UNIVERSITY OF ANBAR
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING

Undergraduate Catalog

2022-2023 | Ramadi - Iraq

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Department Vision and Statement

Vision

- To be one of leading Electrical Engineering Departments in Iraq and the Arab world.
- To combine science, electrical engineering principles, and moral conduct to produce world-class graduates.

Mission Statement

The mission of the Department of Electrical Engineering is to provide comprehensive quality education to the students in electrical engineering, and to adequately prepare them to meet the existing challenges in their profession and be capable of handling them in the future. Upon graduation, students will have acquired sufficient skills in critical thinking, problem solving and communication to achieve a successful career. Their background will provide them the opportunity to pursue graduate programs with ease, enabling them to take up a future role in teaching and research if they so choose. During their study, they will develop the spirit of team work and understand the desirability of following professional ethics to effectively serve the community.

Course Identification

Course Descriptions

Courses are coded as follows:

- Course code and number.
- Course title.
- Parenthesized numerals, e.g., (4-3-1-3), indicate, in order, the credit hours, the classroom hours (1 hour = 1 credit hour), tutorial hours (credit hour = 0), and the laboratory hours (3 hour = 1 credit hour).
- Prerequisites, if any, are indicated at the course description. These have been established to assure an adequate and uniform background for students in advanced classes. Occasionally, students may feel they already have the appropriate background for an advanced course because of previous training, transfer credits, or credit by examination.

Class Numbering System

A course code starts with "EE" followed by a 4 digits number. This number is created as following:

1xxx- First year 2xxx- Second year 3xxx- Third year 4xxx- Fourth year level	x1xx- University Requirements x2xx- College Requirements x3xx- Department requirements	the numbers xx01, xx02, xx03… etc. describe the sequence of a course in each requirement.

Graduation Requirements

Requirements	*Credit hours*
University Requirements	14
College Requirements	38
Department Requirements	88
EE Elective Classes	6
Total	146

Offered Classes	*Credit hours*	*Percentage*	*Range*
University Requirements	14	10%	(10% - 15%)
College Requirements	38	26%	(16% - 22%)
Department Requirements + Electives	88+6=94	64%	(63% - 74%)
Total (minimum=132)	146	100%	

Offered Classes

University Requirements: 14 Credit Hours

Course No.	*Course Title*	*Credit Hours*	*Weekly hours*		
			Lect.	*Tut.*	*Lab.*
EE2105	Arabic Language	2	2	-	-
EE1104	Democracy	1	1	-	-
EE1102	English Language I	2	2	-	-
EE2103	English Language II	2	2	-	-
EE3107	English Language III	2	2	-	-
EE4108	English Language IV	2	2	-	-
EE4106	Ethics and Leadership Skills	2	2	-	-
EE1101	Human Rights	1	1	-	-
Total		14	14	0	0
			14		

College Requirements: 38 Credit Hours

Course No.	*Course Title*	*Credit Hours*	*Weekly hours*		
			Lect.	*Tut.*	*Lab.*
EE1201	Calculus I	3	3	1	-
EE1202	Calculus II	3	3	1	-
EE2208	Calculus III	3	3	1	-
EE2209	Calculus IV	3	3	1	-
EE1207	Chemistry	4	3	-	2
EE1205	Computer Science	3	2	1	2
EE1206	Engineering Drawing	3	2	2	2
EE1204	Engineering Mechanics I (Static)	3	3	1	-
EE3211	Engineering Numerical Methods	3	2	1	2
EE3212	Engineering Statistics	3	3	-	-
EE1301	Fundamentals of Electrical Engineering I	3	2	1	2
EE1203	Physics	4	3	-	2
Total		38	32	10	12
			54		

Department Requirements: 88 Credit Hours

Course No.	*Course Title*	*Credit Hours*	*Weekly hours*		
			Lect.	*Tut.*	*Lab.*
EE3324	AC Machines I	2	2	1	-
EE3325	AC Machines II	2	2	1	-
EE4335	Advanced Communication Systems	2	2	1	-
EE3328	Analog Communications and Noise	2	2	1	-
EE1304	Applied Physics	3	3	-	-
EE3323	Computer Networks	3	3	1	-
EE2312	Computer Programming	2	1	-	2
EE4332	Control Theory I	2	2	1	-
EE4333	Control Theory II	2	2	1	-
EE2313	DC Machines I	2	2	1	-
EE2314	DC Machines II	2	2	1	-
EE3329	Digital Communications	2	2	1	-
EE2304	Digital Techniques I	2	2	-	-
EE2305	Digital Techniques II	3	2	-	2
EE2306	EE Lab 21	2	-	-	4
EE2307	EE Lab 22	2	-	-	4
EE3321	EE Lab 31	2	-	-	4
EE3322	EE Lab 32	2	-	-	4
EE4330	EE Lab 41	1	-	-	2
EE4331	EE Lab 42	1	-	-	2
EE2310	Electric Circuits I	3	3	1	-
EE2311	Electric Circuits II	3	3	1	-
EE3317	Electric Power I	2	2	1	-
EE3318	Electric Power II	2	2	1	-
EE4336	Electric Power III	2	2	2	-
EE2315	Electromagnetic Fields I	2	2	1	-
EE2316	Electromagnetic Fields II	2	2	1	-
EE3326	Electronics I	3	3	1	-
EE3327	Electronics II	3	3	1	-
EE3210	Engineering Economy	3	3	-	-
EE4338	Final Year Project I	3	3	-	-
EE4339	Final Year Project II	3	3	-	-
EE1302	Fundamentals of Electrical Engineering II	4	3	1	2
EE2308	Fundamentals of Electronics I	2	2	1	-
EE2309	Fundamentals of Electronics II	2	2	1	-
EE4334	Information Theory	2	2	-	-
EE4337	Power Electronics	2	2	2	-
EE3319	Signals and Systems I	2	2	1	-
EE3320	Signals and Systems II	2	2	1	-
Total		88	75	27	26
			128		

EE Elective Classes: 6 Credit Hours

Major electives courses are offered occasionally to meet specific demands of society and students. Subject to availability, four courses (6 credits) can be selected from the following list by the department:

Course No.	*Course Title*	*Credit Hours*	*Weekly hours*		
			Lect.	*Tut.*	*Lab.*
EE4344	Antennas	2	2	1	-
EE4343	Digital Electronics	2	2	1	-
EE4340	Digital Signal Processing	2	2	1	-
EE4346	Fiber Optics Communication	2	2	1	-
EE4347	Fundamentals of Renewable Energy Systems	2	2	1	-
EE4342	Micro-Controllers	2	2	1	-
EE4341	Micro-Processors	2	2	1	-
EE4348	Power System Analysis	2	2	1	-
EE4345	Programmable Logic Controller (PLC)	2	2	1	-
Total		18	18	9	0
			27		

Recommended Course Plan by Semester for EE

First Year

First Semester					
Requirements	Course Title	Credit Hours	Weekly Hours		
			Lect.	Tut.	Lab.
College	Calculus I	3	3	1	-
College	Physics	4	3	-	2
College	Fundamentals of Electrical Engineering I	3	2	1	2
University	English Language I	2	2	-	-
University	Human Rights	1	1	-	-
College	Computer Science	3	2	1	2
College	Chemistry	4	3	-	2
-	-	-	-	-	-
-	-	-	-	-	-
Total		20	16	3	8
			27		

Second Semester					
Requirements	Course Title	Credit Hours	Weekly Hours		
			Lect.	Tut.	Lab.
College	Calculus II	3	3	1	-
EE-Required	Applied Physics	3	3	-	-
EE-Required	Fundamentals of Electrical Engineering II	4	3	1	2
University	Arabic Language	2	2	-	-
College	Engineering Drawing	3	2	2	2
University	Democracy	1	1	-	-
College	Engineering Mechanics I (Static)	3	3	1	-
-	-	-	-	-	-
-	-	-	-	-	-
Total		19	17	5	4
			26		

Second Year

First Semester					
Requirements	*Course Title*	*Credit Hours*	*Weekly Hours*		
			Lect.	*Tut.*	*Lab.*
College	Calculus III	3	3	1	-
EE-Required	Electromagnetic Fields I	2	2	1	-
EE-Required	Fundamentals of Electronics I	2	2	1	-
EE-Required	DC Machines I	2	2	1	-
EE-Required	EE Lab 21	2	-	-	4
EE-Required	Electric Circuits I	3	3	1	-
EE-Required	Digital Techniques I	2	2	-	-
University	English Language II	2	2	-	-
-	-	-	-	-	-
Total		18	16	5	4
			25		

Second Semester					
Requirements	*Course Title*	*Credit Hours*	*Weekly Hours*		
			Lect.	*Tut.*	*Lab.*
College	Calculus IV	3	3	1	-
EE-Required	Electromagnetic Fields II	2	2	1	-
EE-Required	Fundamentals of Electronics II	2	2	1	-
EE-Required	DC Machines II	2	2	1	-
EE-Required	EE Lab 22	2	-	-	4
EE-Required	Electric Circuits II	3	3	1	-
EE-Required	Digital Techniques II	3	2	-	2
College	Engineering Statistics	3	3	-	-
-	-	-	-	-	-
Total		20	17	5	6
			28		

Third Year

First Semester					
Requirements	*Course Title*	*Credit Hours*	*Weekly Hours*		
			Lect.	*Tut.*	*Lab.*
EE-Required	Analog Communications and Noise	2	2	1	-
EE-Required	Electronics I	3	3	1	-
EE-Required	EE Lab 31	2	-	-	4
EE-Required	Signals and Systems I	2	2	1	-
EE-Required	Electric Power I	2	2	1	-
EE-Required	AC Machines I	2	2	1	-
EE-Required	Computer Programming	2	1	-	2
EE-Required	Engineering Economy	3	3	-	-
-	-	-	-	-	-
Total		18	15	5	6
			26		

Second Semester					
Requirements	*Course Title*	*Credit Hours*	*Weekly Hours*		
			Lect.	*Tut.*	*Lab.*
EE-Required	Digital Communications	2	2	1	-
EE-Required	Electronics II	3	3	1	-
EE-Required	EE Lab 32	2	-	-	4
EE-Required	Signals and Systems II	2	2	1	-
EE-Required	Electric Power II	2	2	1	-
EE-Required	AC Machines II	2	2	1	-
University	English Language III	2	2	-	-
EE-Required	Computer Networks	3	3	1	-
-	-	-	-	-	-
Total		18	16	6	4
			26		

Fourth Year

First Semester					
Requirements	Course Title	Credit Hours	Weekly Hours		
			Lect.	Tut.	Lab.
EE-Required	Information Theory	2	2	-	-
EE-Required	EE Lab 41	1	-	-	2
EE-Required	Control Theory I	2	2	1	-
EE-Required	Electric Power III	2	2	2	-
EE-Elective	Power System Analysis	2	2	1	-
EE-Required	Final Year Project I	3	3	-	-
EE-Elective	Digital Electronics	2	2	1	-
College	Engineering Numerical Methods	3	2	1	2
-	-	-	-	-	-
Total		17	15	6	4
			25		

Second Semester					
Requirements	Course Title	Credit Hours	Weekly Hours		
			Lect.	Tut.	Lab.
EE-Required	Advanced Communication Systems	2	2	1	-
EE-Required	EE Lab 42	1	-	-	2
EE-Required	Control Theory II	2	2	1	-
EE-Required	Power Electronics	2	2	2	-
EE-Elective	Programmable Logic Controller (PLC)	2	2	1	-
University	English Language IV	2	2	-	-
EE-Required	Final Year Project II	3	3	-	-
University	Management and Leadership Skills	2	2	-	-
-	-	-	-	-	-
Total		16	15	5	2
			22		

Summary of Units

Year	Study Hours			No. of Units		
	First Semester	*Second Semester*	*Total*	*First Semester*	*Second Semester*	*Total*
First Year	405	390	795	20	19	39
Second Year	375	420	795	18	20	38
Third Year	390	390	780	18	18	36
Fourth Year	375	330	705	17	16	33
Sum	1545	1530	3075	73	73	146

ABET Standard

Program Educational Objectives (PEOs):

PEO-1: Professional Presence
As a result, within a few years, the graduate has established an Internet presence, either through professional organizations, social networking and/or other activities which demonstrate an appreciation and use of modern technological capabilities.

PEO-2: Workforce Skilled in Integrating Engineering, Design, and modern Technology
As a result, graduates will identify opportunities to contribute to society from a variety of positions, ranging from running and deploying to designing and optimizing of electrical systems, and engage professionally in private and governmental sectors such as consulting firms, contracting companies, marketing and real-estate investments. The graduate may also pursue further education in the form of graduate and professional degrees.

PEO-3: Leadership in Research, Innovation and Design
As a result, within a few years of graduation, the graduate will have made significant or meaningful contributions in their chosen field, either thorough research publications and/or presentations, the development of a new design or construction process, obtaining patents, or other evidence of contributing to the advancement of knowledge, particularly in the fields of electrical engineering.

PEO-4: Ethical Reasoning, Behavior and Professionalism
As a result, within a few years of graduation, the graduate will demonstrate adherence to the professional codes of conduct appropriate to his or her field of study and/or practice, as well as exhibit behavior consistent with accepted standards of fiduciary responsibility, risk/benefit analysis and professional accountability.

PEO-5: Communication
As a result, graduates will have outstanding communication skills as evidenced by their professional presentations, and in their productive interactions with co-workers. The graduates may also use their communication skills to foster collaborative effort among co-workers and/or may represent his or her company, institution and/or laboratory to other interested parties.

PEO-6: Personal Engagement
As a result, within a few years, the graduate will be working independently and in multidisciplinary teams to effectively and efficiently achieve personal and organizational goals, engage in community or public service, create a product or construction that fills a social need, and/or participate in educating individuals about an issue of societal concern.

ABET Student Outcomes (SOs):

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Linking PEO to SOs

		SO						
		1	2	3	4	5	6	7
PEO	1	✓	✓	✓				
	2	✓	✓				✓	
	3		✓			✓	✓	✓
	4		✓			✓		
	5				✓			✓
	6		✓		✓	✓		

Program Outcome Curriculum Map According to ABET Criterion (SOs):

University Requirements:

Course No.	Course Title	1	2	3	4	5	6	7
EE2105	Arabic Language	X	X	-	X	X	-	-
EE1104	Democracy	X	X	-	X	X	-	-
EE1102	English Language I	X	X	X	-	-	X	-
EE2103	English Language II	X	X	-	X	-	X	X
EE3107	English Language III	X	X	-	X	X	-	-
EE4108	English Language IV	X	X	-	X	X	-	-
EE4106	Management and Leadership Skills	X	X	-	X	-	X	-
EE1101	Human Rights	X	X	-	X	X	X	-

College Requirements:

Course No.	Course Title	1	2	3	4	5	6	7
EE1201	Calculus I	X	X	-	X	-	X	-
EE1202	Calculus II	X	X	-	X	-	X	-
EE2208	Calculus III	X	X	-	X	-	X	-
EE2209	Calculus IV	X	X	-	X	-	X	-
EE1207	Chemistry	X	X	-	X	X	-	-
EE1205	Computer Science	X	X	X	-	-	X	-
EE1206	Engineering Drawing	-	-	X	-	-	-	-
EE1204	Engineering Mechanics I (Static)	X	-	-	-	-	-	-
EE3211	Engineering Numerical Methods	X	-	-	-	-	-	-
EE3212	Engineering Statistics	X	-	-	-	-	-	-
EE1301	Fundamentals of Electrical Engineering I	X	-	-	-	-	-	-
EE1203	Physics	X	X	X	-	-	X	-

Department Electives:

Course No.	Course Title	1	2	3	4	5	6	7
EE4344	Antennas	X	X	-	X	-	-	X
EE4343	Digital Electronics	X	X	-	-	-	X	-
EE4340	Digital Signal Processing	X	X	X	-	X	X	-
EE4346	Fiber Optics Communication	X	X	-	X	-	X	-
EE4347	Fundamentals of Renewable Energy Systems	X	X	-	X	-	X	-
EE4342	Micro-Controllers	X	X	-	X	-	X	X
EE4341	Micro-Processors	X	X	-	-	X	X	X
EE4348	Power System Analysis	-	-	-	X	-	-	-
EE4345	Programmable Logic Controller (PLC)	X	X	-	X	-	X	-

Department Requirements:

Course No.	*Course Title*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
EE3324	AC Machines I	X	X	-	X	X	-	-
EE3325	AC Machines II	X	X	-	X	X	-	-
EE4335	Advanced Communication Systems	X	X	-	X	-	X	-
EE3328	Analog Communications and Noise	X	X	-	X	-	X	-
EE1204	Applied Physics	X	X	-	X	-	X	-
EE3323	Computer Networks	X	X	-	X	-	X	-
EE2312	Computer Programming	X	X	-	X	-	X	-
EE4332	Control Theory I	X	X	-	X	-	X	-
EE4333	Control Theory II	X	-	X	-	X	X	-
EE2313	DC Machines I	X	X	-	X	-	X	-
EE2314	DC Machines II	X	X	-	X	-	X	-
EE3329	Digital Communications	X	X	-	-	X	X	-
EE2304	Digital Techniques I	X	X	-	X	X	X	X
EE2305	Digital Techniques II	X	X	-	X	X	X	-
EE2306	EE Lab 21	X	X	-	X	-	X	X
EE2307	EE Lab 22	X	X	-	X	-	X	-
EE3321	EE Lab 31	X	X	-	-	-	X	X
EE3322	EE Lab 32	X	X	-	X	-	X	-
EE4330	EE Lab 41	X	X	-	X	-	X	-
EE4331	EE Lab 42	X	X	X	-	-	X	-
EE2310	Electric Circuits I	X	X	-	-	-	X	X
EE2311	Electric Circuits II	X	-	-	-	-	-	-
EE3317	Electric Power I	X	X	-	-	X	-	-
EE3318	Electric Power II	X	-	-	-	-	-	-
EE4336	Electric Power III	-	-	X	-	-	-	-
EE2315	Electromagnetic Fields I	-	-	X	-	-	-	-
EE2316	Electromagnetic Fields II	-	-	X	-	-	-	-
EE3326	Electronics I	-	-	X	-	-	-	-
EE3327	Electronics II	-	-	-	X	-	-	-
EE3210	Engineering Economy	X	X	-	X	X	-	-
EE4338	Final Year Project I	X	X	X	X	X	X	X
EE4339	Final Year Project II	X	X	X	X	X	X	X
EE1302	Fundamentals of Electrical Engineering II	X	X	-	X	-	X	-
EE2308	Fundamentals of Electronics I	X	X	-	X	-	X	-
EE2309	Fundamentals of Electronics II	X	X	-	X	-	X	-
EE4334	Information Theory	X	X	-	-	X	X	-
EE4337	Power Electronics	X	X	-	X	X	-	-
EE3319	Signals and Systems I	-	-	-	X	-	-	-
EE3320	Signals and Systems II	X	X	-	X	-	X	-

University Requirements Courses

EE1102 Arabic Language (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course aims at building students' familiarity with and competence in Arabic literature in its various genres to increase their ability to appreciate literature and to develop their awareness of its concepts through the study of poetry, novel and the short story.

Recommended Textbook(s):

By Topics

Prerequisites:

None

Course Topics:

Study the text of the Quran and analyze its language, spelling, and rules. the rules of writing the hamza, Written verbatim by Arab and Za -Rules of number and numerical adjective, punctuation, the method of detection for words in Arabic Dictionaries, In the applications of grammar and language- the actor and his deputy, Debutante and the news Acts missing, Equated with the letters already Byproducts, The case and exception, Ancient literary studies, Definition of literature and its importance, Ages historical Arabic literature – Modern Literary Studies, Study the texts of poetic eras (pre-Islamic, Islamic, Umayyad, Abbasid, Andalusia), Study of ancient prose texts (speeches, messages), examine the texts of modern poetry and contemporary, examine the texts of modern prose (drama, novel, article)

Course Outcomes:

- Develop academic essay writing proficiency
- Apply reading skills
- Expand academic vocabulary through reading
- Improve critical thinking skills

EE1103 Democracy (1-1-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to give the student the definition of freedom democracy, the concept of democracy, history of democracy, the properties of democracy, traditional Greek democracy, its principles, modern democracy, and pressure groups.

Recommended Textbook(s):

By Topics

Prerequisites:

- EE1101

Course Topics:

- The concept of democracy
- History of democracy
- The properties and principle of democracy
- Traditional Greek democracy and modern democracy
- The relationship between human rights and democracy
- Pressure groups

Course Outcomes:

- Ability to identify the meaning of democracy
- Understand the democratic approach in Islam
- Develop the ability to recognize and accept differing in views

EE1104 English Language I (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to enable academic writing course which provides an opportunity for the students to learn and practice the skills needed for handling topics related to the field of study. The course emphasizes the development of academic writing skills as well as the ability to read and think critically. Students will learn to use the library and appropriate online resources to find and evaluate sources to inform, develop and support their ideas in term paper writing. They will also learn skills for reading analysis, such as comprehension and inference.

Recommended Textbook(s):

John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

Prerequisites:

None

Course Topics:

week	Topic	
1.	• Am/ are/ is, my/ your • How are you? • What's this in English? • Plurals	• This is ……. • Good morning! • Numbers 1-10
2.	• Countries • Where's he from? • Numbers 11-30	• He/ she/ they, his/ her • Fantastic/ awful/ beautiful
3.	• Jobs • Negatives and questions • Social expressions-1	• Am/are/is • Personal information
4.	• Our/ their • The family • The alphabet	• Possessive's • Has/ have
5.	• Sports/ food/ drinks • a/ an • Numbers and prices	• Present simple- I/ you/ we/ they • languages and nationalities
6.	• The time • Always/ sometimes/ never • Days of the week	• Present simple- he/ she • Words that go together
7.	• Question words • This/ that • Can I ….?	• Me/ him/ us/ them • adjectives
8.	• Rooms and furniture • Prepositions	• There is/ are • Directions
9.	• Saying years • Past simple- irregular verbs • When's your birthday?	• As/ were born • Have/ do/ go

week	Topic
10.	• Past simple- regular and irregular • Sport and leisure • Questions and negatives • Going sightseeing
11.	• Can/ can't • Adjective+ noun • Adverbs • Everyday problems
12.	• I'd like- some/ any • Signs all around • In a restaurant

Course Outcomes:

- By the end of successful completion of this course, the student will be able to:
- Develop academic writing proficiency and critical thinking skills
- Students are able to conduct effective searches of printed and electronic resources
- Students can use external sources to support ideas in academic writing in electrical engineering
- Students can identify and explain academic integrity (how to avoid plagiarism)
- Students are familiar with the citation methods like the APA style
- Students can participate in a classroom community that involves the constructive exchange of ideas

EE2105 English Language II (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to enable the students to achieve academic oral and written communication to the standard required at the university level. The course integrates all the language skills with emphasis on writing, and stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in electrical engineering.

Recommended Textbook(s):

John & Liz Soars, "New Headway Plus- Pre-Intermediate Student's Book", 10th ed 2012

Prerequisites:

- EE1104

Course Topics:

- Tenses; Vocabulary (Jobs); Question forms; Writing (informal letter)
- Present simple; Present continuous; Have/have to; Writing (Linking words +Describing a person)
- Past simple; Past continuous; Have + noun; Writing (a story 1)
- Count and noncount nouns; Expression of quantity; Articles; Vocabulary (clothes); Writing (filling in forms);
- Verb patterns; Would like and like; Will and going to; Writing (postcard)
- What … like? Comparative and superlatives; Vocabulary (adjective formation); Writing (relative closes)
- Present perfect; Tense revision; Vocabulary (men and women); Writing (a biography)
- have to & got to; have to & should & must; Vocabulary (job description); Writing (formal letter)
- Present simple or will; Conditional clauses; Time clauses; Writing (discussing ideas)
- Verb patterns; used to; Infinitives; Writing (formal letters)
- The passive form; Active and passive; Vocabulary (words with more than one meaning); Writing (email)
- Second conditional; might; Vocabulary (phrasal verbs); Writing (a story 2)

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- Develop academic writing
- Apply reading skills
- Expand academic vocabulary through reading
- Ability to speak through group discussions and debates

EE3106 English Language III (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in electrical engineering.

Recommended Textbook(s):

- John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014.

Prerequisites:

- EE2105

Course Topics:

1.
   - Auxiliary verbs
   - Grammar revision
   - Vocabulary
   - Pronunciation
   - Prepositions
   - **Writing** (Correcting mistakes 1)
   - **Reading** (Wonders of the modern world)
   - **Listening and speaking** (My wonders)
2.
   - Present simple
   - Pronunciation revision
   - Present states and actions
   - Vocabulary
   - Phrasal verbs
   - **Reading and speaking** (I'm a clown doctor!)
   - **Writing** (Letters and emails)
3.
   - Past simple and past continuous
   - Grammar revision
   - Past perfect
   - Past passive
   - Vocabulary
   - Prepositions revision
   - **Listening and writing** (Books and films)
   - **Writing** (Narrative 1)
   - **Everyday English** (Giving opinions)
4.
   - Have to /don't have to
   - Can and be allowed to
   - Should
   - Must and have to
   - Vocabulary
   - Pronunciation

- **Listening and speaking** (Come round to my place!)
- **Writing** (For and against)

5.
- Future form 1
- Future form 2
- Grammar revision
- Vocabulary
- Pronunciation
- Prepositions revision
- **Reading and speaking** (Hotels with a difference)
- **Writing** (Making a reservation)

6.
- Like
- Grammar review
- Verb patterns
- Vocabulary
- Pronunciation
- Phrasal verbs
- **Listening and speaking** (New York and London)
- **Everyday English** (Signs and sounds)
- **Writing** (A description 1)

7.
- Present perfect
- Tense review
- Present perfect passive
- Vocabulary
- Pronunciation
- Prepositions
- **Reading and speaking** (Dream jobs)
- **Listening and speaking** (The busy life of a retired man)
- **Writing** (A letter of application)

8.
- Conditionals 1 and time clauses
- Conditionals 2
- Vocabulary
- Pronunciation
- Phrasal verbs
- **Reading and speaking** (Who wants to be a millionaire)
- **Everyday English** (Making suggestions)
- **Writing** (Narrative 2)

9.
- Modal verbs of probability in the present
- Modal verbs of probability in the past
- Vocabulary
- Pronunciation
- Prepositions
- **Listening and speaking** (Brothers and sisters)
- **Writing** (A description 2)

10
- Present perfect continuous
- Simple and continuous revision
- Time expressions
- Vocabulary
- Pronunciation
- Prepositions

- **Reading and speaking** (A big name in Hollywood)
- **Listening and speaking** (Collectors)
- **Writing** (Writing a biography)

11
- Indirect questions
- Grammar revision
- Question tags
- Vocabulary and pronunciation
- Phrasal verbs
- **Listening and speaking** (The forgetful generation)
- **Writing** (Words that joint ideas)
- **Everyday English** (Informal English)

12
- Reported statements and questions
- Reported commands
- Vocabulary
- Pronunciation
- Phrasal verbs
- Revision
- **Reading and speaking** (A death)
- **Listening and speaking** (My way)
- **Writing** (Correcting mistakes 2)

Course Outcomes:

By the end of the course, at the intermediate level, students will be able to:

- Develop academic essay writing proficiency
- Promote reading skills
- Expand academic vocabulary through reading
- Promote speaking ability through group discussions and debates
- Promote critical thinking skills

EE4107 English Language IV (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students' imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse scientific topics. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings in electrical engineering.

Recommended Textbook(s):

- John & Liz Soars, "New Headway Plus- Beginner Student's Book", 10th ed 2014

Prerequisites:

- EE3106

Course Topics:

1.
   - **Grammar** (The tense system and spoken English)
   - **Vocabulary** (Compound of words lifestyle, home town, house-proud)
   - **Reading** (A home from home-two people describe their experiences of living abroad)
   - **Listening** ('things I miss from home')
   - **Speaking** (Exchanging information about people who live abroad)
   - **Everyday English** (Social expressions)
   - **Writing** (Applying for a job)
2.
   - **Grammar** (Present perfect, simple and continuous, and spoken English)
   - **Vocabulary** (Hot verbs, make, do make way, do damage)
   - **Reading** ('Paradise Lost'- how tourism is destroying the object of its affection)
   - **Listening** (An interview Tashi Wheeler about her travels as child with parents)
   - **Speaking** (Information Gap)
   - **Everyday English** (Exclamations)
   - **Writing** (Informal letters and correcting mistakes)
3.
   - **Grammar** (Narrative tenses, past simple, Conts, and Perfect)
   - **Vocabulary** (books and films)
   - **Reading** (Jane Austen-one of the world's most downloaded authors)
   - **Listening** (The money jigsaw-a news item from BBC's radio)
   - **Speaking** (Retelling a news story, responding to a news)
   - **Everyday English** (Showing interest and surprise)
   - **Writing** (Narrative writing 1)
4.
   - **Grammar** (questions and negatives and spoken English)
   - **Vocabulary** (Prefixes and Antonyms in context)
   - **Reading** ('Diana and Elvis shot JFK!)
   - **Listening** ('My most memorable lie'-people confess to untruths)
   - **Speaking** (Discussion-good and bad lies)
   - **Everyday English** (Being polite)
   - **Writing** (Linking ideas)

5.
- **Grammar** (Future forms and spoken English)
- **Vocabulary** (Hot verbs-take, put)
- **Reading** ('Today's teenagers are just fine')
- **Listening** arranging to meet-three friends decide a time and a place to get together)
- **Speaking** (Future possibilities in your life)
- **Everyday English** (Telephone conversations)
- **Writing** (writing Emails)

6.
- **Grammar** (Expression of quantity)
- **Vocabulary** (Words with variable stress)
- **Reading** (A profile of two famous brands)
- **Listening** (Radio advertisements-what's the product? What are the selling points?)
- **Speaking** (A lifestyle survey)
- **Everyday English** (Business expression, Numbers, Fractions, decimals, date, time…)
- **Writing** (A consumer survey)

7.
- **Grammar** (Modals and related verbs 1, spoken English, Declarative questions, and Question expressing surprise)
- **Vocabulary** (Hot verb-get)
- **Reading** ('Meet the kippers'-an article about grown-up children who won't leave home)
- **Listening** (Getting married-an Indian lady talks about her marriage)
- **Speaking** (The pros and cons of arranged marriage)
- **Everyday English** (Exaggeration and understatement)
- **Writing** (Arguing your case)

8.
- **Grammar** (Relative clauses)
- **Vocabulary** (Adverb collocations and adverb adjectives)
- **Reading** ('Chukotka, the coldest place on earth'-an article about a remote territory of Russia)
- **Listening** (Extreme experiences-people describe their experiences in extreme weather conditions)
- **Speaking** (Making descriptions longer, talking about your experiences)
- **Everyday English** (The world around)
- **Writing** (Describing places)

9.
- **Grammar** (Expressing habit)
- **Vocabulary** (Homonyms and Homophones)
- **Reading** ('People and their money-an article about three very different people)
- **Listening** (A teacher I will never forget-people describe a teacher who made a lasting impression on them)
- **Speaking** (Discussion-a teacher I'll never forget)
- **Everyday English** (Making your point)
- **Writing** (Writing of talking)

10.
- **Grammar** (Modal auxiliary verbs 2)
- **Vocabulary** (Synonyms)
- **Reading** ('How the West was won'-the story of settlers in nineteenth -century America)
- **Listening** (Hilaire Belloc's Tales for children)
- **Speaking** (The murder game-one man drops dead in a country house :)
- **Everyday English** (Metaphors and idioms-the body)
- **Writing** (Formal and informal letters and Emails)

11.
- **Grammar** (Hypothesizing)
- **Vocabulary** (Word pairs)
- **Reading** ('Have you ever wondered'? -the answers to some important questions in life)
- **Listening** (The interpretation of dreams-paul's amazing dream)
- **Speaking** (Practicing a conversation and describing your dreams)
- **Everyday English** (Moans and groans)
- **Writing** (narrative writing 2)

12.
- **Grammar** (Articles)
- **Vocabulary** (Hot words-life and time)
- **Reading** ('you are never too old'-A life in the day of Mary Hobson, who gained her PhD aged)
- **Listening** (happy days-people talk about what make them happy and unhappy)
- **Speaking** (Discussion-the different ages of life, and their pros and cons)
- **Everyday English** (Linking and commenting)
- **Writing** (Adding emphasis in writing)

Course Outcomes:

By the end of the course, students will be able to:

- Develop academic essay writing proficiency
- Promote reading skills
- Expand academic vocabulary through reading
- Promote speaking ability through group discussions and debates
- Promote critical thinking skills

EE4108 Management and Leadership Skills (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed for engineering students who are interested in advancing into management and leadership roles. You will gain a perspective on what it is like to be an engineering leader. You will develop awareness of your own strengths and weaknesses as a leader when you are placed in charge of a project. You will learn how to leverage your strengths and control your weaknesses. You will also learn how to manage relationships with your team members and how to set up a creative environment for your team to motivate each team member to reach his or her potential. You will also learn how to deal with different ethical issues that are related to engineering field.

Recommended Textbook(s):

- Benator, Barry and Thumann, Albert "Project Management and Leadership Skills for Engineering and Construction Projects." 2003, The Fairmont Press, Inc., USA
- Fleddermann, C. B. (2012). Engineering Ethics. Upper Saddle River, NJ: Prentice Hall.
- Code of Ethics- Iraqi Engineers Association

Prerequisites:

None

Course Topics:

- **Introduction to leadership:** definition, can one person make a difference? Why is leadership important for engineers? Are leaders born or made? Personality assessment
- **Leadership and management styles:** Command leadership vs. servant leadership, Characteristics of servant leader, Management styles, Leader or manger? The outstanding leader competencies
- **Effective team leadership:** What is team? Why work in teams? Different types of teams, Team roles, Role of team leader
- **Practical Implementation:**Time management (first things first), Project related activities, Conducting Effective Meetings, Giving effective feedback, Recognition and reward
- **Communication:** Communication types, Thought's emotion and communication (head, heart and hands), What influences our communication, damaging communication habits, Connecting with others, Peer communication assessment
- **Leadership and management styles:** Management styles, Attributes of the engineering leader, Modern leadership, Characteristics of servant leader, Command leadership vs. servant leadership
- **Professional Ethics:** Definition, Origins, Principles
- **Introduction to Engineering Ethics**: Professional Codes of Ethics
- **Ethical Issues in Engineering Practice:** (1) Safety Considerations, (2) The Role of Good Design: A-Sustainable design and design for all, B-Safety and risk in Design, (3) Environmental Ethics
- **Steps in Confronting Moral Dilemmas**
- **Case Studies**

Course Outcomes:

Following completion of this course, students will be able to:

1- Explain the basic concepts of leadership.
2- Build power and influence.
3- Add value to their sphere of influence
4- Give and receive feedback, actively listen, provide supportive communication, and coach and counsel their team members.

EE1101 Human Rights (1-1-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to give the student the definition of freedom and the right language and idiomatically and legitimacy of the user, Origin of the right in the eyes of Islamic law, Elements of the right and types of, Personal freedom, Intellectual freedom, Rights and economic freedoms, Islam and Slavery, Human rights objectives, The use of freedom and the right general project, The right of a Muslim to his Muslim brother, Parental rights, Right neighbor, The right of women, Human rights in the heavenly religions, Religious tolerance in Islam.

Recommended Textbook(s):

By Topics

Prerequisites:

None

Course Topics:

- The definition of freedom and the right
- Origin of the right in the eyes of Islamic law
- Elements and Types of the Human right
- Rights and economic freedoms
- Islam and Slavery
- Human rights objectives
- The use of freedom and the right general project
- The right of a Muslim

Course Outcomes:

Students can:

- Explain the concept of “human rights”
- Able to recognize the human rights in Islam
- Define and describe the relationship between human rights and democracy

College Requirements Courses

EE1201 Calculus I (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course provides a comprehensive guide and up-to-date treatment of engineering mathematics with an in-depth overview of the many mathematical. It is intended to introduce students of engineering, physics, mathematics, computer science, and related fields to those areas of applied mathematics that are most relevant for solving practical problems.

Recommended Textbook(s):

- Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendentals. Cengage Learning.
- Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). Thomas' Calculus. Pearson Education Limited.
- Stroud, K. A., & Booth, D. J. (2020). Engineering mathematics. Bloomsbury Publishing.

Prerequisites:

None

Course Topics:

- Tangent line and slope problems.
- Drawing of functions
- Continuity and limit of functions
- Limits at infinity, horizontal asymptote. infinite limits, vertical asymptotes and drawing of functions
- Derivative of functions and rates of change. Differentiation of polynomials, product and quotient rules
- Derivatives of exponential, logarithmic, and trigonometric functions
- Chain rule and implicit differentiations
- Applications of differentiation maximum and minimum values. the mean value theorem
- Derivative of hyperbolic functions and indeterminate forms and l'Hospital's rule.
- Optimization problems and anti-derivative of functions

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- To develop mathematical skill so that students are able to sketch the graph of various functions and evaluate Limits by using different techniques including L'Hopital's Rule.
- Apply mathematical methods and principals in solving various derivative problems from Engineering fields, involving applications of derivatives.
- Demonstrate algebraic facility with algebraic topics including linear, quadratic, exponential, logarithmic, and trigonometric functions,
- Compute derivative and anti- derivative of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, and apply them to solve problems in a wide range of engineering applications.

EE1202 Calculus II (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course provides a comprehensive guide and up-to-date treatment of engineering mathematics with an in-depth overview of the many mathematical. It is intended to introduce students of engineering, physics, mathematics, computer science, and related fields to those areas of applied mathematics that are most relevant for solving practical problems.

Recommended Textbook(s):

- Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendentals. Cengage Learning.
- Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). Thomas' Calculus. Pearson Education Limited.
- Kreyszig, E., Stroud, K. and Stephenson, G., 2008. Advanced engineering mathematics. Integration, 9(4).

Prerequisites:

- EE1201

Course Topics:

- Fundamentals of Integrals
- Definite and indefinite integrals
- Integration Techniques -Integration by Parts.
- Integration Techniques- Trigonometric Integrals.
- Integration Techniques- Partial Fractions.
- Applications of Integrals- Arc Length and Surface area
- Applications of Integrals- Volumes (Disk, Washer, Shell)
- Polar Coordinates - Common Polar Coordinate Graphs.
- Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.
- Sequences and Series.
- Power series and their convergence test.

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- Evaluate of definite, indefinite and improper integrals by using different integration techniques.
- To determine arc length, surface area and volume by using the applications of integration techniques.
- Define polar coordinate graphs and solve related problems including area, arc length and volume.
- Identify the properties of sequences and their limits with identifying standard convergent operations of power series.

EE2208 Calculus III (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Advanced topics in calculus, including vectors and vector-valued functions, partial differentiation, Lagrange multipliers, multiple integrals, and Jacobians; application of the line integral, including Green's Theorem, the Divergence Theorem, and Stokes' Theorem.

Recommended Textbook(s):

- Thomas' Calculus Early Transcendentals 12th Edition.by George B. Thomas Jr. (Author), Maurice D. Weir (Author), Joel R. Hass (Author).
- Calculus, by H. Anton, I. Bivens, and S. Davis, 8th Edition, 2002, Wiley

Prerequisites:

- EE1202

Course Topics:

- **Vectors and the Geometry of Space:** Three-Dimensional Coordinate Systems, Vectors, The Dot Product, The Cross Product, Lines and Planes in Space, Cylinders and Quadric Surfaces
- **Vector-Valued Functions and Motion in Space:** Curves in Space and Their Tangents, Integrals of Vector Functions; Projectile Motion, Arc Length in Space, Curvature and Normal Vectors of a Curve, Tangential and Normal Components of Acceleration
- **Partial Derivatives:** Functions of Several Variables, Limits and Continuity in Higher Dimensions, Partial Derivatives, The Chain Rule, Directional Derivatives and Gradient Vectors, Tangent Planes and Differentials, Extreme Values and Saddle Points, Lagrange Multipliers
- **Multiple Integrals:** Double and Iterated Integrals over Rectangles, Double Integrals over General Regions, Area by Double Integration, Triple Integrals in Rectangular Coordinates
- **Integration in Vector Fields (Vector Analysis):** Vector Fields and Line Integrals, Green's Theorem in the Plane, Stokes' Theorem, The Divergence Theorem and a Unified Theory

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- Perform calculus operations on vector-valued functions, including derivatives, integrals curvature, displacement, velocity, acceleration, and torsion.
- Perform calculus operations on functions of several variables, including partial derivatives, directional derivatives, and multiple integrals.
- Find extrema and tangent planes.
- Solve problems using the Fundamental Theorem of Line Integrals, Green's Theorem, The Divergence Theorem and Stokes' Theorem.
- Apply the computational and conceptual principles to the solutions of real-world problems.

EE2209 Calculus IV (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Differential Equations, begins with some definitions and terminology and mathematical models used in a differential equations course. First-order and higher-order differential equations, along with the methods of solutions and their applications are introduced. Modeling with higher-order, Laplace transform, and systems of linear first-order differential equations are covered. At the end, students learn series solutions of linear equations. Numerical methods are covered throughout the course. This course focuses on differential equations and their applications in science and engineering.

Recommended Textbook(s):

- Differential Equations with Boundary-Value Problems, seventh edition. Dennis G. Zill, Michael R Cullen. 2009, Brooks/Cole.
- Differential Equations with Boundary-Value Problems Student Solutions Manual. Warren S. Wright, Dennis G. Zill, Carol D. Wright. 2009, Brooks/Cole.

Prerequisites:

- EE2208

Course Topics:

- **Ordinary differential Equations:** Classify differential equations by order, linearity, and homogeneity
- **First order linear differential equations:** use separation of variables to solve differential equations, solve exact differential equations, use variation of parameters to solve differential equations, solve first order linear differential equations, Bernoulli equation, Application of first Order Differential Equations
- **Higher order Differential Equations:** Solutions of Homogeneous Linear D.E with constant coefficients, Solutions of Inhomogeneous Linear D.E with constant coefficients, The Method of Undetermined Coefficients, Method of Variation of Parameters, The Euler-Cauchy Differential Equations, Reduction of Order, Applications of Higher Order Differential Equations
- **Simultaneous Linear Differential Equations:** Elimination of dependent variables by differentiation, Elimination of dependent variables using operator equation, Solution by Cramer rule
- **Fourier series:** Periodic functions, Trigonometric series, Bounds of a Function, Continuity of a Function, Euler Coefficients, Even and Odd Functions, Half Range Expansion, Applications
- **Laplace Transforms:** Properties of Laplace Transforms, Inverse of Laplace transforms, Solution of Ordinary D.E's by Laplace transforms, D.E's with constant coefficients, D.E's with variable coefficients, Solution of Simultaneous Linear D.E's by Laplace transforms.

Course Outcomes:

By the end of the course students will be able to:

- Classify differential equations by order, linearity, and homogeneity
- Solve first order linear differential equations
- Solve linear equations with constant coefficients
- Use separation of variables to solve differential equations
- Solve exact differential equations
- Use variation of parameters to solve differential equations
- Use the method of undetermined coefficients to solve differential equations

- Determine whether a system of functions is linearly independent using the Wronksian
- Model real-life applications using differential equations
- Use power series to solve differential equations
- Use Laplace transforms and their inverses to solve differential equations
- Solve systems of linear differential equations using matrix techniques and eigenvalues
- Use numerical methods to solve differential equations
- Solve applied problems using first order differential equation models.
- Apply second order differential equations to solve vibration models based on real life problems.
- Use the power series method at regular and singular points to solve differential equations.
- Employ the methods of separation and D'Alembert's solution to obtain the solution of known partial differential equations including Laplace, heat and wave equations.

EE1207 Chemistry (4-3-0-2)

This is a required course for the Electrical Engineering Program.

Course Description:

Chemistry and Measurement and significant figures. Atoms, molecules and ions. Formulas and names. Stoichiometry and chemical calculations. Chemical reactions. Thermochemistry and enthalpy changes. Quantum theory of the atom and electron configuration. Chemical bonding and molecular geometry. The Lab. Section presents Safety in the Lab. Measurement of mass, volume and density. Identification of an unknown compound. Qualitative analysis of anions. Empirical formula of a compound. Thermal decomposition of hydrates. Stoichiometric determination. Acidbase and redox titrations. Enthalpy of reactions.

Recommended Textbook(s):

- Chang R. & College W., Chemistry, McGraw Hill 9th ed., 2007 Laboratory Manual, Compiled by Instructor.

Prerequisites:

- EE1201

Course Topics:

- Measurements. Handling Numbers. Dimensional Analysis in Solving Problems, recognize chemical safety and hazardous materials icons, and apply laboratory safety rules.
- Atomic Number, Mass Number, and Isotopes. The Periodic Table. Molecules and Ions. Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment.
- Chemical Formulas. Naming Compounds. Atomic Mass. Avogadro's number and Molar Mass of an Element. Describe and use UV/VIS spectrophotometric methods of analysis**.**
- Molecular Mass. The Mass Spectrometer. Percent Composition of Compounds. Experimental Determination of Empirical Formulas. Chemical Reactions and Chemical Equations. Describe how to Prepare accurate laboratory reports of their experimental results.
- Amounts of Reactants and Products. Limiting Reagent Calculations. Reaction Yield**.**
- General Properties of Aqueous Solutions. Precipitation Reactions. Acid-Base Reactions. Oxidation-Reduction Reactions.
- Concentration of Solutions. Acid-Base Titrations. Gases. Pressure.
- The Ideal Gas Equation. Gas Stoichiometry. Partial Pressures
- The Nature of Energy and Types of Energy. Energy Changes in Chemical Reactions. Introduction to Thermodynamics.
- Enthalpy of Chemical Reactions. Calorimetry. Standard Enthalpy of Formation and Reaction**.**
- From Classical Physics to Quantum Theory. Bohr's Theory of the Hydrogen Atom. Quantum Numbers. Atomic Orbitals.
- Electron Configuration. Development of the Periodic Table. Periodic Classification of the Elements. Periodic Variation in Physical Properties.
- Ionization Energy. Electron Affinity. Lewis Dot Symbols. The Ionic Bond. The Covalent Bond. Electro negativity. Writing Lewis Structures. Formal Charge and Lewis Structures.
- The Concept of Resonance. Exceptions to the Octet Rule. Bond Energy**.** Molecular Geometry. Dipole Moment. Spectrophotometric Analysis of tetracycline
- Valence Bond Theory. Hybridization of Atomic Orbital's. Hybridization in Molecules. Containing Double and Triple Bonds. Delocalized Molecular Orbital's**.**

Lab. Section:

- Safety, Lab Check-in. Mass and Volume Measurements.
- Qualitative Analysis of Anions: Part I
- Qualitative Analysis of Anions: Part II
- The Empirical Formula of a Metal Oxide
- Volumetric Analysis: Standardization of Sodium Hydroxide and Determination of Molar Mass of an Acid
- Applications of Volumetric Analysis: Determination of Active Ingredients of Commercial Bleach and Vinegar.
- Evaluation of the Universal Gas Constant, R
- Heat of Formation of Magnesium Oxide
- UV/VIS Spectroscopy and Spectrophotometry
- Spectrophotometric Analysis of Aspirin
- Synthesis of Alum and Crystal Growth

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- Define the structure of the atom in terms of the nucleus with protons and neutrons, and electrons.
- Write and balance chemical equations, name inorganic compounds and ions and describe the properties of the main group elements.
- Carry out chemical calculations, including mass relations in chemical reactions, limiting reagent and reaction yield calculations, and calculations involving reactions taking place in solution
- Understand the concept of oxidation-reduction, calculate oxidation numbers, and balance redox reactions.
- Apply the ideal gas law in solving problems involving the gas phase
- Solve problems in chemical thermodynamics and calorimetry.
- Predict the electronic structure of atoms and ions from quantum theory, and relate the position of an element in the periodic table to its electronic structure and to the physical and chemical properties of the elements.
- Describe the principles of chemical bonding and write Lewis structures
- Predict the geometry of the electron pairs and the shape of molecules using VSEPR theory, predict bond polarity and molecular dipoles
- Describe the valence bond theory, predict the hybridization of atoms in molecules, and describe bonding in molecules with single, double and triple bonds in terms of and π bonds, and delocalized molecular orbitals

EE1205 Computer Science (3-2-1-2)

This is a required course for the Electrical Engineering Program.

Course Description:

This course presents an overview of fundamental computer science topics and an introduction to computer programming. Overview topics include an introduction to computer science and its history, computer hardware, operating systems, digitization of data, computer networks, office and application.

Recommended Textbook(s):

Prerequisites:

None

Course Topics:

General Definitions. System, Computer System, Program, Hardware, Software, …etc. - Hardware Components. CPU, Main Memory, I/O, System Bus. CPU Structure (ALU, Registers, Control Unit, CPU Interconnection). Basic Computer Functions (Data Processing,) - Memory System Input/ output. Input Devices. Output Devices (Display Screens, Printers, Speakers). Mass Storage or External Storage - Representation of Information on Computer. Numeric Data. Number System (Decimal, Binary, Octal, Hexadecimal). Computer safety and licenses. Operating systems. Microsoft word, Microsoft PowerPoint, introduction to excel sheet: creation and manipulation. Advanced Microsoft word. Basic applications of Internet.

Course Outcomes:

- Analyze, design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
- Identify problems and formulate solutions for systems.
- Communicate effectively with a range of audience.
- Work effectively as part of a team to develop and deliver quality software artifacts.
- Design solutions using approaches that integrate ethical, social, legal, and economic responsibilities.

EE1206 Engineering Drawing (3-2-2-2)

This is a required course for the Electrical Engineering Program.

Course Description:

This course discusses the fundamental concepts of engineering graphics. It gives also an introduction to computer graphics using CAD software. The following topics are covered: Drawing conventions such as standards, line types and dimensioning; drawing of inclined and curved surfaces; deducting the orthographic views from a pictorial; drawing full and half sections; deducting an orthographic view from given two views; pictorial sketching (isometric and oblique).

Recommended Textbook(s):

- Interpreting Engineering Drawings, Jensen, C.H. and Helsel, G.D., 7th ed., Thomson Delmar Learning, 2007.

Prerequisites:

None

Course Topics:

- Introduction: graphic language, standards, instruments, letters…etc.
- Basics for interpreting drawings, line types, types of drawings and sketches
- Orthographic views. Deducing front, top, and side views from a pictorial Dimensioning
- Sectional views: full and half sections
- Drawing a missed view from given two
- Pictorial sketching: isometric and oblique

Course Outcomes:

- Recognize the value of engineering graphics as a language of communication.
- Infer the nature of engineering graphics, the relationships between 2D and 3D environments.
- Comprehend and deduce orthographic projections of an object.
- Visualize wide variety of objects and drawing the missing views.
- Comprehend and deduce section views.
- Produce three dimensional drawings utilizing CAD software.

EE1204 Engineering Mechanics I (Static) (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving.

Recommended Textbook(s):

- R. C. Hibbeler, "Engineering Mechanics - Statics " 13th Edition, 2012

Prerequisites

- EE1201, EE1202, EE1203, EE1204

Course Topics :

- **General Principles:** Fundamental concepts, units of measurement, force vectors: force system resultants: moment of a force, moment of a couple, addition of a system of coplanar forces.
- **Equilibrium of a Particle**: Condition for the equilibrium of a particle, free-body diagram and three-dimensional force systems.
- **Equilibrium of a Rigid Body**: Conditions for rigid-body equilibrium, support reactions.
- **Structure Analysis:** Simple trusses, the method of joints, zero-force members, the method of sections, frames and machines.
- **Center of Gravity and Centroid:** Center of Gravity, Center of Mass, and the Centroid of a Body.
- **Moments of Inertia:** Definition of moments of inertia for areas, and parallel-axis theorem for an area.
- **Friction:** Characteristics of dry friction, problems involving dry friction, and frictional forces on flat belts.

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- To understand the principles of mechanics to determine resultant forces of a system in rectangular or nonrectangular coordinates.
- To construct free-body diagrams and identify their appropriate equilibrium equations in terms of reaction forces in a frame structure and the connection forces in trusses.
- An ability to analyze systems that include frictional forces.
- An ability to locate centroid of an area and calculate second moments of inertia.

EE3211 Engineering Numerical Methods (3-2-1-2)

This is a required course for the Electrical Engineering Program.

Course Description:

The numerical methods course involves solving engineering problems drawn from all fields of engineering. The numerical methods include: Error analysis, roots of nonlinear algebraic equations, solution of linear and transcendental simultaneous equations, matrix and vector manipulation, curve fitting and interpolation, numerical integration and differentiation, solution of ordinary and partial differential equations.

Recommended Textbook(s):

- Numerical Methods for Engineers, S. C. Chapra and R. P Canale, McGraw-Hill, 6th edition 2010.

Prerequisites

- EE1205, EE2209

Course Topics :

Part-I: Basic Tools

Unit-1: Error Analysis
- Measuring Errors
- Sources of Error
- Consistency, Order, Smoothness and Convergence

Unit-2: Roots of equations (**Nonlinear Equations)**
- Bisection Method
- False-Position Method (Optional)
- Newton-Raphson Method
- Secant Method (Optional)

Unit-3: Simultaneous Linear algebraic Equations
- Direct Methods
  - Review of Determinants and Matrices
  - Cramer's Rule
  - Gauss-Elimination method (simple and partial pivoting methods)
  - Gauss-Jordan Method
  - Matrix Inversion method
- Indirect (Iterative) Method
  - Jacobi Method
  - Gauss-Seidel Method
  - Successive Over-Relaxation Method

Unit-4: Numerical Differentiation and Integration
  - Numerical differentiation using difference method
  - Numerical Integration, Trapezoid and Simpson's Rules
  - Extrapolation of Errors

Unit-5: Interpolation and Curve Fitting
  - Direct Fit Polynomial
  - Least Squares Method
  - Logarithmic regression (Optional)
  - Exponential regression (Optional)
  - Linear interpolation, Quadratic Interpolation
  - Lagrange Interpolation (Optional)
  - Newton Divided Difference Interpolation (Optional)

Part-II: Numerical Solutions of Ordinary Differential Equations

Unit-6: Initial Value Problem
- Euler's Method
- Runge-Kutta 2nd
- Runge-Kutta 4th
- Higher Order Equations

Unit-7: Boundary Value Problem
- Equilibrium (Finite Difference) Method

Part-III: Numerical Solutions of Partial Differential Equations

Unit-8: PDEs
- Elliptic Equations
- Parabolic Equations
- Hi-parabolic Equations
- Advanced Application (Case Studies based on each department interests).

Course Outcomes:

Students who successfully complete the course will able to:

- Be aware of the mathematical background for the different numerical methods introduced in the course.
- Understand the different numerical methods to solve the algebraic equations and to solve system of linear and nonlinear equations.
- Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations.
- Understand how numerical methods afford a mean to generate solutions in a manner that can be implemented on digital computers.
- Use the built-in functions in MATLAB and EXCEL.
- Create MATLAB functions for solving numerical engineering problems.
- Work on multidisciplinary projects.

EE3212 Engineering Statistics (3-3-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Statistical Engineering models are based on mathematics and probability theory. This course provides students with a working knowledge of fundamental statistics principles and probability in addition to a preface to the regression and correlation analysis. By the end of the semester, students should be able to determine when each of the various topics we have covered is appropriate to use, and to apply them to practical engineering situations or problems. This course will cover techniques on data collection and presentation, descriptive statistics, basic elements of probability theory, sampling techniques and theory, statistical estimation, hypothesis testing and regression analysis.

Recommended Textbook(s):

- Elementary Statistics a Step-by-Step Approach, Eighth Edition, By Allan G. Bluman.
- Probability and Statistics for Engineers and Scientists, Fourth Edition, By Sheldon Ross.

Prerequisites:

- EE1202

Course Topics:

Fundamentals (Introduction to Statistics)

- Introduction
- Descriptive and Inferential Statistics
- Variables and Types of Data
- Data Collection and Sampling Techniques
- Observational and Experimental Studies

Presentation of a Statistical Data

- Introduction
- Organizing Data
- Grouped Frequency Distributions or Frequency Distributions Table
- Graphs: Histograms, Frequency Polygons, and Ogive
- Other Types of Graphs

Data Description

- Measures of Central Tendency (Mean, Median and Mode)
- Measures of Variation
    - 2.1. Population Variance and Standard Deviation
    - 2.2. Sample Variance and Standard Deviation
    - 2.3. Variance and Standard Deviation for Tabulated Data
    - 2.4. Range
- Coefficient of Variation

Probability and Counting Rules

- Sample Spaces and Probability
- Tree diagram
- Basic Probability Rules
- Venn Diagram
- The Addition Rules for Probability
- The Multiplication Rules and Conditional Probability
- Conditional Probability

- Counting Rules
    - 8.1. Permutations
    - 8.2. Combinations
- Probability and Counting Rules

Discrete Probability Distributions

- Probability Distributions
- Mean, Variance, Standard Deviation
- The Binomial Distribution
- The Poisson Distribution

Continuous Probability Distributions: The Normal Distribution

- Normal Distributions
- Applications of the Normal Distribution
- Normal Distributions Formula
- The Standard Normal Distribution
- Finding Areas Under the Standard Normal Distribution Curve (Table Method)
- A Normal Distribution Curve as a Probability Distribution Curve
- Applications of the Normal Distribution
- Determining Normality
- The Normal Distribution Approximation to the Binomial Distribution

Confidence Intervals and Sample Size

- Preface
- Confidence Intervals for the Mean When σ is Known
    - 2.1. A point estimate
    - 2.2. An interval estimate
    - 2.3. Confidence Intervals
- Sample Size
- t-Distribution
- Confidence Intervals for the Mean When σ is Unknown
- The chi-square Distribution
- Confidence Intervals for Variances and Standard Deviations
    - Confidence Interval for a Variance
    - Confidence Interval for a Standard Deviation

Hypothesis Testing

- Preface
- Steps in Hypothesis Testing—Traditional Method
    - The null hypothesis (H_0)
    - The alternative hypothesis (H_1)
    - The level of significance
- *z* Test for a Mean
- P-Value Method for Hypothesis Testing
- t Test for a Mean
- z Test for a Proportion
- X^2 Test for a Variance or Standard Deviation

Testing the Difference Between Two Means, Two Proportions, and Two Variances

- Preface

- Testing the Difference Between Two Means: Using the z Test
- Testing the Difference Between Two Means of Independent Samples: Using the t Test
- Testing the Difference Between Two Means: Dependent Samples
- Testing the Difference Between Two Variances

Correlation and Regression

- Preface
- Scatter Plots and Correlation
- Regression
- Coefficient of Determination and Standard Error of the Estimate.

Course Outcomes:

On completion of this course, the student should be able to:

- use a number of methods and techniques for collecting and presentation the sets of data;
- calculation and demonstration the center tendency and variation of data;
- compute the probabilities in a simple case and using the rules of probability in computing;
- give an account of the concept random variable and be able to use some common probability distributions;
- understand the meaning of the central limit theorem;
- use point and interval estimates for some typical statistical problems;
- apply elementary regression for fitting measured data.

EE1301 Fundamentals of Electrical Engineering I (3-2-1-2)

This is a required course for the Electrical Engineering department.

Course Description:

This course introduces the basics of electric circuits, series and parallel connection, and DC circuit analysis. Additionally, the course presents ohms law, Kirchhoff laws for solving series parallel circuits. Furthermore, it introduces circuit theorem and their analysis; including mesh, nodal, and superposition theorems. Thevenin and Norton theorems are also included. Finally, the course introduces capacitors and inductor into the circuit and how to deal with it under dc condition.

Recommended Textbook(s):

- Alexander and Sadiku "Fundamentals of Electric Circuits" Third Edition McGraw Hill.
- Boylestad, R. L., Introductory Circuit Analysis (10th Edition).

Prerequisites:

- EE1201

Course Topics:

- Introduction to electrical engineering
- Charge, current, and voltage
- Ohms law
- Kirchhoff laws
- Star delta analysis
- Nodal analysis
- Mesh analysis
- Source transformation
- Superposition theorem
- Thevenin circuits
- Norton circuits
- Capacitor C
- Inductor L
- Circuit analysis including R, L, and C

Course Outcomes:

By the end of successful completion of this course, the student will be able to:

- Understand the basic concept of electrical circuits.
- Solve series and parallel DC circuits.
- Apply Methods of Analysis and Circuit Theorems to solve DC circuits.
- Solve series/parallel circuits with capacitors and inductors.

Laboratory:

- Introduction to the LAB
- Ohm's law
- Kirchhoff's current and voltage law
- series-parallel network
- Superposition theorem
- Thevenin's theorem
- Norton's theorem

EE1203 Physics (4-3-0-2)

This is a required course for the Electrical Engineering Program.

Course Description:

This is the first course in the two-semester sequence of calculus-based introductory physics courses designed to meet the needs of student majoring in Engineering. The course is a survey of the concepts, principles, methods and major findings of classical Physics .Primarily, it covers Newtonian mechanics, and thermal Physics, with topics include: Physics and measurement, Vectors, kinematics and dynamics of motion of a single particle in one and two dimensions, work and energy, system of particles, linear momentum and collisions, kinematics and dynamics of rotational motion, equilibrium of rigid bodies, and elasticity, fluid static and fluid dynamics, oscillatory motion, wave motion, and temperature and thermal equilibrium.

The subject matter of the course will be covered in The Lab-based section which presents an introduction to the methods of experimental physics emphasis is on developing student's skills in experimental techniques, data analysis, and scientific reporting of lab work. During the course students execute a series of experiments on Kinematics of motion, kinetic and potential energy, Oscillatory motion, Thermal properties of matter, and Viscosity. The course includes computer-based experiments on Classical Mechanic

Recommended Textbook(s):

- R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008 Laboratory Manual, Compiled by Instructor

Prerequisites:

- Concurrent requirement with EE1201

Course Topics:

- Physics and measurement; Kinematics of motion of a single particle in one and two dimensions; Kinematics of projectile and circular motion.
- Dynamics of motion of a single particle and multiple objects in one and two dimensions and Newton's Laws; Free body diagrams; various types of mechanical forces; Application on the use of Newton's Laws.
- Work and energy; Conservative systems and the concept of potential energy; Conservation of mechanical energy.
- System of particles; Linear momentum; Conservation of linear momentum and collisions; Elastic and Inelastic collisions; Center of mass.
- Kinematics and Dynamics of rotational motion; Torque; Moment of inertia; Angular momentum; Static equilibrium of rigid bodies; Elasticity and concepts of stress and strain.
- Phases of matter; Pressure and density, Equations of Fluid static; Equations of fluid dynamics: Continuity and Bernoulli's equations.
- Oscillating systems; Simple Harmonic Motion (SHM); Energy of SHM; Damped oscillations; Forced oscillations and Resonance.
- Types of waves: Transverse and Longitudinal; Traveling waves; Wave speed; The wave equation; Power and intensity in wave motion; Reflection and transmission of wave; The principle of superposition; Interference of waves; Standing waves; Resonance
- Macroscopic and microscopic description of matter; Concept of temperature and thermal equilibrium (zeroth law of thermodynamics); Measuring temperature; Thermal expansion.

Lab. Section

- Orientation. Introduction to Error Analysis/ Part (I). Introduction to Error Analysis/ Part (II)

- Experiment 0: Measurements and Data Analysis
- Experiment 1: Analyzing the kinematic components of 1Dmotion by using motion sensor
- Experiment 2: Determination of the Acceleration of Gravity by studying Free fall
- Experiment 3: Verification of Newton's Second Law
- Experiment 4: Conservation of mechanical energy
- Experiment 5: Verification of Work – energy theorem
- Experiment 6: Static Equilibrium of a rigid object
- Experiment 7: Determination of the Acceleration of Gravity using the Simple Pendulum
- Experiment 8: Verification of Hook's Law
- Experiment 9: Determination of the speed of Sound in Air using a resonance tube
- Experiment 10: Determination of the Coefficient of Viscosity
- Experiment 11: Determination of the Mechanical Equivalent of Heat
- Experiment 12: Determination of Specific Heat Capacity of a solid

Course Outcomes:

- Describe the SI unit system and convert units.
- Describe the translational motion of a single particle in terms of position and inertial frames, inertia, velocity, acceleration, linear momentum and force.
- Describe the rotational motion of a rigid body using the concepts of rotation angle, angular velocity, angular acceleration, angular momentum, moment of inertia, and torque.
- State the Newton's three laws of motion and apply them to solve problems on one and two-dimensional translational motion.
- Represent graphically the problem of motion of a physical system using the free-body diagram technique.
- Identify the forces acting on ordinary mechanical systems to be gravity and electromagnetism (Drag force, frictional force, normal force, etc.).
- State the fundamental laws of kinematics and dynamics of rotational motion of a rigid body and use them to solve problems on simple rotational motion.
- Analyze the translational and rotational motion using a scalar approach based on the concepts of work, conservative and non-conservative forces, potential energy and conservation of mechanical energy.
- Describe and solve problems of the motion of many-particle system by employing the concept of center of mass, law of conservation of mechanical energy, Principle of momentum and angular momentum conservation.
- State the two conditions of static and dynamic equilibrium of a point particle and a rigid body and use them to solve problems of static equilibrium.
- Describe and solve some problems on the elastic properties of materials using the following elasticity concepts and relations: Rigidity; Plasticity; Plastic deformation; stress and strain; Bulk stress and strain; Bulk deformation and bulk modulus; Linear tensile stress and strain; Young's modulus; Shearing.
- Analyze and solve the problems of static fluid in terms of density and pressure, and fluid at motion using the continuity equation and Bernoulli's equation.
- Define and calculate the following parameters of oscillatory and wave motion: amplitude, period, frequency, angular frequency, speed of a wave, energy transported, Power and intensity;
- Describe Simple Harmonic Motion qualitatively and quantitatively.
- Recognize and analyze some wave characteristics: principle of superposition, interference, diffraction, reflection, transmission, refraction, standing waves and Resonance.
- Illustrate some applications of harmonic and wave motion in a wide variety of physical situations.
- Define what is meant by: temperature, specific and molar heats of capacity.

- State zeroth and first laws of thermodynamics and use them to solve some related problems.
- Explain the theory of heat energy transfers and apply it in some simple situations.

Lab. Section

- Test experimentally some of the physical laws and theories taught in lecture room.
- Fit observed data with mathematically modeled physical phenomenon.
- Use a variety of physical measuring devices e.g. Micrometer, Vernier Caliper, Stop watch, Power Supply, Voltmeter, Ammeter, and CRO.
- Estimate the uncertainty by applying the rules of Standard Deviation in the case of repeated measurements of a single quantity and by employing the technique of Least-Squares Fitting in the case of experiment that involves the measurement of several values of two or more different quantities.
- Apply the technique of error propagation to estimate and manipulate the uncertainty in directly and indirectly measurement of physical quantities.
- Evaluate some uncertainty related quantities, namely accuracy and precision, confidence level, discrepancy, and significance of a discrepancy, and utilize them to determine the sources of experimental errors, and to discuss how to minimize the uncertainties in the funded results.
- Incorporate computer in measuring and analyzing the experimental result.
- Communicate scientific results in a written manner through presenting a word-processed report on the conducted experiment.
- Measure, determine, and graph the basic components of 1D motion: position, velocity, and acceleration.
- Verify Newton's second law experimentally through observing, and measuring some common forces that occur in our everyday life e.g. gravity, g f friction S f & K f, and tension T.
- Inspect the laws of conservation of energy for rotating and non-rotating systems.
- Test practically the correctness of the two conditions of static equilibrium.
- Analyze experimentally some features of oscillatory and wave motion by studying SHM using simple pendulum, and semi-ideal spring, and examining resonance of closed and open-air columns.
- Check experimentally the Viscosity property of a fluid by measuring the Coefficient of Viscosity of engine oil by Stokes method.
- 15.Construct simple DC circuit and design simple thermal experiment to measure the mechanical equivalent of heat, and specific heat capacity of a solid.

Department Requirements Courses

EE3324 AC Machines I (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed to enable the students to understand the AC machines especially induction motors to the standard required at department level. The course integrates Introduction of AC machines construction and operation principle for students of the third year in electrical engineering department. Students, in this course, will deals with single phase induction machine, equivalent circuit, three phase induction machines etc. Theoretical preparation of students to work in the field of electrical machine design, operation, fault detection and control. Applying numerical method to solve industrial problem.

Recommended Textbook(s):

- Chapman "Electric Machinery Fundamental", Fourth Edition.
- B.L Thiraja, A.K Thiraja, " A text book of electrical technology, volume II.

Prerequisites:

- EE2315, EE2316, EE2313 and EE2314.

Course Topics:

- Introduction of electromagnetic field.
- Design electrical machine.
- Single phase induction motor.
- Main and auxiliary windings the doubt revolving field theory.
- The equivalent circuit-performance calculations.
- Three phase induction motors-3-phase.
- AC winding-the rotating electromagnetic field.
- The equivalent circuit performance.
- Open circuit and short circuit tests of three phase induction motor, efficiency calculations.
- Torque speed curve and torque characteristics.
- Starting of induction machine.
- Speed control of induction motors.
- Other modes of operation-starting.

Course Outcomes:

- Explain the AC machines type in general. single phase induction machine, three phase induction machines etc.
- Describe the field of electrical machine design, operation, fault detection and control.
- Apply numerical method to solve industrial problem.

EE3325 AC Machines II (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed to enable the students to understanding synchronous machines and transformers to the standard required at department level. The course integrates Introduction of SG and SM definition of all types, operation and control of Synchronous machines and transformer for students of the third year in electrical engineering department. Students, in this course, will deals with operation principle of synchronous generator, equivalent circuit of SG and efficiency calculation. Study motor operation mode and its equivalent circuit. Efficiency calculation of SM, starting and stopping of SM. introduction of transformers and its several types. Power transformer and distribution transformer.

Recommended Textbook(s):

- Chapman "Electric Machinery Fundamental", Fourth Edition.
- B.L Thiraja, A.K Thiraja, " A text book of electrical technology, volume II.

Prerequisites:

- EE3324, EE2315, EE2316, EE2313 and EE2314

Course Topics:

- Introduction of Three phase synchronous machines.
- Basic theory of operation of synchronous generator.
- Voltage & torque equations for cylindrical rotor of SG.
- Voltage and -torque equations for salient pole of SG.
- Parallel operation of SG.
- Basic theory of operation of synchronous motor.
- Efficiency and losses of SG.
- Voltage & torque equations of SM.
- Efficiency and losses of SM.
- Starting and stopping of SM.
- Transformer principle: Single phase transformer, Transformer-types of transformer, construction, phasor diagram, no-load and short circuit tests.
- losses in transformers, the equivalent circuit of the transformer, efficiency, regulation, auto-transformer.
- Three phase transformers.
- Efficiency and maximum efficiency condition of transformer.
- Parallel operation of transformer.

Course Outcomes:

- Explain the synchronous machines type in general, synchronous generators and its control, parallel operation of SG.
- Describe the synchronous motors and its control and applications, single phase and three phase transformer and its operation and application in industry life.
- Apply numerical method to solve industrial problem.

EE4335 Advanced Communication Systems (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course introduces the fundamentals of the digital communication systems. It discusses different techniques of transmitting analog signals in form of discrete/binary signals. Different carrier modulation methods of the binary data are presented.

Recommended Textbook(s):

- Timothy Pratt; "Satellite Communications", 2002.
- Haykin; "Communication Systems", 4th ed.
- Skolnik; "Introduction to Radar Systems", 3rd ed.

Prerequisites:

- EE3329

Course Topics:

- Fundamentals of Spread spectrum (Direct Sequence & Frequency hopping). Pseudo Random Number generation, Jamming/Noise immunity, security. Gold code generation/usage & advantages.
- Introduction to RADAR Systems (types, ranging, resolution).
- Satellite communications (Introduction, Transmitters & receivers, orbits, applications, uplink/downlink propagation).
- Fundamentals of GPS System.

Course Outcomes:

- Understand the principles and importance of the Spread spectrum techniques.
- Study some types and applications of the Spread spectrum techniques.
- Understand the principles and operation of the RADAR systems.
- Understand the principles of the satellite communications.
- Understand the fundamentals and operation of GPS Systems.

EE3328 Analog Communications and Noise (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course introduces the fundamentals of communication system engineering. Specifically, the analog communication systems (AM and FM). The noise within the communication systems is also introduced.

Recommended Textbook(s):

- Proakis, and Salehi. “Communication Systems Engineering”. 2002.
- Lathi, and Ding. “Modern Digital and Analog Communication Systems”, 2010.

Prerequisites:

- EE3319

Course Topics:

- Introduction to communication system, channel, waves propagation.
- Amplitude Modulation: DSB-SC, DSB-LC, SSB, VSB.
- FDM
- Frequency Conversion, Super-Heterodyne Receiver
- Frequency Modulation: power, bandwidth, generation, detection.
- Introduction to the noise in communication systems. Noise Sources, Thermal Noise, White & Filtered Noise, Equivalent Temperature.
- Noise & SNR in selected studied systems.

Course Outcomes:

- Understand and analyze communication systems in both the time and frequency domains.
- Understand the principles of amplitude and frequency modulations.
- Understand the sources of the electrical noise and its roles on the communications.

EE1304 Applied Physics (4-3-0-2)

This is a required course for the Electrical Engineering Program.

Course Description:

This is the second semester, calculus-based introductory physics course that follows CE 1203. It is a Continuation of the survey of principles of classical physics presented in CE1203. Topics studied include Electrostatics, Electric charge and electric field, Coulomb's law, electric potentials, Capacitance and dielectric, currents, Resistance Ohm's law, Electromotive force, Direct current circuits, magnetism, Magnetic field and magnetic forces, Sources of magnetic field, Biot-Savart Law, and Ampere's law, induction, Faraday's Law, Maxwell's equations, electromagnetic radiation, wave motion, and physical and geometrical optics. The Lab. section presents an introduction to the methods of experimental physics. Emphasis is on experimental, data analysis, and written presentation skills of lab work. During the course students execute a series of experiments on electrostatic fields, Magnetic fields, Induction, DC circuits, and AC circuits.

Recommended Textbook(s):

- R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008
- Laboratory Manual, Compiled by Instructor

Prerequisites:

- EE1201, EE1203

Course Topics:

- Electric charge; Coulomb's law; Superposition of forces; Electric field; Electric fields of simple geometric static charge configuration; Electric field lines; Electric field around conductors in e.s. equilibrium; Electric dipole field; dipole moment and torque on a dipole. Concept of field; Electric field flux and Gauss's law.
- 10/13 Profile of Physics Courses Servicing Engineering III.4. Course Topics & Matrix Topics to Be Covered Teaching Duration Learning Outcomes Assessment Tools Part(I) Electrostatics: Electric charge; Coulomb's law; Superposition of forces; Electric field; Electric fields of simple geometric static charge configuration; Electric field lines; Electric field around conductors in e.s. equilibrium; Electric dipole field; dipole moment and torque on a dipole. Concept of field; Electric field flux and Gauss's law. 4 Weeks A.1, A.2, A.3, A.6 _ Assignments _ Quizzes _ Tutorial _ Exam 1, 3 Electric potential energy; Electric potential difference (Voltage); Equipotential lines; Energy stored in simple charge configurations, Potential due Electric dipole.
- Capacitors and their capacitance; Capacitors in series and parallel; energy storage.
- Current; resistance and Voltage; Ohm's law; Resistivity; Conductivity; Electromotive force(emf); Power; Kirchhoff's laws; RC circuits
- Gauss's law in magnetism; Lorentz's force law; Force on a current-carrying wire; Force between current carrying wires; Torque on a current loop; Magnetic field; Magnetic field due to steady current; Magnetic dipoles; Ampere's law; Biot-Savart Law; magnetic flux; Magnetic materials: Dia-, Para-, and Ferro-magnetism
- Induced emf; Faraday's law; Lenz's law; Energy stored in a magnetic field. Eddy currents; Inductors; Mutual and self-inductance; Energy stored in an inductor; Transformers.
- AC voltage and current; simple Ac circuits and applications; Impedance and phases. LR, LC, and LRC circuits
- Ampere's law and displacement current; Maxwell's equations; Electromagnetic waves; Light and electromagnetic wave; Geometrical optics.

Lab. Section

- Experiment 0: Measurements and Data Analysis

- Experiment 1: Verification of Ohm's Law
- Experiment 2: temperature dependence of electrical resistance
- Experiment 3: The relationship between the fusing current of a conducting wire and its diameter
- Experiment 4: Electrical conduction through semiconductor
- Experiment 5: Determination of Dielectric Constant
- Experiment 6: Cathode-ray oscilloscope Operation and Basic Measurements
- Experiment 7: Measurement of Time constant of an RC Circuit
- Experiment 8: Some electrical properties of transformers
- Experiment 9: Properties of a series resonant circuit
- Experiment 10: Charge to mass ratio of the electron
- Experiment 11: Laser diffraction

Course Outcomes:

- Explain the origin of electromagnetic phenomena in view of modern atomic theory.
- Define and calculate the basic physical quantities of electrostatics for the case of simple static charge distribution; namely: Coulomb's force, electrostatic field, electric Flux, electrostatic potential, voltage, and capacitance.
- Ability to represent the electric and magnetic field graphically for various charge distributions.
- Ability to draw the equipotential lines of electric potential for various simple charge configurations.
- Define and calculate the basic physical quantities of Magnetostatics for the case of simple steady current distribution; namely magnetic force, magnetic field, and magnetic dipole moment.
- Describe and explain the effects due to the electric and magnetic properties of materials.
- Classify matter according to its response to external magnetic field: Ferromagnetism, Paramagnetism, and Diamagnetism.
- Define and determine the basic quantities of 1D steady electrodynamics; specifically: current, current density, voltage, Resistance, resistivity, conductivity, emf, and power.
- Explain the formation of Eddy's current in conducting materials.
- Illustrate the phenomena of electromagnetic induction and self and mutual inductance.
- state the fundamental laws and theorems of Electricity & Magnetism in their integral and differential forms, namely: Coulomb's law, Gauss's law, Ohm's Law, Kirchhoff's Rules, Lorentz force law, Biot-Savart law, Ampere's circuital theorem, Faraday's law, and Lenz's law.
- Apply the knowledge of the fundamental laws and theorems of Electricity & Magnetism in solving problems involving simple dynamic charge configurations, Analyze simple DC and AC circuits.
- Understand the Maxwell's four equations that govern all electromagnetic phenomena.
- State the basic properties of electromagnetic waves.
- Explain the fundamental laws of geometrical optics.

Lab. Section

- Test experimentally some of the physical laws and theories taught in lecture room.
- Fit observed data with mathematically modeled physical phenomenon.
- Use a variety of electrical measuring instruments and tools, e.g. AC/DC Power Supply, Voltmeter, Ammeter, Multi meter, CRO, Resistor, Transformer, Coil, and Capacitor and utilize them to construct simple AC and DC circuits.
- Estimate the uncertainty by applying the rules of Standard Deviation in the case of repeated measurements of a single quantity and by employing the technique of Least-

Squares Fitting in the case of experiment that involves the measurement of several values of two or more different quantities.

- Apply the technique of error propagation to estimate and manipulate the uncertainty in directly and indirectly measurement of physical quantities
- Evaluate some uncertainty related quantities, namely accuracy and precision, confidence level, discrepancy, and significance of a discrepancy, and utilize them to determine the sources of experimental errors, and to discuss how to minimize the uncertainties in the funded results.
- Incorporate computer in measuring and analyzing the experimental result.
- Communicate scientific results in a written manner through presenting a word-processed report on the conducted experiment.
- Check experimentally the phenomenon of increasing of the capacitance of a capacitor when a dielectric fills the space between its plates.
- Verify Ohm's law experimentally for different resistors setting, and use it to measure the resistivity, and conductivity of aluminum and copper.
- Test experimentally the relation between the electrical current near the melting point of a conducting wire and its diameter.
- Practice the exponential behavior of charging –discharging of a capacitor in an RC circuit and measure the long and short time constant of the circuit.
- Check experimentally the linear temperature dependence of the electrical resistance of a conducting material and the exponential temperature dependence of the electrical resistance of a semiconducting material and use the results to Identify the structure of the material.
- Measure the strength of the local Magnetic Field of the Earth using the Biot-Savart law at the center of a coil.
- Verify experimentally the expected geometrical behavior of electron moving in electric and magnetic fields and use the data to estimate the electron charge to mass ratio.
- Inspect the electrical properties of AC transformer and measure its efficiency.
- Analyze the resonance phenomenon that occurs in the AC series LRC circuit.
- Verify the laws of diffraction and the principle of superposition using Laser beam.

EE3323 Computer Networks (3-3-1-0)

This is a required course for the Electrical Engineering Program

Course Descraption:

This course cover the following subjects: Data Communications, Data Networking, and the Internet. Protocol Architecture, TCP/IP, and Internet-Based Applications. Data Transmission: Concepts and Terminology. Transmission Media. Signal Encoding Techniques. Data Link Control Protocols. Multiplexing. Local Area Network: Topologies and Transmission Media, LAN Protocol Architecture. Wireless LAN Technology. Internetwork Protocols. Circuit Switching and Packet Switching. Network Security. Internet Applications: Electronic Mail and Network Management, Internet Directory Service and World Wide Web.

Recommended Textbook(s):

- Behrouz A. Forouzan, "data communications and networing''4th ed., 2007, Mc Graw Hill.
- William Stallings ''Data and computer communications'' 8th edition, 2007, Pearson Education, Inc.

Prerequisites:

None

Course Topics:

- Network communications, and data networking
- Data transmission: concepts and terminology. transmission media.
- Signal encoding techniques, and digital data communications techniques
- Network topologies, network types, computer communications networks,
- LAN protocol architecture, topologies and transmission media
- Wireless LAN Technology, IEEE 802.11 architecture and services, physical layer
- OSI reference model and its layers, physical layer,
- Data link control protocols. Network layer,
- TCP / IP and its layers,
- Internetwork protocols
- Circuit switching and packet switching
- Routing in switched networks
- Transport protocols
- Network security and cryptography
- Internet applications: electronic mail and network management, internet directory service and World Wide Web.

Course Outcomes:

After completing this course, the students will understand:

- Understand the data communication and its fundamentals
- Understand the fundamentals of data & signal, types of data & signal, Transmission Modes and their types, Characteristics and nature of analog & digital signal
- Explain the concept of dividing a job into layered tasks, the functions of the various layers of the OSI Mode.
- Explain the basics of TCP/IP model, functions of the different layers and protocols involved, addressing mechanisms used under the TCP/IP, IPv4 and importantly IP address and IP header format.
- Define the Transmission Medium and its types, understand various network strategies and topologies, Understand switches and router, routing concept, and concept of switching.

EE2312 Computer Programming (2-1-0-2)

This is a required course for the Electrical Engineering Program.

Course Description:

This course provides introduction to MATLAB. It is designed to give students fluency in MATLAB, including popular toolboxes. Programming in MATLAB includes input and output of data, algebraic and logical expressions and operators, hierarchy of precedence of operations, all data types including complex numbers and strings, structured and cell arrays, array indexing and array operations, matrices and matrix operations, control structures, loops, script and function m-files, function handles and their use, graphics and plots. Applications of MATLAB to solutions of engineering problems include solutions of systems of linear equations. Introduction to Simulink.

Recommended Textbook(s):

- Introduction to MATLAB for Engineers by William J. Palm III, McGraw-Hill, 3rd Edition, 2011.

Prerequisites:

- EE1205

Course Topics:

- General introduction to MATLAB.
- Numeric, Cell, and Structure Arrays.
- Matrix and Array Operations.
- Matrix Methods for solving linear equations.
- Script Files and Functions.
- Programming in MATLAB.
- Control flow and operators.
- Plotting, creating multiple plot types and three-dimensional plots.
- Introduction to Simulink and its instruments.

Course Outcomes:

After successful completion of this course, students should be able to:

- Perform operations in Matlab.
- Use matrix forms to describe and solve linear systems of equations.
- Programm with MATLAB to solve mathematical and engineering problems.
- Use MATLAB to generate graphics.
- Use the Simulink simulation package to simulate some electric circuits.

EE4332 Control Theory I (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course gives the students a theoretical foundation for understanding feedback control system analysis it Introduce basic techniques for analysis and design of feedback control systems. It gives a definition about control theory and a comparison between open loop and closed loop systems, derivation of transfer function and making a mathematical representation for various types of physical systems, block diagram formulation and reduction, signal flow graph formula. The course enables the student to know test input signals and transit response analysis for first, second and higher order systems, error analysis and stability theorem in s domain using Routh-hurtize criteria.

Recommended Textbook(s):

- Ogata, K, 2010, Modern control engineering, 5th Edition, Prentice Hall
- Dorf, R.C and Bishop, R.H, 2011, Modern Control systems, 12th Edition Addison-Wesley

Prerequisites:

- EE2209, EE2311, EE3320 and EE3325

Course Topics:

- Introduction to control system: Definitions, closed loop and open loop control systems, Examples of control systems; Elements of automatic (feedback) control system; Application of control engineering.
- Mathematical Representation of physical systems: Linear system, nonlinear system, transfer functions, Mechanical Translational Systems, Mechanical Rotational systems, Gear Trains, Electrical Systems, Analogy between Mechanical and electrical quantities
- Block diagrams Processing Procedures for drawing a block diagram, block diagram reduction
- Signal flow graphs, Signal flow graph representation of linear system, Mason's gains formula for signal flow graph.
- Transient response analysis, Introduction; standard test signals; types of systems; transient response of first, second and higher order systems, damping ratio and natural frequency, transient response specifications.
- Steady – state error in unity- feedback control system Classifications of control systems types, static position error coefficients, dynamic error coefficients.
- Stability Analysis in S-Domain: Concept of stability; Characteristic equation; Necessary conditions for stability; Ruth- Hurwitz stability criterion.

Course Outcomes:

- Understand the control theory and the fundamentals of automatic control engineering.
- Understand the mathematical representation of different types physical systems.
- Understand the methods of block diagram reduction and signal flow graph formula.
- Understand the different types of error analysis.
- Understand the transit response analysis.
- Understand the stability concept using Routh-Hurtize criteria.

EE4333 Control Theory II (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course gives the students the ability for understanding steps and procedure drawing root locus plot, and designing compensator using root locus method, frequency domain analysis including polar plot, bode plot, gain and phase margin, Nyquist stability criteria, three term controller (PD, PI, PID) controllers. The course focuses on analysis of control systems in state space and the methods of design of control system using state space approach. In the end of the course, the course introduces sampled data systems and analysis of digital control systems.

Recommended Textbook(s):

- Ogata, K, 2010, Modern control engineering, 5th Edition, Prentice Hall
- Dorf, R.C and Bishop, R.H, 2011, Modern Control systems, 12th Edition Addison-Wesley

Prerequisites:

- EE4332

Course Topics:

- Root Locus: general rules for constructing root loci, special cases, conditionally stable system, non-minimum phase systems.
- Control system design by the root locus method: Effects of the addition of poles and zeroes, lead compensator, lag compensator, lead-lag compensator
- Frequency Domain Analysis: Introduction, Polar plots., Frequency domain specifications, bode diagrams, Determination of Frequency domain specifications and transfer function from the Bode Diagram, Phase margin and Gain margin, Stability Analysis from Bode Plots. Correlation with time domain, Nyquist stability criterion, Application of Nyquist stability criterion for linear feedback system
- Design of conventional controllers, Proportional controllers, Proportional plus derivative controllers, Proportional plus integral controllers, Proportional plus integral plus derivative controllers
- Analysis of control systems in state space: Concept of state; state variables and state model; state models of linear continuous-time systems (electrical, mechanical, electromechanical, thermal system); correlation between transfer function and the state space equations. State transition matrix; Controllability and observability, pole placement, design by pole placement, Ackermann's formula.
- Introduction to Digital Control Systems Basic digital control system, advantages of digital control, basic discrete time signals, z-transform and inverse z-transform, modeling of sample-hold circuit, pulse transfer function, output response in z domain

Course Outcomes:

- Understand the methods of sketching and designing compensators using root locus method.
- Understand the frequency domain analysis and plots used to represent frequency domain.
- design a three-term controller.
- Analyze control systems using state space approach.
- Understand the principles of digital control systems.

EE2313 DC Machines I (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to enable the students to understand the DC machines as a required at department level. The course integrates the Generator-principle of rotating electrical machines and calculation of induced e.m.f., energy, power and torque in DC machines. Construction of DC machines and function of commutator. Type of armature windings. Calculation of m.m.f. per pole. Type of excitation connections. Armature reaction. Commutation.

Recommended Textbook(s):

- Theraja and Theraja (A Textbook of Electrical Technology) volume I basic electrical engineering in S.I. System of units revised by: Tarnekar Chand an ISO 9001:2000 company Chand & company ltd. Ram Nagar (2005)

Prerequisites:

- EE1301, EE1302 and EE1204

Course Topics:

- DC MACHINE BASICS: Basic Interactions, Wire loop, Commutator, Armature, Magnetic Field, Armature Coil Equations, Coil emf, Coil Torque, Coil Resistance, Electromechanical Power Conversion, Generator Action, Motor action,
- CONSTRUCTION: Materials, Temperature Rise, Machine Rating, Main parts of the dc machine.
- ARMATURE WINDING: Winding details, Winding Schemes, Lap winding, Wave winding, Armature Calculations.
- MAIN FIELD: Main Field Distribution, Field excitation, Magnetization curve
- ARMTURE REACTION: Distributed Armature m.m.f., Resultant field, Effects of armature reaction, Demagnetizing effect, Shift of the magnetic neutral axis, Flashover, Treatment of Armature Reaction, Brush shift,
- Commutation: The Process of Commutation, Equivalent circuit of commutating coil, Linear Commutation, Reactance voltage, Treatment of sparking, Interpoles, Brush shift

Course Outcomes:

- Explain DC machines type in general.
- Explain DC generators with principle of operation.
- Explain types of winding schemes.
- Explain Armature reaction effects and treatment.
- Explain commutation process and its problems with some of solutions.
- Calculate m.m.f. per pole. Type of excitation connections and voltage calculation.

EE2314 DC Machines II (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is designed to enable the students to understand the DC machines as a required at department level. The course integrates the Losses and efficiency of D.C. generators. Type and characteristic of D.C. generator. Parallel operation of D.C. generators. Motors-principle of operation of D.C. motors. Calculation of speed, torque, starting of D.C. motors, characteristic (shunt, series, compound, separately), speed control, electric breaking. Brush less DC motor.

Recommended Textbook(s):

- Theraja and Theraja (A Textbook of Electrical Technology) volume I basic electrical engineering in S.I. System of units revised by: Tarnekar Chand an ISO 9001:2000 company Chand & company ltd. Ram Nagar (2005)

Prerequisites:

- EE2313

Course Topics:

- Losses and efficiency of D.C. generators: Power Balance, Motor operation, Generator operation, Losses, Classification of losses, Measurement of losses, Efficiency, Maximum efficiency
- GENERATOR OPERATION: The Voltage Equation, Speed of Rotation, Field excitation, Voltage drops, Definitions, External characteristic, Voltage control, Voltage regulation, Voltage Build-Up, Applications, Parallel operation.
- MOTOR OPERATION: Governing equations, Load :torque and current, Applied voltage, Field excitation, Mechanical characteristic, Stability
- Speed control: Armature voltage control, Armature resistance control, Field control,
- Starting: Direct on-line starting, Variable voltage starting, Resistance starting, Starters,
- Braking: External braking, Electric braking, Applications.
- Brushless DC motor principle of operation, construction Applications.

Course Outcomes:

- Explain the losses in DC machines.
- Explain the DC generators characteristics.
- Explain the mechanical characteristic of DC motor.
- Explain the speed control of DC motors.
- Explain the starting and braking of DC motor.
- Explain the Brushless DC motor principle of operation.
- Calculate speed and torque with loads and no-load

EE3329 Digital Communications (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course introduces the fundamentals of the digital communication systems. It discusses different techniques of transmitting analog signals in form of discrete/binary signals. Different carrier modulation methods of the binary data are presented.

Recommended Textbook(s):

- Proakis, and Salehi. "Communication Systems Engineering". 2002.
- Lathi, and Ding. "Modern Digital and Analog Communication Systems", 2010.

Prerequisites:

- EE3328

Course Topics:

- The sampling theory, Nyquist sampling and aliasing in reconstruction.
- PCM.
- Delta PCM, Deferential PCM, Delta Modulation.
- PAM-TDM, PCM-TDM, ISI & Eye Diagram.
- M-ary baseband signaling.
- Digital modulation: BASK, BFSK, BPSK.
- M-ary Modulation, QPSK, QAM.

Course Outcomes:

- Understand the principles of sampling and encoding of analog signals.
- Understand the TDM.
- Understand the principles of digital modulation.

EE2304 Digital Techniques I (2-2-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course introduces the student to digital fundamentals concepts, which includes: numbers systems. Codes, Types of logic gates, and Boolean expressions of different circuits. The course also examines the design of main logic circuits, along with an introduction to analysis of clocked sequential circuits.

Recommended Textbook(s):

- A. Saha, and N. Manna, "Digital Principles and Logic Design", Infinity Science Press LLC, (2007).
- Thomas Floyd, "Digital fundamentals", 8th edition, Person education Inc.

Prerequisites:

None

Course topics

- Data and numbers systems: Number Systems, Conversion between Number Systems.
- Complement Arithmetic, Signed Binary Numbers,
- Binary Arithmetic, BCD arithmetic.
- Codes and their conversions.
- Errors detection codes,
- Definition of Boolean Algebra. Properties and Theorems of Boolean Algebra
- Boolean Functions, Simplification of Boolean Expressions.
- Digital Logic Gates. Truth tables of logic gates.
- simplification and minimization of Boolean function using Karnaugh map,
- Multi-level gate circuits. Design of multi levels NAND and NOR gates.
- Combinational circuits design; Adder, Substrate, code conversion, magnitude comparator
- Decoder, Encoder, Multiplexer, Demultiplexer, parity generator.
- Minterm and Maxterm.
- Examples of truth table construction.

Course Outcomes:

- Understand concept of data representation and conversion between number systems.
- Understand Binary arithmetic and other code numbers arithmetic.
- Recognize the different types of codes.
- Operate on Boolean algebra, and simplification of Boolean function.
- Understand different types of logic gates, and here truth tables.
- Apply methods of simplification and minimization of Boolean expressions.
- Be familiar with multi-level gate circuits and combinational circuits.
- construct truth tables of various logic expressions.

EE2305 Digital Techniques II (3-2-0-2)

This is a required course for the Electrical Engineering Program

Course Description:

This course introduces the student to understand the Flip-flops, types of flip-flops, there logic symbols, and excitation tables of different flip-flops. The course also examines the design of main logic circuits, along with an introduction to analysis of clocked sequential circuits and the topics of sequential circuit analysis and design, PLD, and Logic families.

Recommended Textbook(s):

- A. Saha, and N. Manna, "Digital Principles and Logic Design", Infinity Science Press LLC, (2007).
- Thomas Floyd, "Digital fundamentals", 8th edition, Person education Inc.
- Introduction to Logic Design (3rd Ed.) by Alan B. Marcovitz. McGraw-Hill, 2009.

Prerequisites:

EE2304

Course topics

- Latches and Flip-flops Types of Flip-flops, Clocked S-R Flip-flop, J-K Flip-flop,
- Clocked D Flip-flop, T Flip-flop, Toggling Mode of S-R and D Flip-flops,
- Triggering of Flip-flops, Excitation Table of a Flip-flop, Sequential Circuit Model, Classification of Sequential Circuits
- Analysis of Sequential Circuits,
- Registers and Shift Registers,
- Counters, Synchronous Counters.
- Ripple Counters. Up-down counter, mode N counters
- Design Procedure of counters Circuits.
- Sequential circuits: design, implementation and minimization
- Sequential Circuits with Programmable Logic Devices: introduction, and types of PLDs
- Random-Access Memory. Memory Decoding. Read-Only Memory. Programmable Logic Array.
- Integrated circuit technologies, basic concepts, major IC technologies: TTL and CMOS.
- Define Propagation delay, power dissipation, performance of Logic Families.
- Basic TTL and CMOS gates operate at components level.

Lab section:

- Logic gates circuits.
- Combinational logic circuits.
- Comparator circuits.
- Half-adder and full adder circuit.
- Half sub tractor and full sub tractor.
- Decoder circuit.
- Encoder circuit.
- Multiplexer circuit.
- Flip-flop circuit.
- Counter circuit

Course Outcome:

A student who successfully fulfills the course requirements will have demonstrated an ability to:

- analyze and design procedures of Sequential circuits.

- Implement functions using digital circuit (Sequential).
- design sequential systems through the application of system reduction techniques and the use of sequential system design tools.
- Differentiate between Logic families.
- Define the problem (Inputs and Outputs) of the PLDs, and write its functions
- Use simulation software, for testing the designed circuit.

Course Outcomes (lab section):

- Describe the characteristic and principles of various logic gates.
- construct other combinational logic gates using NOR gates.
- Describe the construing and operational principles of digital comparators.
- Describe the half-adder and full-adder in the arithmetic unit.
- Describe the theory of complements and construction of subtract or circuits.
- Describe the operating principles of decoder, encoder and multiplexer circuit.
- Describe the difference between combinational and sequential logic circuits, and the applications of various memory units.

EE2306 EE Lab 21 (2-0-0-4)

This is a required course for the electrical Engineering Program. This course is two labs, dc machine I and fundamentals of electronics I laboratory.

Course Description (dc machine I):

This course is a Lab designed to enable the students to understand the DC machines as a required at department level. The course integrates many experiments about the DC Generator-principle of rotating electrical machines and calculation of induced e.m.f., energy, power and torque in D.C. machines. Construction of D.C. machines and function of commutator. Type of armature windings.

Recommended Textbook(s):

- Laboratory Manual, Compiled by Instructor

Pre-requisite:

- EE2313

Course Topics:

- The Construction of DC Machines
- Building up Voltage of Self-Excited Shunt motor
- Characteristic of Separately Excited Generator
- Characteristic of Self Excited Shunt Generator
- Characteristic of (a) Compound Generator and (b) Series Generator
- Separation of Mechanical Eddy-Current and Hysteresis Losses in DC Generator by an Auxiliary Motor.

Course Outcomes:

- Understand DC machines type and connections in practice.
- Understand DC machines behavior and connections in practice.
- Understand DC generators: principle of operation, and types of winding schemes connections.
- Understand how to calculate losses in practice

Course Description (fundamentals of electronics I lab.):

This course is a Lab designed to enable the students to understand the Rectification, Regulation, clipping.

Recommended Textbook:

- Laboratory Manual, Compiled by Instructor

Pre-requisite:

- EE2308

Course Topics:

- Experiment 1: Lab Equipment Familiarization
- Experiment 2: Diode Characteristics
- Experiment 3: Diode Applications (1)
- Experiment 4: Diode Applications (2)
- Experiment 5: Zener Diode Characteristic
- Experiment 6: Zener Diode Applications
- Experiment 7: Light Emitting Diode

Course Outcomes:

After successfully completing the course, the students will be able to:

- understand electrical laboratory instrumentation, including multimeters, power supplies, function generators and oscilloscopes.
- Design and conduct experiment as well as to analyze and interpret data.
- Perform fundamental measurements on electronic circuits.
- Understand the format and content requirements for complete technical reporting.

EE2307 EE Lab 22 (2-0-0-4)

This is a required course for the electrical Engineering Program. This course is two labs, dc machine II and fundamentals of electronics II laboratory.

Course Description (dc machine II):

This course is designed to enable the students to understand the DC machines as a required at department level. The course integrates the Losses and efficiency of DC generators. Type and characteristic of DC generator. Parallel operation of DC generators. Motors-principle of operation of DC motors. Calculation of speed, torque, starting of D.C. motors, characteristic (shunt, series, compound, separately), speed control, electric breaking. Brush less DC motor.

Recommended Textbook(s):

- Laboratory Manual, Compiled by Instructor

Pre-requisite:

- EE2314

Course Topics:

- Connection & Rotational direction test of DC-Shunt Machines Operating as Motors
- Speed Control of a DC Shunt Motor
- Load Characteristics of the Separately - Excited Shunt-Wound DC Motor,
- Connection & Rotational direction Test of DC-Series Machines Operating as Motors
- Load Characteristics of the Series-Wound DC Motor
- Load Characteristics of Shunt and Compound DC Motor

Course Outcomes:

- Explain the Connection & Rotational direction test of DC-Shunt Machines.
- Explain the Speed Control of a DC-Shunt Motor.
- Explain the Load Characteristics of the Separately - Excited Shunt-Wound DC Motor,
- Explain the Connection & Rotational direction Test of DC -Series Machines Operating as Motors.
- Explain the Load Characteristics of the Series-Wound DC Motor and Load Characteristics of Shunt and Compound DC Motors.

Course Description (fundamentals of electronics II lab):

This course is designed to enable the students to understand the BJT as an amplifier, FET as an amplifier, Field Effect Transistor Characteristics and Biasing, Field Effect Transistor Applications, JFET as an Amplifier, and Four Terminal Semiconductor Device.

Recommended Textbook(s):

- Laboratory Manual, Compiled by Instructor

Pre-requisite:

- EE2309

Course Topics:

- Experiment 1: Bipolar Junction Transistor (BJT) Characteristics
- Experiment 2: Bipolar Junction Transistor Biasing Applications
- Experiment 3: Logic Gate Circuits
- Experiment 4: Small Signal BJT Amplifier
- Experiment 5: Junction Field Effect Transistor Characteristics
- Experiment 6: Field Effect Transistor Biasing

- Experiment 7: Small Signal JFET Amplifier.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Work on electrical laboratory instrumentation, including multimeters, power supplies, function generators and oscilloscopes.
- Design and conduct experiment as well as to analyze and interpret data.
- Perform fundamental measurements on electronic circuits.
- Understand the format and content requirements for complete technical reporting.

EE3321 EE Lab 31 (2-0-0-4)

This is a required course for the electrical Engineering Program. This course is two labs, ac machine and electronic laboratory.

Course Description (AC machine lab.):

Testing and studying an ac machine performance and all tests, speed control and starting of induction motor three phase and single phase. Use of electrical, mechanical measuring equipment.

Recommended Textbook(s):

- Laboratory Manual, Compiled by Instructor

Prerequisites:

- EE3324

Course Topics:

- general knowing of electrical machines.
- characteristics of the single-phase induction motor.
- connection and rotational direction of three phase induction motor.
- operation of three phase induction motor in star and delta circuit.
- efficiency, current and power factor of three phase induction motor.
- connection & rotational direction and optimum starting resistance test of three phase induction motor fitted with slip ring rotor.
- characteristics of three phase induction motor fitted with slip ring rotor.

Course Outcomes:

- Students will obtain knowledge in experimental procedures and processes.
- Students will attain the ability to deliver effective written communication.
- Students will attain skills in the use of state-of-the-practice facilities and equipment.
- Ability to dealing with single phase induction motor and its power characteristics.
- Ability to make a several tests of single-phase induction motor and its fault detection.
- Dealing with three phase induction motors and its performances.
- Ability to make a several tests of three phase induction motors in addition of efficiency calculations.
- Ability to connect three phase induction motors in star and delta connections.
- Make an optimum starting resistance test of three phase induction motor fitted with slip ring rotor.
- Dealing with characteristics of three phase induction motor fitted with slip ring rotor and decide of choosing motor type and its additional resistance.

Course Description (electronic lab):

This course is design to understand the Setting up the Rest Point- Amplifier, Measurement of input resistance and output resistance- Amplifier, Frequency Response of the amplifier, multistage transistor amplifiers, operational amplifier – inverting, non-inverting characteristic, summing operational amplifier, Voltage follower (Buffer), differential operational amplifier.

Recommended Textbook:

- Laboratory Manual, Compiled by Instructor

Pre-requisite:

- EE2308 and EE3326.

Course Topics:

- Experiment # 1: Setting up the Rest Point- CE Amplifier.
- Experiment # 2: Measurement of input resistance and output resistance- CE Amplifier.
- Experiment # 3: Frequency Response of the BJT Amplifier.
- Experiment # 4: Frequency Response of the FET Amplifier.
- Experiment # 5: multistage transistor amplifiers.
- Experiment # 6: Operational Amplifier-inverting and non-inverting Characteristic.
- Experiment # 7: Summing Operational Amplifier and Voltage follower (Buffer).
- Experiment # 8: Differential Operational Amplifier.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Understand the electrical laboratory instrumentation, including multimeters, power supplies, function generators and oscilloscopes.
- Design and conduct experiment as well as to analyze and interpret data.
- Perform fundamental measurements on electronic circuits.
- Understand the format and content requirements for complete technical reporting.
- Understand the frequency response of a BJT and FET amplifier.
- Understand the square-wave testing to determine the frequency response of an amplifier.
- design a complete electronic circuit system using a top-down approach which starts from system specifications,
- model the design using such tools as Multisim and Matlab, test the completed circuit and verify that it meets design specification.

EE3322 EE Lab 32 (2-0-0-4)

This is a required course for the electrical Engineering Program. This course is two labs, ac machine and electronic laboratory.

Course Description (AC machine):

Testing and studying a synchronous machine performance and all tests, load characteristics of synchronous motor and generators, transformers connection and tests in addition of transformer efficiency.

Recommended Textbook(s):

- Laboratory Manual, Compiled by Instructor.

Prerequisites:

- EE3325

Course Topics:

- Connection and rotational direction test of synchronous generator.
- No load characteristics of synchronous generator.
- Load characteristics of synchronous generator.
- Main synchronization and control characteristics of the synchronous generator.
- connection and rotational direction test and load characteristics of synchronous motor.
- V- curve of the syn. Motor.
- Open circuit & short circuit tests of single-phase transformer.
- Polarity making and conversion of two winding transformer into auto transformer.
- Back-to-back test on single phase transformer.
- Regulation and efficiency of three phase transformer by direct load.
- SCOTT connection of transformer.

Course Outcomes:

- Students will attain the ability to deliver effective written communication.
- Students will attain skills in the use of state-of-the-practice facilities and equipment.
- Ability to dealing with synchronous generator its power characteristics.
- understand No load & load characteristics of synchronous generator.
- understand the Mains synchronization and control characteristics of the synchronous generator.
- understand the load characteristics of synchronous motor.
- make the open circuit & short circuit tests of single-phase transformer.
- understand the polarity making and conversion of two winding transformer into auto transformer.
- calculate efficiency of three phase transformer by direct load

Course Description (electronic laboratory):

This course is design to understand the Active filter, the triangle- square wave generator, applying negative feedback on amplifiers, Monostable Circuit, Astable Circuit, voltage regulator and current regulator.

Recommended Textbook:

- Laboratory Manual, Compiled by Instructor

Pre-requisite:

- EE3327

Course Topics:

- Experiment # 1: Active filter.
- Experiment # 2: The triangle- square wave generator.
- Experiment # 3: Class A Power Amplifiers.
- Experiment # 4: Applying Negative Feedback on Amplifiers.
- Experiment # 5: Monostable Circuit.
- Experiment # 6: Astable Circuit.
- Experiment # 7: Voltage Regulator.
- Experiment # 8: Current Regulator.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Understand the electrical laboratory instrumentation, including multi meters, power supplies, function generators and oscilloscopes.
- Design and conduct experiment as well as to analyze and interpret data.
- Perform fundamental measurements on electronic circuits.
- Understand the format and content requirements for complete technical reporting.
- design a complete electronic circuit system using a top-down approach which starts from system specifications,
- design using such tools as Multisim and Matlab, test the completed circuit and verify that it meets design specification.

EE4330 EE Lab 41 (1-0-0-2)

This is a required course for the electrical Engineering Program. This course is two labs, control I and communication I laboratory.

Course Description (Control I Lab.):

This course gives the students an experimental foundation for understanding feedback control systems. The course integrates many experiments, which conclude Mathematical Representation of different types of physical systems, analyzing first and second order systems. Analysis of error signals.

Recommended Textbook(s):

- Laboratory manual. Plus, instructor experiments manual.

Prerequisites:

- EE4332

Course Topics:

- 1. Experiment One: Mathematical Model response for electrical system.
- 2. Experiment Two: Mathematical Model response for mechanical systems
- 3. Experiment Three: Mathematical Model response for electrical machines
- 4. Experiment Four: first Order Systems Analysis.
- 5. Experiment Five: second order Systems Analysis.
- 6. Experiment Six: Steady State Error Analysis

Course Outcomes:

- Understand the control theory and the fundamentals of automatic control engineering
- Develop an experiments bout Mathematical Representation of different types physical systems
- Explain the transit response analysis.
- Explain the different types of error analysis

Course Description (Communication I Lab):

Carrying out various experiments in digital communication modulation schemes using prepared modules. Some modulations schemes are simulated using Matlab.

Recommended Textbook(s):

- Laboratory manual. Plus, instructor experiments manual.

Prerequisites:

- EE3328

Course Topics:

- RF oscillators
- 2nd order filter
- AM-DSB-LC Modulation
- AM-DSB-SC Modulation
- Frequency Modulation
- FDM

Course Outcomes:

- Understand the concepts of filtering, and analog modulation
- conduct experiments, analyze and interpret data.

- deliver effective written communication.
- use modern communication engineering tools, software and equipment to analyze problems.

EE4331 EE Lab 42 (1-0-0-2)

This is a required course for the electrical Engineering Program. This course is two labs, control II and communication II laboratory.

Course Description (Control II Lab):

This course gives the students an experimental foundation for understanding feedback control systems. The course integrates many experiments, which conclude Root Locus, Control system design by the root locus method, Bode diagram, Nyquist stability criterion, PID controller, Analysis of control systems in state space.

Recommended Textbook(s):

- Ogata, K, 2010, Modern control engineering, 5th Edition, Prentice Hall
- Dorf, R.C and Bishop, R.H, 2011, Modern Control systems, 12th Edition Addison-Wesley

Prerequisites:

- EE4333

Course Topics:

- Experiment One: Root Locus plot.
- Experiment Two: NY Quist stability criterion.
- Experiment Three Bode diagram, gain and phase margin.
- Experiment Four: PID controller
- Experiment Five: control system design using root locus (lead and lag compensators).
- Experiment Six: State Space Representation and analysis.
- Experiment Seven: control system design using state space.

Course Outcomes:

- Understand the root locus plot in experimental environments
- Understand the frequency domain analysis
- Represent bode plot and Nyquist stability criteria
- Understand the state space analysis.
- Understand the different types of compensators.

Course Description (Communication II Lab.):

Carrying out various experiments in digital communication modulation schemes using prepared modules. Some modulations schemes are simulated using Matlab.

Recommended Textbook(s):

- Laboratory manual. Plus, instructor experiments manual.

Prerequisites:

- EE3329

Course Topics:

- PCM
- PWM
- TDM
- ASK
- FSK
- PSK
- MPSK

Course Outcomes:

- Understand the concepts of sampling, coding, and digital modulation
- conduct experiments, analyze and interpret data.
- deliver effective written communication.
- use modern communication engineering tools, software and equipment to analyze problems.

EE2310 Electric Circuits I (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is a first course on electric circuits. The course is designed to provide students with an importance for electrical engineering field: Natural and Step Response of RL and RC Circuits, Sequential Switching; Natural and Step Response of Parallel and Series RLC Circuits. Operation Amplifiers. Balanced Three-Phase Circuits, Analysis of circuits (Wye, Delta); Power Calculations. Unbalanced Three-Phase systems.

Recommended Textbook(s):

- Charles K. Alexander, Matthew N. O. Sadiku "Fundamentals of Electric Circuits" Fifth edition.
- James W. Nilsson, Susan A. Riedel "Electric Circuits" Ninth edition

Prerequisites:

- EE1301 and EE1302

Course Topics:

- Response of RL and RC circuits: Natural and step responses of RL and RC circuits. Sequential switching.
  2. Natural and step responses of RLC circuits: Under-damped, critically damped and over-damped responses
- Operational amplifier terminals, terminal voltages and currents, the inverting and non-inverting amplifier circuit, the summing-amplifier circuit, and the difference –amplifier circuit
- Balanced Three-Phase Circuits: 3-P Voltages, 3-P Voltage Sources, Analysis of Y-Δ transformation; Power Calculations and Measurements of Average Power in 3-PCircuits.
  5.Unbalanced Three-Phase systems

Course Outcomes:

- Analyze and determine the complete response of RL, RC and RLC circuits
- Analyze inverting, summing, and noninverting Op amp circuits.
- understand 3-phase system and its power calculation.
- apply delta–wye or wye–delta transformation in Three-Phase Circuits as necessary to simplify circuit analysis.

EE2311 Electric Circuits II (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

This course is a second course on electric circuits. The focus of the course is to impart useful skills on the students to enhance their circuit analysis capability. Hence, the course is designed to provide students with a knowledge on circuit analysis by Introducing the topic and illustrating its importance for electrical engineering field: Laplace transform and relation between current and voltage for resistance, capacitance and inductance, Laplace transform and its applications in electric circuit the concept of magnetic coupling, Analysis of magnetic coupled circuits, Linear transformers, Ideal transformers. Two-port networks and its different equation forms, Evaluation of its parameter, Interconnected two-port networks, Frequency response. High-pass, low-pass, Band pass, and Band-stop filters. Revision and a set of solved examples.

Recommended Textbook(s):

- Charles K. Alexander, Matthew N. O. Sadiku "Fundamentals of Electric Circuits" Fifth edition.
- James W. Nilsson, Susan A. Riedel "Electric Circuits" Ninth edition

Prerequisites:

- EE2310

Course Topics:

- Laplace Transform Analysis of Circuits:
- The Laplace transform and its inverse. Properties: multiplication-convolution, differentiation, initial and final value theorems. Application of Laplace in Circuits in the s-domain: transfer function, impedance, circuit reduction, initial conditions.
- Mutual Inductance and Transformers: Mutual inductance. Coupling coefficient. Analysis of coupled coils. Dot rule. Energy in a pair of coupled coils. Conductively coupled equivalent circuits. Linear transformer. Ideal transformer.
- Autotransformer. Reflected impedance.
- Frequency Response, Filters
- Frequency response. High-pass and low-pass networks. Half-power frequencies. Band-pass filters and Band-stop filters.
- Two-Port Networks
- Terminals and ports, z-parameters. t-equivalent of reciprocal networks. y-parameters.
- Conversion between z and y parameters. h and g parameters. Transmission parameters. Interconnecting two-port networks.

Course Outcomes:

- Understand the basic properties of Laplace transform and its application to electric circuits.
- Analyze electrical networks using complex frequency approach and Laplace transform.
- Apply such approaches to magnetically coupled circuits and two port networks.

EE3317 Electric Power I (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed to introduce elements of power system, generation unit, thermal plants, Hydro plants, Steam plants, nuclear plants. Explain principle of Load factor, capacity factor, transmission line constants, resistance, inductance, single phase two wire, three phase, symmetrical distance, unsymmetrical distance, flat arrangement, horizontal arrangement, hexagonal arrangement. Give an overview of Capacitance, single phase two wire, three phase, symmetrical distance, unsymmetrical distance, flat arrangement, horizontal arrangement, earth effect. Performance design of T.L, short T.L, equivalent circuit, voltage regulation, phasor diagram, Medium T.L, equivalent circuit, voltage regulation, phasor diagram, T model, pi model, Long T.L, equivalent circuit, voltage regulation, phasor diagram.

Recommended Textbook(s):

- W. Stevenson, element of power system analysis, McGraw- Hill Pub., 2005.
- Principles of power system, V.K Mehta, S. Chand & company ltd., 2004.

Prerequisites:

- EE1301, EE1302, EE2310 and EE2311

Course Topics:

- Energy resources, various types of power stations,
- Load factor and capacity factor.
- Constants of transmission line.
- Symmetrical and unsymmetrical distance.
- Flat, horizontal, and hexagonal arrangements.
- Three phase, symmetrical distance, and unsymmetrical distance.
- 7. Performance of transmission line.
- Short transmission line.
- Medium transmission line.
- Long transmission line.

Course Outcomes:

- Explain the basic concept of power generation.
- Explain the electrical power generations methods.
- Understand the electrical design of transmission line.
- Design a transmission line system by applying mathematical methods.

EE3318 Electric Power II (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed to introduce the 2-port network, ABCD constants, power circle diagram, power flow through T.L. Give an overview of Overhead T.L insulators, string insulators, voltage distribution, and corona. Explain Sag and stress calculations, parabola equation, effect of ice and wind, different level supports, economic operation, and underground cables.

Recommended Textbook(s):

- W. Stevenson, element of power system analysis, McGraw- Hill Pub., 2005.
- Principles of power system, V.K Mehta, S. Chand & company ltd., 2004.

Prerequisites:

- EE3317

Course Topics:

- Parameters of 2-port networks
- Load ability and power flow through T.L.
- Mechanical design of O.H.T.L. insulators.
- Voltage distribution on string insulator.
- Sag calculations through same and different supports.
- Corona phenomena study.
- Parameters of underground cables.
- Economic dispatch of power system.

Course Outcomes:

- To understand the 2-port networks parameters.
- To explain the load ability and power flow through T.L.
- To understand O.H.T.L insulators.
- To understand the basic concept of sag calculation
- To understand underground cables.
- To know the principle of economic dispatch of power system.

EE4336 Electric Power III (2-2-2-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed to enable the students to understand of power system analysis for students of the Fourth year in electrical engineering department. The course integrates Power system representation; Per unit system; Balanced and unbalanced faults, Symmetrical fault calculations. Symmetrical components, Unsymmetrical faults; Synchronous machine in power system; Power system load flow problems. Direct methods involving inversion of the nodal admittance matrix, iterative methods Gauss-Seidal method, Newton Raphson method;

Recommended Textbook(s):

- Jonn Grainger, "Power System Analysis", 1994.
- Kothari, "Power System Engineering", second editions. 2008.

Prerequisites:

- EE3317 and EE3318.

Course Topics:

- Introduction of power system
- Power system representation
- Per unit system
- Balanced faults,
- Symmetrical fault calculations.
- Symmetrical components
- Unsymmetrical faults
- Synchronous machine in power system;
- Power system load flow problems
- Direct methods involving inversion of the nodal admittance matrix
- iterative methods Gauss-Seidal method,
- Newton Raphson method.

Course Outcomes:

- Understand the Power system representation.
- Explain the Balanced and unbalanced faults.
- Explain the Symmetrical and Unsymmetrical fault calculations. Symmetrical components.
- Understand the Synchronous machine in power system and its necessity.
- Understand the Power system load flow problems and its analysis methods.

EE2315 Electromagnetic Fields I (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed for students to understand vector analysis, Coulomb's law and electric field intensity, Electric flux density, Gauss's law and divergence, Energy and potential.

Recommended Textbook(s):

- William H. Hayt, Jr and Jone A. Buck "Engineering Electromagnetics" 6th Edition.

Prerequisites:

- EE1201, EE1202 and EE1204

Course Topics:

- Vector analysis, scalars and vectors, vector algebra, the Cartesian coordinates system, vector components and unit vector, the vector field.
- The dot products, the cross product, other coordinates system: circular cylindrical coordinates, the spherical coordinates system.
- The experimental law of Coulomb, Electric field intensity, field due to continuous volume charge distribution.
- Field of line charge, field of a sheet charge.
- Electric flux density, Gauss's law, Application of Gauss's law: some symmetrical charge distributions.
- Application of Gauss's law: Differential volume element, divergence, Maxwell s first equation (Electrostatics filed).
- The vector operator and the divergence theorem.
- Energy expended in moving a point charge in electric field, line integral, definition of potential difference and potential.
- Potential field of point charge, the potential field of a system of charges.
- Potential Gradient, the Dipole, Energy density in the electrostatic field.

Course Outcomes:

- Understand the fundamental of vector concepts and operation.
- Understand the Coulomb's law and electric field intensity.
- Understand the electric flux density, Gauss's law, divergence and the divergence theorem.
- Use Coulomb's law and Gauss's law to find the electric field about many distributions of charge.

EE2316 Electromagnetic Fields II (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed for students to understand current and conductors dielectrics and capacitance, Poisson's and Laplace's equations, the steady magnetic field, Magnetic forces, materials and inductance, Time-varying fields and Maxwell's equations.

Recommended Textbook(s):

- William H. Hayt, Jr and Jone A. Buck "Engineering Electromagnetics" 6th Edition.

Prerequisites:

- EE2315

Course Topics:

- Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, semiconductors.
- The nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance.
- Poisson and Laplace equations, derivation of Poisson and Laplace equations, examples of solution of Poisson and Laplace equations.
- Biot- Savart law, Ampere law, curl.
- stokes theorem, magnetic flux and magnetic flux density, the scalar and vector magnetic potentials
- Derivation of the steady –magnetic field laws, force on moving charge, force on differential current element, force between differential current element, force and torque on a closed circuit.
- The nature of magnetic materials, magnetic boundary conditions, the magnetic circuit, potential energy and forces on magnetic materials.
- Faraday law, displacement current.
- Maxwell equation in point form, Maxwell equation in integral form, the retarded potentials.

Course Outcomes:

- Understand the current and current density and continuity of current.
- Understand the metallic conductor, conductor properties and boundary conditions and semiconductor.
- Understand the dielectric materials and capacitance.
- Understand the relationship between the potential and electric fields.
- Use Laplace and Poisson equations to find potential fields within regions bounded by the charge density.
- Understand the steady magnetic field.
- Understand the magnetic force, materials and inductance.
- Understand the time-varying field and Maxwell equations.

EE3326 Electronics I (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Multistage and compound Configurations, Amplifier frequency response. Differential amplifier, Application to CMOS and BIMOS circuits, Operational amplifier Characteristics, Op -Amp applications: Constant-Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Comparator, Log and antilog amplifiers, Active Filters.

Recommended Textbook:

- R. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", 11th ed, 2013.
- Thomas L. Floyd, "Electronic devices: electron flow version". 9th ed.

Pre-requisite:

- EE2309, EE1302 and EE2310.

Course Topics:

- Multistage Amplifier, Darlington connection.
- Current Mirror circuits, Current source circuits.
- Amplifier Frequency Response.
- Low-Frequency Response – BJT and JFET Amplifier.
- High-Frequency Response – BJT and JFET Amplifier.
- Multistage Frequency Effects.
- Differential Amplifier Circuits, BIMOS and CMOS Differential Amplifier circuits.
- Operational Amplifiers Basics.
- Operational Amplifier (op-amp) Circuits: Inverting and non-Inverting amplifier, Summing amplifier, Integrator and Differentiator.
- Op-Amp Specifications – DC offset parameters and Frequency parameters.
- Differential and common – mode operation.
- Op-Amp Applications: Multiple – stage gains, Voltage Subtraction, Voltage Buffer.
- Controlled Sources, Instrumentation Circuits.
- Voltage Comparator, Log and antilog amplifiers.
- Active Filters: low – pass filter, High – pass filter and Band pass filter.

Course Outcomes:

- Apply knowledge of mathematics, science, and engineering to the analysis and design of electronic circuits (Multistage Amplifier, Current source, Amplifier Frequency Response, Operational Amplifier and Active Filters,).
- identify, formulate, and solve engineering problems in the area circuits and systems.
- use the techniques, skills, and modern engineering tools such as Multisim, necessary for engineering practice.
- conduct experiments, as well as to analyze and interpret data.
- function on multi-disciplinary teams.

EE3327 Electronics II (3-3-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Power Amplifiers: Definitions and Amplifier Types. Feedback Circuits: Feedback Concepts, Feedback Connection Types. Linear Oscillators: Basic Principles of Sinusoidal Oscillators, Positive Feedback and Oscillation, The Oscillation Criterion. RC Oscillator: RC Phase-Shift Oscillator and Wien-Bridge Oscillator. LC and Crystal Oscillator. Non-Sinusoidal Oscillators and Tim Circuits. Wave shaping of function generator, Monostable Multi-vibrator, Astable Multi-vibrator. Power Supplies (Voltage Regulators) and Practical Applications.

Recommended Textbook:

- R. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", 11th ed, 2013.
- Thomas L. Floyd, "Electronic devices: electron flow version". 9th ed

Pre-requisite:

- EE3326 and EE2311

Course Topics:

- Power Amplifiers: Definitions, Amplifier Classes and Efficiency.
- Class-A, Class-B Class-AB, and Class-C amplifiers.
- Feedback Circuits: Feedback Concepts. Feedback Connection Types.
- Practical Feedback Circuits: Voltage –shunt, Voltage- series configuration.
- Practical Feedback Circuits: Current –shunt, Current - series configuration.
- Linear Oscillators: Principles of Sinusoidal Oscillators, Positive Feedback & Oscillation,
- RC Phase-Shift Oscillator and Wien Bridge Oscillator.
- LC Oscillator, Crystal Oscillator.
- Wave shaping of function generator.
- Monostable Multi-vibrator.
- Astable Multi-vibrator.
- Power Supplies (Voltage Regulators) and Practical Applications.
- Discrete Transistor Voltage Regulation.
- IC Voltage Regulators.

Course Outcomes:

- apply knowledge of mathematics, science, and engineering to the analysis and design of electronic circuits (Power Supplies, Feedback Circuits, Oscillators and Multi-vibrator).
- identify, formulate, and solve engineering problems in the area circuits and systems.
- use the techniques, skills, and modern engineering tools such as Multisim, necessary for engineering practice.
- conduct experiments, as well as to analyze and interpret data.
- function on multi-disciplinary teams.

EE3210 Engineering Economy (3-3-0-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Principles of Engineering Economy. Equivalence and compound interest formula. Single payment model. Uniform payment model. Gradient payment model. Decision criteria for single and multiple alternatives: Present worth, annual worth, future worth, internal rate of return, and benefit cost ratio. Before and after-tax analysis.

Recommended Textbook(s):

- Leland Blank and Anthony Tarquin, Engineering Economy, McGraw-Hill, 6th ed., 2005.

Prerequisites:

- EE1202

Course Topics:

- 1.Introduction: Investment Explained.
- Interest and Financial Mathematics. Simple interest. Compound interest. Graphical Conventions
- 3.Single Payment. Uniform Series. Arithmetic Gradient.
- Nominal and Effective Interest Rates.
- Interest and Principal Separation.
- Present Worth Analysis. Present Worth Analysis.
- Investment in Bonds.
- Use computer software (MS Excel) to perform basic economic analyses.
- Annual Worth Analysis.
- 10 Rate of Return Analysis3.
- Analysis of Public Projects. The Benefit-Cost-Analysis.
- Depreciation Methods
- Depreciation Analysis using Computer software (MS Excel).
- Income Taxes. After tax analyses.
- Effects of Inflation, Loans.
- Breakeven Analysis.

Course Outcomes:

- Understand the basic concepts and terminology used in engineering economics. This includes single payment, uniform series, arithmetic gradient, and nominal and effective interest rates.
- Evaluate alternatives based on
- Present worth analysis
- Annual worth analysis
- Benefic/Cost analysis
- Internal rate of return analysis
- Calculate depreciations and understand the impact of inflation
- Apply computer software to perform economic analyses
- Perform before and after-tax analysis
- Perform breakeven analysis for a single project and between two alternatives
- Explain the economic impact of engineering solution.

EE4338 Final Year Project I (3-3-0-0)

EE4339 Final Year Project II (3-3-0-0)

EE1302 Fundamentals of Electrical Engineering II (4-3-1-2)

This is a required course for the Electrical Engineering department.

Course Description:

Capacitors, Inductors, series and parallel connection, AC circuit analysis, sinusoidal review, complex numbers, sinusoidal circuits, impedance and admittance, series and parallel connection and phase relation in Sinusoidal Circuits, Phasor Diagram, More Sinusoidal Circuits, instantaneous, average, apparent power and power factor and reactive power, complex power and power triangle, RMS values, maximum power transfer in sinusoidal circuits. Resonance in AC Circuits, Magnetic Circuits.

Recommended Textbook(s):

- Alexander and Sadiku "Fundamentals of Electric Circuits" Third Edition McGraw Hill.
- Boylestad, R. L., Introductory Circuit Analysis (10th Edition).

Prerequisites:

- EE1202 and EE1301

Course Topics:

- Sinusoidal sources and phasor representation
- Sinusoidal Circuits
- Impedance and Admittance
- Series and Parallel connection and phase relation in Sinusoidal Circuits
- Phasor relationships for circuit elements
- Series/parallel AC circuit analysis
- Apply nodal and mesh analysis. Use Thevenin's theorem and Maximum power transfer and superposition theorems for circuit analysis. to solve AC circuits
- Apply superposition and source transformation methods to solve AC circuits
- Instantaneous, Average, Apparent Power
- Power Factor and reactive power
- Complex Power
- RMS Values, Maximum power transfer in sinusoidal circuits
- Conservation of AC Power
- Power Factor Correction
- Resonance in series and parallel circuits
- Magnetic field, series and parallel magnetic circuits.

Lab. Section:

DC experiments

- Introduction to lab. Instruments.
- Ohm's law for linear and nonlinear circuit.
- Kirchhoff's current and voltage law
- Superposition theorem
- Thevenin's and Norton's theorem.

AC experiments

- Introduction to The Cathode Ray Tube C.R.T.
- Frequency and phase measurement using C.R.T.
- Impedance element characteristics.
- The series resonant circuit.

- The parallel resonant circuit.

Course Outcomes:

- Understand the concept of phasors.
- Solve series/parallel AC circuits.
- Apply Methods of Analysis and Circuit Theorems to solve AC circuits
- Be familiar with concepts Instantaneous, Average, Apparent Power
- Understand the Power Factor, reactive power, Complex Power,
- Understand the RMS Values, Maximum power transfer in sinusoidal circuits
- Understand the Conservation of AC Power
- Understand the methods that make the power factor closer to unity
- Solve series/parallel Resonance circuits.
- Understand the Magnetic Circuits

Lab. Section:

- Study the relation between voltages for linear and nonlinear elements
- Understand the connection series/parallel DC circuits
- Apply Kirchhoff's current law and Kirchhoff's voltage law
- Apply Superposition theorem
- Apply Thevenin's Theorem and Norton's theorem for DC circuits
- Understand the cathode ray tube C.R.T
- Understand the Frequency and phase measurement using the cathode ray tube C.R.T
- Analyze electric circuit using simulation software.

EE2308 Fundamentals of Electronics I (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

Semiconductor Materials and PN Junction: Forward biased, Reversed biased, and I-V Relationship. Diode and Zener diode circuits: DC analysis, models and applications. Bipolar junction transistor. Transistor Structure, and I-V Relationship. DC-Biasing BJT and Basic transistor applications: Switch, Digital Logic, etc. Field Effect Transistors (FETs): Structure and Operation of JFET P-Channel, N-Channel, Enhancement-Mode, Depletion-Mode MOSFETs.

Recommended Textbook:

- Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 11th edition, Pearson, 2013.

Pre-requisite:

- EE1302 and EE1201

Course Topics:

- PN junction (Diode) physics and I/V Characteristics
- Diode models and circuit analysis
- Diode applications (Rectifier, Limiters, Clampers, Power Supply)
- Zener diode Characteristics and Application
- BJT structure and physical operation
- BJT I/V Characteristics and different operating regions.
- BJT DC analysis
- JFET structure and physical operation
- JFET I/V Characteristics and different operating regions.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Apply mathematics, science, and engineering to analyze and design electronic circuits
- Identify, formulate, and solve engineering problems in the area circuits and systems.
- Identify and characterize different semiconductor devices (P-N Junction and BJT)
- explain different diode and transistor applications (clipping, clamping, amplifier, ...)
- Analyze and design different electronic circuits contain semiconductor devices using devices' models.
- understand the design parameters and different characteristics of small signal BJT amplifiers.

EE2309 Fundamentals of Electronics II (2-2-1-0)

This is a required course for the Electrical Engineering Program.

Course Description:

small signal analysis of BJT circuits of transistor. Field effect Transistor (JFET), DC and small signal analysis of JFET circuits, MOSFETs, DC circuit analysis of Depletion and Enhancement MOSFETs and JFETs. Basic MOSFET applications, Switch, Digital Logic Gates, and Amplifiers.

Recommended Textbook:

- Boylestad and Nashelsky, "Electronic Devices and Circuit Theory", 11th ed., 2013.

Pre-requisite:

- EE2308

Course Topics:

- Small signal analysis of BJT Circuits.
- JFET DC biasing and analysis
- JFET as an amplifier and small signal analysis
- Depletion-Type MOSFET, Enhancement-Type MOSFET Operation
- MOSFET Handling.

Course Outcomes:

After successfully completing the course, the students will be able to:

- Apply mathematics, science, and engineering to the analyze and design electronic circuits
- Identify, formulate, and solve engineering problems in the area circuits and systems.
- Identify and characterize different semiconductor devices (P-N Junction, JFET, and MOSFET)
- Understand different type of diode and JFET transistor applications.
- Perform a dc and small Signal analysis of JFET, MOSFET, and MESFET networks.
- Analyze and design different electronic circuits contain semiconductors using devices' models.
- Understand the design parameters and different characteristics of small signal amplifiers.

EE4334 Information Theory (2-2-0-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course will cover the following topics: Information Presentation and Information Sources, Measures of Information, Entropy and Information, Entropy Ergodic Theorem, Information Rate, Channel modeling, Introduction to Coding, Channel Coding, Source Coding, Coding for Noisy Channels, Block Codes, Convolutional Code, Optimal Error Correction Codes

Recommended Textbook(s):

- Glavieux, “Channel Coding in Communication Networks”, ISTE, 2007
- Viterbi, and Omura, “Principles of Digital Communication and Coding”, 1979.
- Ash, “Information Theory”, 1966.

Prerequisites:

- EE3328, EE3329

Course Topics:

- Elements of a digital communication system.
- Measure of Information content of a message.
- Entropy & Mutual Information,
- Marko statistical model for information source.
- Markov source. Encoding of the source output.
- Shannon's Encoding Algorithm.
- Huffman Encoding Algorithm.
- Fano Encoding Algorithm. communication channels: capacity of discrete memoryless channel, capacity of physical channel, optimum decision level.
- error correction & detection: linear block codes, cyclic codes, convolutional codes.

Course Outcomes:

- understand and compute measures of information
- understand and calculate Entropy and Information Rate
- Design a code and perform channel coding
- Design a code and perform source coding
- Define and use RS error correction codes.

EE4337 Power Electronics (2-2-2-0)

This is a required course for the Electrical Engineering department.

Course Description:

Power Semiconductor Devices: Power Diode, Thyristor, Diac, Triac, BJT Transistor, MOSFET. AC/DC converters (Rectifier), Uncontrolled and Controlled Half and Full wave Rectifier. DC/DC Convertor (Choppers), DC/AC Convertor (Inverters), AC/AC Convertor (Cyclo-converters). Static Switches.

Recommended Textbook:

- M. H. Rashid; "Power Electronics: Circuits, Devices & Applications", 3rd Ed, 2008.

Pre-requisite:

- EE2308 and EE2309

Course Topics:

- Introduction of Power Electronic.
- Overview of power semiconductor devices: Diodes, Thyristors, BJT, MOSFET, IGBT.
- Rectifiers: Single-phase and three-phase diode rectifiers with different types of loads, Average power output, Performance parameters, Harmonic analysis.
- Switch-mode DC-DC converters: Design, analysis and control of Step-down (Buck), Step-Up (Boost), Buck-Boost.
- Switch-mode DC-AC converters: Basic inverter concept, Sinusoidal PWM.
- Voltage Controllers (AC – AC Converters).

Course Outcomes:

- Explain the static and dynamic characteristics of fundamental power semiconductor devices.
- Explain the working principle of uncontrolled rectifiers and calculate the performance parameters from the average, RMS and peak values of the related circuit parameters.
- Calculate harmonics in the output and input currents for rectifier operations.
- Design and analyze various types of switched-mode DC converters.
- Explain the control of power converters using pulse-width modulation (PWM).
- describe the basic working principle of switch-mode inverters,
- Simulate simple power electronic circuits using simulation packages like Multisim.
- Conduct experiments with converters and compare the results with theoretical concepts and simulations.

EE3319 Signals and Systems I (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course introduces the fundamentals of the continuous signals and systems. It studies the linear time-invariant (LTI) systems and their impulse response, convolution, and correlation. The Fourier transform, and series of continuous signals and systems are also studied. The course teaches the frequency response and its applications in the electrical systems and signals communication. The types and designs of analog filters in Fourier domain are presented.

Recommended Textbook(s):

- Oppenheim; Willsky; Hamid; "Signals and Systems" 2nd ed.
- Hsu; "Schaum's Outline of Signals and Systems" 3ed.

Prerequisites:

- EE2209

Course Topics:

- Signals and Classification of Signals. Continuous-Time Signals. Systems and Classification of Systems.
- Response of a Linear Time-Invariant Systems. Convolution.
- Fourier Analysis of Continuous-Time Signals and Systems: Fourier Series and Transform. Frequency Response of Continuous LTI Systems.
- Selected types and designs of analog filters in Fourier domain.

Course Outcomes:

- Understand the basic types of analog signals and systems.
- Understand the causality and stability of continuous LTI systems.
- Understand and deploy the Fourier transform/series of continuous-time signals and Systems in the electrical engineering.
- Understand the principal of filtering in frequency domain.

EE3320 Signals and Systems II (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course introduces the fundamentals of the discrete signals and systems. It studies the linear time-invariant (LTI) discrete systems and their impulse response, convolution, and correlation. The Fourier transform, and series of discrete signals and systems are also studied. The course introduces the z-Transform and its applications in the electrical systems and signals communication.

Recommended Textbook(s):

- Oppenheim; Willsky; Hamid; "Signals and Systems" 2nd ed.
- Hsu; "Schaum's Outline of Signals and Systems" 3ed.

Prerequisites:

- EE3319

Course Topics:

- Discrete-time signals, and systems.
- Response of a discrete Linear Time-Invariant Systems. discrete convolution.
- Fourier Analysis of discrete-Time Signals and Systems: Fourier Series and Transform. Frequency Response of discrete LTI Systems.
- The z-Transform. z-Transforms of Some Common Sequences. Properties of the z-Transform. The Inverse z-Transform.

Course Outcomes:

- Understand the basic types of discrete signals and systems.
- Understand the causality and stability of discrete LTI systems.
- Understand and deploy the Fourier transform/series of discrete -time signals and Systems in the electrical engineering.
- Understand and deploy the z-transform.

Department Elective Classes

EE4344 Antennas (2-2-1-0)

This is an elective course for the Electrical Engineering department.

Course Description:

This course covers: Single element radiators, Aperture, printed, Printed Slot Antennas, Horn, Reflector Antennas, Array Antennas, Antenna Radiation Pattern Measurements, Antenna polarization, Directivity and gain of antennas, Low power hand held antennas.

Recommended Textbook(s):

- John D. Kraus, and Ronald J. Marhefka, "Antennas for All Applications"

Prerequisites:

- EE2315 and EE2316

Course Topics:

- Antenna, antenna parameters.
- The isotropic and point radiators.
- The Hertizian dipole.
- Gain.
- polar diagram.
- radiation resistance.
- Directivity and radiation solid angle and beam width.
- Short dipole and monopole.
- half wave dipole and monopole small loop antenna.
- Thin liner antenna &current distribution.
- Wire antennas (drive & plot).
- Antenna polarization.
- polarization mismatch factor.
- Receiving antenna and antenna aperture and application.
- Folded monopole & dipole.
- Array of two driven point radiators antenna.
- Broad side and end fine arrays.
- Yagi antenna, Slot antenna.
- Microwave antennas, horn & parabola.
- Helix & helical beam antenna.
- reflector antenna, types of feeding.
- Lens antennas, Antenna losses.

Course Outcomes:

By the end of the course the student will be able to

- Understand antenna fundamentals as well as the application of the electromagnetic theory in antennas.
- Understand antenna parameters and some applications such as antenna polarization, antenna application in communication links, radars and satellites.

EE4343 Digital Electronics (2-2-1-0)

This is an elective course for the Electrical Engineering Program.

Course Description:

This course is designed to enable the students to understand the Digital Electronics circuits. The course concerned with design and implementation of digital circuits using finite state machines (synchronous and asynchronous), Studying various types of digital to anlage (D/A) and analog to digital (A/D) convertors. Knowing the characteristics and types of different logic families, studying the construction and types of Semiconductor memories and programmable logic devices.

Recommended Textbook(s):

- M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
- S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006.

Prerequisites:

- EE2304 and EE2305.

Course Topics:

- Design and analysis of synchronous state machines: Finite state machine principles, Mealy and Moors model, state diagram and table derivation; reduction of state table (implication chart); state assignments, circuit realization using flip-flops, analysis of synchronous state machines
- Design and analysis of asynchronous state machines: state diagram and flow-table derivation, minimization of flow-table (implication chart reduction and merging process); state assignments. timing problems (racing, static and essential hazards), circuit realization using latches analysis of asynchronous state machines.
- D/A and A/D converters: principles and design, types of error in ADC's and DAC's, D/A converters (weighted-resistors DAC, R-2R ladder DAC's), A/D converters (single and dual slope ADC, successive approximation ADC, stair step ramp ADC, tracking ADC, Simultaneous or Flash A/D Converters, Counter-Type A/D Converter)
- Logic families: characteristics and types of digital integrated circuits (IC), transistor-transistor logic (TTL), emitter-coupled logic (ECL), CMOS logic families (CMOS, PMOS, NMOS), injection integrated logic (I2L), interfacing between different logic families
- Semiconductor memories: memory classification, memory architecture, Read Only Memory (ROM), programmable ROM (PROM), erasable PROM (EPROM) electrically EPROM (E2PROM), static RAM, dynamic RAM
- Programmable logic devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA). Generic Array logic (GAL), Programming Languages (VHDL Hardware Description Language).

Course Outcomes:

- Understand the steps and the procedures for designing and analyzing synchronous and asynchronous state machines.
- Understand the methods of conversion between digital and analog signals using different types of D/A and A/D convertors.
- Understand the various types of logic families and learning the methods of connection between them.
- Understand the construction, types and characteristics of digital memories.
- Understand the various types of programmable logic devices.

EE4340 Digital Signal Processing (2-2-1-0)

This is an elective course for the Electrical Engineering department.

Course Description:

This course introduces the digital signal processing. It describes designs and implementations of digital filters. The DFT and FFT algorithms are also discussed.

Recommended Textbook(s):

- Oppenheim; "Discrete-Time Signal Processing", 3rd edition

Prerequisites:

- EE3320

Course Topics:

- Review of discrete time signals and systems in time and frequency domains.
- Discrete Fourier transform, and Fast Fourier transform.
- Digital filters: design techniques for digital filters, recursive and non-recursive filters, effect of finite word length, applications.
- System stability through pole and zero locations.

Course Outcomes:

- Understand the principles and importance of the digital signal processing techniques in the modern technologies.
- Understand and analyze the discrete system performance.
- Apply the filter design methods to create digital filters.
- Understand the differences between the FIR and IIR implementations.
- Understand the effect of poles/zeros locations on the system stability.
- Understand the FFT algorithm and its importance.

EE4346 Fiber Optics Communication (2-2-1-0)

This is an elective course for the Electrical Engineering Department.

Course Description:

Find solutions to the problems of signal attenuation, signal dispersion in the optical fiber. Calculation of power loss as light travels along distances. Explain the concept of light modulation and the effect of low power received by optical detector on the overall system performance. Selection and use of mathematical function to calculate the signal to noise ratio at receiver.

Recommended Textbook:

- Govind P. Agrawal, "Fiber-Optic Communications Systems", 3rd ed. 2002.
- Gred Kesier, "Optical Fiber Communications", 3rd ed. 2012.
- T. Schneider, "Nonlinear Optics in Telecommunications". 2004.

Course Topics:

- Introduction of fiber optics communication.
- Ray Transmission Theory, Total Internal Reflection, Acceptance Angle and Numerical Aperture.
- Modes Theory for Optical Fiber, Normalized Frequency (V number), Number of Modes (M) and Cutoff Wavelength $\boldsymbol{\lambda c}$
- Optical Fiber Types, Step Index Fibers, Graded Index Fibers, Single Mode Fiber.
- Transmission Characteristic of Optical Fibers.
- Attenuation, Absorption Losses in Silica Glass Fibers, Linear Scattering Losses, Nonlinear Scattering Losses, Bending Losses.
- Dispersion.
- Optical Sources.
- General Characteristics of Optical Sources and Materials.
- Light Generating Mechanism, Spontaneous and Stimulated Emissions.
- Light Emitting Diodes LEDs. Modulation Bandwidth.
- Optical Detectors. Optical Amplifier.

Course Outcomes:

- Understand advanced concepts in optical communications for students, like theory of light propagation within optical waveguide, optical fiber types etc.
- Understand some theoretical preparation to work in the field of optical fiber communications.
- Apply physical fundamentals of light wave propagation inside optical fiber.
- Understand the theory and operation of optoelectronics devices and their applications in solve engineering problems.

EE4347 Fundamentals of Renewable Energy Systems (2-2-1-0)

This is an elective course for the Electrical Engineering Program

Course Description:

This course is designed to give historical background, advantages, and disadvantages of hydropower energy, geothermal power, power from waste, wind power, photovoltaic, and solar thermal power. Introduction to PV power; PV cell, module and array, equivalent electrical circuit, open-circuit voltage and short-circuit current, I-V and P-V curves, peak-power operation, PV system components, and PV stand-alone system. Introduction to wind power, wind speed and power relations, power extracted from wind, wind system components, maximum power capture, maximum power operation, and wind stand-alone system.

Recommended Textbook(s):

- Renewable Energy Focus Handbook, first edition 2009, Academic Press is an imprint of Elsevier.
- Mukund R. Patel, "Wind and Solar Power Systems Design, Analysis, and Operation", Second Edition, 2006 by Taylor & Francis Group.

Prerequisites:

- EE4337

Course Topics:

- Various types of power generation, advantages, and disadvantages.
- Introduction to the basic concept, equivalent electrical circuit, modeling, and component of PV power.
- Introduction to the basic concept equivalent electrical circuit, modeling, and component of wind power.

Course Outcomes:

- understand the necessity of renewable energy systems compared with the conventional power sources.
- understand the basic concepts of hydropower energy, geothermal power, power from waste, wind power, photovoltaic (PV), and solar thermal power.
- understand the principles, modelling, and design of photovoltaic and wind power systems.

EE4342 Micro-Controllers (2-2-1-0)

This is an elective course for the Electrical Engineering Program.

Course Description

implementation. It includes embedded system types, microcontroller architecture, programming, I/O interfacing, task scheduling, design and develop an embedded system based on a single-chip microcontroller. Interrupt management and other related topics

Recommended Textbook(s):

- J. Peatman, "Embedded Systems Design with the PIC18F452 microcontroller", 2003.

Prerequisite: EE1205

- EE2304 , EE2305, EE2309, EE2311, EE3327

Course topics:

- Introduction to Microcontrollers
- Microprocessor and Microcontroller
- Micro-PIC Family Architecture,
- program Languages and Instruction Set
- Microcontroller Programming: Program Developing.
- Memory Interfacing
- I/O interfacing
- Timer Operations
- Serial Port Operation
- Multi-processor communications
- Interfacing to external devices
- Examples of Microcontrollers application

Course Outcomes:

Upon successful completion of this course module students possess advanced knowledge, skills and competences in the subject of Microcontrollers and Embedded Systems that enable them to:

- Demonstrate knowledge and understanding of the fundamental principles embedded systems design, explain the process and apply it.
- Demonstrate knowledge and understanding of the microcontroller technology both for hardware and software
- Design embedded systems based on microcontrollers
- Describe the internal architecture of microcontroller systems, including counters, timers, ports, and memory
- Demonstrate knowledge and understanding of Hardware/Software co-design techniques for microcontroller embedded system
- Program microcontrollers in C using Integrated Development Environments
- Understand and classify microcontrollers' peripherals; know, understand and explain low-power technology and Interrupt mechanisms
- Design and implement a complete embedded system as a project.

EE4341 Micro-processors (2-2-1-0)

This is an elective course for the Electrical Engineering Program

Course Descraption:

This course cover the following subjects: Computer based microprocessor, and internal architecture of 8086 µp. Recognize the modes of operation, addressing modes, programming models and instruction sets. The course also designated to give the student the 8086 hardware specifications, memory interface, basic I/O interface, interrupts. System programming-based software interrupts (BIOS, DOS), basic programmable peripheral interface.

Recommended Textbook(s):

- Barry B. Brey. ‘’Intel Microporcessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and pentium Pro processor. Architecture, programming, and Interfacing’’, fourth Edition, Prentice Hall.
- Walter A. and Avtar Singh‘’The 8088 and 8086 Microprocessors: Programmimg, Interfacing, Software, Hardware and Applications’’, Prentice Hall.
- Muhammad Mazid, “The 80X86 IBM PC and Compatible Computers: Assembly Language”
- Design, and Interfacing’’ Volumes I&II”, Prentice Hall.

Pre-requisite:

- EE2304 and 2305

Course Topics:

- Introduction to micro-processor and microcomputers.
- Micro-architecture of 8086 µp: Functions of Bus Execution Unit (BEU), Functions of Execution Unit(EU)
- Addressing Modes of 8086 µp, Software Model of 8086 µp.
- Operations Modes of 8086 µp, Memory address space: data organization, data types,
- Segment registers and memory segmentation.
- instructions set of µp.
- Develop programs & codes using instructions set,
- 8086 µp assembly language programming: computations Programming & instructions of Control-Flow instructions,
- Subroutines & subroutine handling instructions Loop & String handling instructions & Flag control instructions set.
- Assembly programming based MASM.
- Interrupts interface of 8086 µp: Types of Interrupts, and interrupt instructions handling
- System programming-based software interrupts (BIOS, DOS).
- Bus interface, memory interfacing.
- Input output interface, I/P address decoding, and programmable peripheral interface.

Course Outcomes:

Upon completion of this course the student will be able to:

- Describe the function of µp and details about its operation.
- Draw the block diagram of computer system and explain the purpose of each block.
- Describe the function and purpose of each program register in 8086µp.
- Explain the operation of each data-addressing mode, and each program memory addressing mode.
- Select the appropriate addressing mode to accomplish a given task.
- Explain the operation of each type of instruction set.

- Explain the purpose of assembly language and keywords.
- Select the appropriate assembly instruction set to accomplish a specific task.
- Develop programs using DOS and BIOS functions call.
- Describe the function of each 8086 pin and interpret the timing diagram.
- Explain how to interface RAM and ROM to a μp.
- Explain the operation of basic input and output interfaces.

EE4348 Power System Analysis (2-2-1-0)

This is a required course for the Electrical Engineering department.

Course Description:

This course is designed to enable the students to understand of power system analysis for students of the Fourth year in electrical engineering department. The course integrates Power system stability; Study of protection of power system generation, transmission and distribution. Study of important parts of system protection. explanation of grounding system. Introduction of distribution system. High voltage DC transmission system performance.

Recommended Textbook(s):

- Jonn J. Grainger, Power System Analysis, 1994.
- D. P. Kothari, Power System Engineering, second editions. 2008.

Prerequisites:

- EE3317, EE3318 and EE4336

Course Topics:

- Introduction of Power System Stability.
- Study Stat Stability, Transient Stability, Dynamic Stability.
- General Concepts of Power System Protection.
- Generator Protection.
- Transformer Protection.
- Transmission Line Protection.
- Different Types of Relay Construction and Operation.
- Grounding Types.
- Power System Distribution.
- Earthing System.
- HVDC.

Course Outcomes:

- understand the power system analysis.
- understand the power system stability and its calculations.
- understand the Power System Protection with all applications.
- understand the Grounding and Earthling system and its necessity.
- understand the Power System Distribution.
- understand the HVDC transmission system.

EE4345 Programmable Logic Controller (2-2-1-0)

This is an elective course for the Electrical Engineering Program

Course Descraption:

Understand the fundamentals Programmable Logic Controllers systems. Identify the types of PLC communications and network systems. Design, edit, test, and document PLC Ladder Logic Programs. Diagnose and troubleshoot PLCs using Rockwell's A.I. and R.S. Series software. Specify safety consideration for personnel, field devices and automated equipment.

Recommended Textbook:

- Clements-Jewery, Keith, "The PLC Workbook: Programmable logic controllers made easy". 1996.
- Petruzella, Frank D. "Programmable Logic Controllers", 2nd ed., 1998.

Pre-requisite:

- EE2304 , EE2305, EE1205, EE2309, EE2311, EE3327

Course Topics:

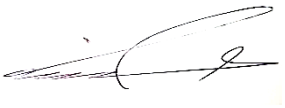
- PLC basis elements, construction, application
- Differential programming methods
- PLC choosing
- PLC system technology and architecture
- Main units: CPU, Inputs, Outputs, Memory, etc
- Communication with PLC
- Network of PLC
- MODBUS system
- Product catalogues
- Troubleshooting, reliability
- Debugging
- Investigates methods of programming PLCs
- PLC-5 Hardware Components. And Programming PLC-5 Systems.
- Programming PLC (Programming SLC-500 Systems, and PLC-5 Systems),

Course Outcomes:

- Manipulate basic elements of PLC components.
- Understand the differnets programming methods.
- Identify the basic properties of PLC architecture.
- Recognize different types of communications techniques with PLC.
- Deploy focusing on the PLC networks.
- Investigate the methods of programming PLC.
- Work productively with peers on the various PLC Hardware Components. And Programming Systems.

Committee Signatures

اللجنة المشرفة على تحديث منهج قسم الهندسة الكهربائية للعام 2018



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