-courses/17759/files

https://teams.microsoft.com/l/team/19%3a4Rtle3alc7tkqUjOx04xvzQKzLneMR7DocmXJdz0DPc1%40thread.tacv2/conversations?groupId=d2b09b7a-22e2-40ae-abc5-d97c197bb799&tenantId=49fec46f-5c8a-405f-8772-a755acd6364a

- Course Coordinator: Dr. Gehan Sami, Dr. Islam Mansour **Signature:**

- Program Coordinator: Assoc.Prof. Dr. Lamiaa Elrefaei **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the program: Electrical Engineering Department
Department offering the course: Communications and Electronics Engineering Program

1- Course Data (Basic Information)

Course Code & Title: ECE422 Advanced Electronic Systems
Semester/Year: Second / 2020-2021
Prerequisite Course(s): NA **Core or Elective:** Elective
Weekly Contact Hours: **Lecture:** 2 **Tutorial:** 2 **Laboratory:** 0

2- Course Aims

For students undertaking this course, they will be able to recognize the basics of electronic satellite communications systems, analyze satellites' orbiting laws, Report and discuss Recent Trends in satellite Communication Systems (LEO Satellites Constellations and Cubsat Satellites). Moreover, employ link budget analysis (single channel and/or multiple channel). Finally, identify the concepts of Global Positioning System (GPS) to recognize how GPS determine location.

3- Course Contents (As indicated in the program Bylaw)

Design and analysis of digital and analog electronic systems-audio and visual systems using microwaves- satellites- Mobile telephone and personal computer technologies

4- Program Competences Served by the Course (B4, B5 and C1)

Level (A) General Engineering Competences

None

Level (B) Electrical Engineering Competences

B.4 Estimate and measure the performance of an electrical system and circuit under specific input excitation and evaluate its suitability for a specific application.

B.5 Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

Level (C) Electrical Engineering & Control Competences

C.1 Design and implement the performance of digital and analog communication, mobile communication, coding, and decoding systems

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Define the basics elements of electronic satellite communications systems
LO2	Classify Satellites and transmission types
LO3	Identify and design satellite Orbits using parameters
LO4	Apply link budget analysis to calculate received power at different points in satellite communication system.
LO5	Solve Trilateration problems used in GPS for localization.
LO6	Describe communication satellite services: satellite Telephony, satellite TV, satellite data communication.
LO7	Differentiate multiple access techniques for satellite communication system.
Psychomotor Domain	
LO8	Report the state-of-the-art technologies in Satellite communication
Affective Domain	
	None

6- Mapping Learning Outcomes (LO's) with competences

LO's / NARS	B4	B5	C1
Cognitive Domain			
LO1		■	
LO2		■	
LO3			■
LO4	■		
LO5	■		
LO6		■	
LO7		■	
Psychomotor Domain			
LO8	■		
Affective Domain			

7- Lecture Plan

a) Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes							
			LO1 B5-1	LO2 B5-2	LO3 C1-1	LO4 B4-1	LO5 B4-2	LO6 B5-3	LO7 B5-4	LO8 B4-3
W1	• Introduction to Satellite Communication System • How Satellites Work • Types of satellite transmissions • Passive and active satellites • History of Early Artificial Satellites	4	■							
W2	• Satellite Orbits • Kepler's planetary laws	4			■					
W3	• Definitions of Terms for Earth-Orbiting Satellites	4			■					
W4	• Synchronous and nonsynchronous Orbital Satellites • LEO, MEO and GEO Satellites parameters	4		■	■					
W5	• Satellite Coordinates and Look Angles • Satellite Footprint Categories	4			■					
W6	• Introduction to Students Surveys on LEO and Cubsat,	4								■
W7	Midterm Exam	4								
W8	• Satellite System Link Models Satellite System parameters	4				■				
W9	• Satellite System Link Equations • Satellite System Link Budget	4				■				
W10	• Introduction to global navigation satellite systems (GNSS) • Basics of Global positioning system (GPS) • GPS Trilateration • 2D Trilateration and its application on Indoor positioning	4					■			
W11	Communication satellite services and applications: • Satellite Telephony • Satellite TV • Satellite data communication	4						■		
W12	• Introduction to multiple access techniques for communications satellites. • Basics of Frequency division multiple access (FDMA) for satellite system. • Calculations of C/N ratio for FDMA satellite system	4							■	
W13	• Basics of Time division multiple access (TDMA) for satellite system. • Calculations of C/N ratio for TDMA	4							■	

Week	Topics	Planned Hours	Learning Outcomes							
			LO1 B5-1	LO2 B5-2	LO3 C1-1	LO4 B4-1	LO5 B4-2	LO6 B5-3	LO7 B5-4	LO8 B4-3
	satellite system • Comparison between FDMA and TDMA									
W14	Assignments delivery and discussions	**4**								■

b) Additional private study/learning hours expected for students per week is FOUR hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1		❖	❖							
	LO2		❖	❖							
	LO3		❖	❖							
	LO4		❖	❖							
	LO5		❖	❖							
	LO6		❖	❖							
	LO7		❖	❖							
Psychomotor Domain	LO8				❖		❖	❖	❖	❖	
Affective Domain											

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.

- Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
- A WhatsApp group as well as Microsoft Team group are created where students can attend online lecture / tutorial, ask questions and share files with teaching staff. Moreover, these groups are used to announce the student marks, changes to the timetable, exam days …etc.
- There are no disabled students in the programs, so no special support is needed.

9- Student Assessment

a) Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Pop Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1		●								●
	LO2		●								●
	LO3		●			●					●
	LO4	●				●					
	LO5	●				●			●		
	LO6	●									
	LO7	●				●					
Psychomotor Domain	LO4		●					●	●		●
Affective Domain											

*There is one formative assessment (writing Exam), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment	Week	Weight/ marks
Midterm Examination	7	15
Final Examination	(As Schedule)	60
Home assignments, and Reports	2, 6,10	15
Oral Exam	12	10
Total		**100**

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access
- □ Other: ……

11- List of References

a- Course Notes

Lectures Notes in PDF

http://www.bu.edu.eg/staff/basem.mamdoh-courses/15100

https://bu.edu.eg/staff/sawsanelsayed3-courses/14609

b- Books

1. L.Frenzel, "Principles of electronic communication systems", (Fourth Edition), McGraw-Hill Education, 2016
2. Wayne Tomasi, "Advanced Electronic Communications Systems", (Sixth Edition), Pearson Education Limited,2013
3. Maini, Anil K., and Varsha Agrawal. 'Satellite technology: principles and applications'. John Wiley & Sons, 3rd Edition, 2014.

c- Recommended Books

1. Wayne Tomasi, "Advanced Electronic Communications Systems", (Sixth Edition), Pearson Education Limited,2013

d- Web Sites

http://www.bu.edu.eg/staff/basem.mamdoh-courses/15100

- Course Coordinator: Assoc. Prof. Basem ElHalawany **Signature:**

- Program Coordinator: Assoc. Prof. Basem ElHalawany **Signature:**

- Electrical Eng. Department Head: Prof. Mahmoud Soliman **Signature:**

University: Benha University
Faculty: Faculty of Engineering at Shoubra
Department offering the course: Electrical Engineering Department

1- Course Data (Basic Information)

Course Code: ECE447 **Course Title:** Robot Engineering

Semester/Year: Second / 2020-2021 **Specialization:** Electrical Communication and Electronics
Total Hours: 6 **Lecture:** 4 **Practical/practice:** 2

2- Course Aims

The aim of this course is to provide students with the basic knowledge of robot components, subsystems, configurations, and applications. Moreover, analyze the kinematics, dynamics, control, and trajectory planning of robots. Finally, apply the fundamentals of vision systems, including different techniques for image processing and image analysis in robotics applications.

3- Course Contents (As indicated in the program Bylaw)

Coordinate systems and transformation- robot kinematics-inverse kinematics-robot dynamics motion path planning-robot motion control-control of robot derivers.

4- Program Competencies Served by The Course (A.2, B.5, and C5)

Level (A) Engineering Competencies

On completing this course, students will be able to:

A.2 Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

Level (B) Electrical Engineering Competencies

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

B.5 Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

Level (C) Communications and Computer Engineering Competencies

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

C.5 Synthesis and integrate electronic systems for robot specific application using the right equipment.

5- Learning Outcomes (LO's)

At the end of the course, the student will be able to:

Cognitive Domain	
LO1	Recognize the different components of robot systems to select the suitable one for the corresponding application.
LO2	Solve the forward and inverse kinematics/dynamics to get the robot end effector location and/or joint variables.
Psychomotor Domain	
LO3	Design a robot to meet the required specifications.

Affective Domain	
LO4	Observe the robot trajectory operation to judge the system efficiency.

6- Mapping Learning Outcomes (LO's) with Competencies

LO's \ NARS	A2	B5	C5
Cognitive Domain			
LO1		■	
LO2	■		
LO3		■	
Affective Domain			
LO4	■		■

7- Lecture Plan

Topics to be Covered weekly & Matrix of LO's

Week	Topics	Planned Hours	Learning Outcomes			
			LO1	LO2	LO3	LO4
W1	• Quality Assurance requirements for the course • Robotics, robot types, components, configurations, and applications. • Robot Degree of Freedom (DOF) and robot workspace.	**6**	■			
W2	• Spatial descriptions and homogeneous transformations • Parameterization of Rotations and MATLAB robotics toolbox.	**6**		■		
W3	Introduction to Robot kinematics, forward kinematics, Denavit-Hartenberg Convention (DH-Parameters), and assignment of coordinate frames.	**6**		■		
W4	• Inverse kinematics. • Velocity kinematics.	**6**		■		
W5	Robot dynamic analysis.	**6**		■		
W6	Robot trajectory planning.	**6**		■		■
W7	Robot simulation; Case Study	**6**		■	■	■
W8	Introduction to mobile robots.	**6**	■			
W9	Sensors (Shaft Encoder-Ultrasonic ranging – Infra red ranging –Laser ranging)	**6**	■		■	
W10	Sensors (Accelerometers-Gyroscopes – Inclinometer)	**6**	■		■	

Week	Topics	Planned Hours	Learning Outcomes			
			LO1	LO2	LO3	LO4
W11	Sensors (Camera Technologies – Introduction to image processing)	**6**	■		■	
W12	Actuators (DCM –BLDCM –Stepper motors-servos) and drivers	**6**	■		■	
W13	Robot control (discrete P –PI –PD - PID controllers) - Differential drive Mobile robot motion control.	**6**			■	■
W14	Differential drive Mobile robot kinematic and inverse kinematic. Robot programming.	**6**		■	■	

Additional private/self-study/learning hours expected for students per week is Four hours

8) Teaching and Learning Methods

Learning Outcomes		Teaching and Learning Methods									
		Face-to-face Lecture	Online Lectures	Tutorial / Exercise	Group Discussions	Laboratory	Self-Reading	Presentation	Collaborate Learning (Team Project)	Research and Reporting	Brain Storming
Cognitive Domain	LO1	●	●	●							
	LO2	●	●	●			●		●		●
Psychomotor Domain	LO3	●	●	●	●		●		●		●
Affective Domain	LO4	●		●	●			●	●	●	●

Student Academic Counseling and Support

- Students are directed to contact teaching staff for academic support during specific office hours.
- Regarding this course, Instructor and TA will be available two hours a week as indicated on the timetable declared for students from the beginning of the semester.

9- Student Assessment

a- Student Assessment Methods

Learning Outcomes		Assessment Methods*									
		Written Exams	Online Exams	Oral Exam	Quizzes	In-class Problem Solving	Take-Home Exam	Research Assignments	Reporting Assignments	Project Assignments	In-class Questions
Cognitive Domain	LO1	●	●			●			●		●
	LO2	●		●	●	●			●	●	●
Psychomotor Domain	LO3			●				●	●	●	●
Affective Domain	LO4			●	●			●	●	●	●

* There is one formative assessment (quiz), and all other assessments are summative.

b- Assessment Schedule and Weight

Assessment	Week	Weight
Midterm Examination	8	13.33 %
Final Examination	(As Schedule)	66.67 %
Quizzes (2 times)	5, 12	3.33 %
Assignments, and Reports	4, 11	3.33%
Mini project	13	13.33 %
Total		**100** %

10- Facilities

The following facilities are needed for this course:

- ■ Classroom
- □ Lecture Hall
- □ Sound and Microphone
- □ Other: ……
- □ Smart Board
- ■ White Board
- ■ Data Show
- □ Computer with software
- ■ MIS system
- ■ Internet Access

11- List of References

a- Course Notes

Lectures Notes in PDF
http://www.bu.edu.eg/staff/mohamedselmy3-courses/ (Last access: June 21st, 2021)

b- Books

1- M. W. Spong, S. Hutchinson and M. Vidyasagar, Robot Modelling and Control, Wiley, 2005.
2- J. Craig, Introduction to Robotics: Mechanics and Control, Prentice Hall, 2005.
3. Corke, P., Robotics, vision and control: fundamental algorithms in MATLAB, Springer, 2017.
4. Spyros G. Tzafestas, Introduction to Mobile Robot Control, ELSEVIER, 2014.
5. R. Siegwart and I. Nourbakhsh, Introduction to Autonomous Mobile Robots, The MIT Press, 2004.

c- Recommended Books

1- S. B. Niku, Introduction to Robotics: Analysis, Control, Applications, John Wiley, 2011.
2- Kevin M. Lynch and Frank C. Park, Modern Robotics Mechanics, Planning, And Control, Cambridge University Press, 2017.

d- Web Sites

1- https://petercorke.com/
2- https://www.coppeliarobotics.com/
3- http://gazebosim.org/
4- https://www.theconstructsim.com/
5- Srinivas Kumar Palvadi, Pooja Dixit, Vishal Dutt, Introduction to Robotics, Wiley, 2021, DOI: 10.1002/9781119711230.ch1, https://0810e1s1f-1105-y-https-onlinelibrary-wiley-com.mplbci.ekb.eg/doi/10.1002/9781119711230.ch1

- Course Coordinator: Dr. Ashraf Hafez **Signature:**

Dr. Mohamed Salah Selmy **Signature:**

- Program Coordinator: Prof. **Signature:**