Chapter Three:

A B. Sc. Program in Communications and Computers Engineering (CCE) with Credit Hours System

1. INTRODUCTION

The Communications and Computers Engineering program offers a sophisticated specialization for those who want to combine the specialty of Electronics, Communications Engineering, Computer Engineering and Control Systems as it provides a balanced mix of communications and computers and this mix has become necessary for the presence of computers as essential components in many areas of electronics and for the needs of computer industries and for engineers to be able to deal with Hardware and software design. This is also in line with the knowledge economy and the dynamic nature of specialization. Each branch has become a stand-alone industry such as the software industry, electronics industry,telecommunications technology industry, computer network technology industry, and control systems industry.This specialization is considered one of the modern specializations on the international level, where the department grants a bachelor's degree to graduates in communications and computers engineering after preparing them with a comprehensive curriculum according to NARS 2018 standards. It also explores new areas in communications and computers engineering where the program integrates knowledge in different areas of design, the computer parts' applications, computer programs, communication networks' connections, the optical communication basics, satellites and microwave communications, as well as areas of computer visions.

2. The Bachelor of Science in Communications and Computers Engineering Program

2.1 CCE Program Vision

Achieve leadership in the field of communications and computers engineering and gain the confidence of the local and regional community in the program graduates.

2.2 CCE Program Mission

The Computer and Communications Engineering program at Mansoura University aims to prepare scientifically qualified and professional engineers in the fields of communications and computer engineering, able to compete in the local and regional labor market and conduct scientific research to serve the community and develop the environment.

2.3 CCE Program Objectives

A. In-depth knowledge: Acquire in-depth knowledge of the requirements of mathematics and natural sciences
B. Broad specialized science: Acquisition of specialized science for communications engineering, including knowledge of various contemporary engineering issues related to disciplines.
C. Professional: Use practical and managerial skills to design systems, conduct experiments, analyze data, manage projects, identify and solve engineering problems necessary for productive occupations in the public and private sectors, or to pursue higher education.
D. Professionalism: Identify communication, presentation and language skills to ensure effective communication, demonstrate professional and ethical responsibilities, and engage in lifelong self-learning so that graduates are prepared for a modern and complex work environment
E. Creativity: Providing an environment that enables students to pursue their goals in an innovative,
F. rigorous, developed and supportive program.

2.4. The following are the aimed graduate attributes.

A. Apply knowledge of mathematics, science and engineering.
B. Design and conduct experiments as well as analyze and interpret data.
C. Design a system, component or process to meet desired needs.
D. Communicate and work effectively within multi-disciplinary teams.
E. Identify, formulate and solve engineering problems.
F. Acquire professional and ethical responsibility.
G. Use Broad education necessary to investigate the impact of engineering solutions in a global-societal context.
H. Recognize the ability to engage in life-long learning.
I. Acquire knowledge of contemporary issues.
J. Use the techniques, skills and modern engineering tools necessary for engineering practice.
K. Acquire Leadership qualities and business adminstartion
L. Design, operate, analyze and maintain different communication systems
M. Designing and simulating different applications using computers and mobile phones

2.5 Graduate Competencies in Accordance with the National Academic Standards

According to NARS 2018, a graduate must be able to:

A1. Be able to define, configure and solve complex engineering problems

A2. Develop, analyze and evaluate results of experiments, simulations and use statistical analysis to extract results

A3. Applying engineering design processes to produce innovative solutions at low cost to meet the needs of society

A4. Optimal utilization of contemporary technology, health and safety requirements and principles of crisis management

A5. Implementing research techniques as an integral part of learning

A6. Planning, supervising and following up the implementation of engineering projects

A7. Work efficiently as a member of a multicultural team

A8. Communicate effectively with listeners through contemporary means

A9. Use innovative and critical thinking and gain leadership skills to confront new situations

A10. Acquire and apply new knowledge and other learning strategies

In addition to the competencies of most engineering programs, the engineering CCE program has some special competencies, which are as follows:

B1. Optimal design and analysis of electrical, electronic and digital systems for specific applications

B2. Measuring the performance of electrical, electronic and digital systems and evaluating their suitability for a specific application

B3. Adopting national, international standards and codes for designing, building, operating, inspecting and maintaining electronic equipment, systems and services

C1. Design, analyze and measure the performance of communication and control systems in various applications

C2. Designing and simulating different applications using computers and mobile phones

3. CCE Program Plan Requirements

To prepare the student for the above targeted educational objectives, a set of program outcomes, that describes what students are expected to know and able to do by the time of

graduation, has been adopted. The student must successfully pass a number of courses totaling 160 credit hours in order to obtain a bachelor's degree in Communications and Computers Engineering Based on credit hours systems (CHS) from the Faculty of Engineering, MansouraUniversity.

The following figure shows courses coding system according to reference framework NARS 2018, where the course code is composed of three letters and three digits. The letters indicate the course specialization department. The first digit indicates the year 0, 1, 2, 3, or 4. The second digit between 1 and 9 displays the discipline in the major. The third digit is the course sequence in each discipline.

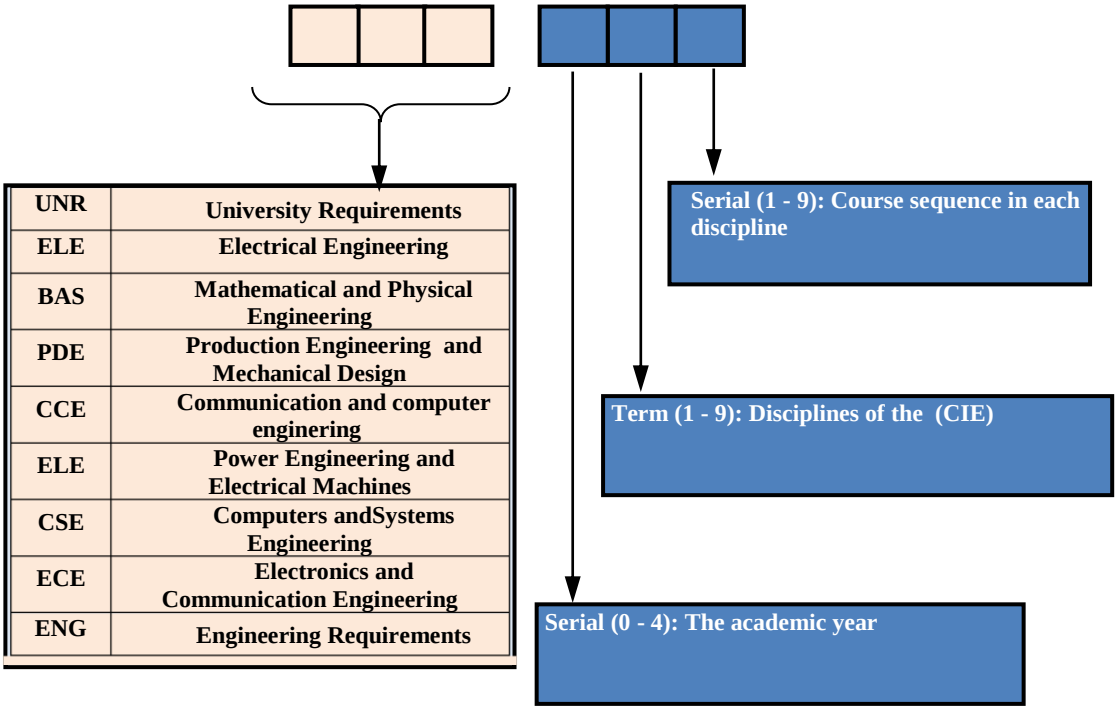


Figure (1): Courses coding system

3.1 CCE Program Courses

Table (1), illustrates the courses credit units, Total SWL and marks distribution for the university. The following points must be considered :.

1. The letters indicate the majors in which the degree is given but some of these represent university requirements, college requirements, or specialized courses.
2. Course descriptions refer to the semester in which this course is usually given, but these dates are subject to change, as not all courses are taught every year, and before the start of each

semester, college affairs show the tables of courses that will be taught in this semester, their teaching times and those in charge of teaching.

Table (1): The University Requirements (13 Credit hours)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final Term
UNR 061	English (1)	2	5	20	30	--	50
UNR 062	English (2)	2	5	20	30	--	50
UNR 171	History of Engineering and Technology	1	2	20	30	--	50
UNR 241	Communication and Presentation Skills	2	5	20	30	--	50
UNR 281	Law and Human Rights	2	4	20	30	--	50
UNR 461	Ethics and Morals of The Profession	2	4	20	30	--	50
UNR 471	Marketing	2	4	20	30	--	50
Total		13	29				

3.2 The College Requirements

Table (2) indicates the college requirements which contain basic science courses and basic engineering science courses.

Table (2): The College Requirements (45 Credit hours)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final Term
BAS011	Mathematics (1)	3	8	20	30	--	50
BAS021	Mechanics (1)	3	8	20	30	--	50
BAS012	Mathematics (2)	3	8	20	30	--	50
BAS022	Mechanics (2)	3	8	20	30	--	50
BAS031	Physics (1)	3	9	20	20	10	50
BAS032	Physics (2)	3	9	20	20	10	50
BAS041	Principals of Engineering Chemistry	3	9	20	20	10	50
PDE051	Principles of Manufacturing Engineering	3	8	20	20	10	50
PDE052	Engineering Drawing	3	10	20	30	--	50
ENG111	Technical Reports Writing	2	6	20	30	--	50
BAS113	Mathematics (3)	3	8	20	30	--	50
BAS114	Mathematics (4)	3	8	20	30	--	50
BAS115	Statistics and Probabilty Theory	2	6	20	30	--	50
ELE151	Electrical Power and Machines	3	8	20	30	--	50

BAS215	Mathematics (5)	3	8	20	30	--	50
ENG412	Project Management	2	6	20	30	--	50
Total		45	127				

3.3 The Program Requirements (Core Courses)

Tables (3), (4) and (5) show the courses distribution according to the specializations in CCE which include:

- Compulsory Courses
- Elective Courses
- Training and Graduation Projects

Table 3: Compulsory Courses for Specialization Requirements

(77 credit hours, 48.125% of the total 160)

Code	Course Name	Credit	Total SWL	Marks Distribution				Groups Name
				Mid Term	semester Works	Lab	Final Term	
CSE 042	Introduction to Computer Systems	3	9	20	20	10	50	
CSE 141	Digital Design (1)	3	8	20	20	10	50	
CSE 112	Algorithms and Data Structure	3	9	20	20	10	50	
CSE 221	Control (1)	3	8	20	30	--	50	
CSE 212	Data Base systems	3	9	20	20	10	50	
CSE 211	Digital Design (2)	3	8	20	30	--	50	
CSE 213	Computer Architecture	3	9	20	20	10	50	
CSE 311	Operating Systems	3	9	20	20	10	50	
CSE 312	Computer Networks (1)	3	9	20	20	10	50	
CSE 313	Microprocessors	3	8	20	30	--	50	
ECE 123	Electronic Basics	3	9	20	20	10	50	
ECE 121	Electrical Circuits	3	8	20	30	--	50	
ECE 221	Electronic circuits	3	9	20	20	10	50	
ECE 131	Signals and Systems	2	6	20	30	--	50	
ECE 232	Analog Communication Systems	3	8	20	30	--	50	
ECE 331	Digital Communication Systems	3	8	20	30	--	50	
ECE 231	Digital Signal Processing	3	8	20	30	--	50	
ECE 122	Solid State Electronics	3	8	20	30	--	50	
CSE 314	Computer Drawings	3	9	20	20	10	50	
CSE 315	Embedded Systems	3	9	20	20	10	50	
ECE 341	Electromagnetic Fields	3	8	20	30	--	50	
ECE 342	Waveguides and Antennas	3	9	20	20	10	50	
CSE 411	Advanced Programming Techniques	3	9	20	20	10	50	
CSE 421	Programmable Logic Control	3	9	20	20	10	50	

CSE 422	Artificial Intelligence	3	9	20	20	10	50	
ECE 431	Mobile Communications	3	8	20	30	--	50	
Total		77	220					

Table 4: Elective Courses for Specialization Requirements

In communications and computer engineering

(18credit hours 11.25% of the total 160 credit hours)

Code	Course Name	Credit	Total SWL	Marks Distribution				Groups Name
				Mid Term	semester Works	Lab	Final Term	
CCE 311	Integrated Circuits	3	8	20	30	--	50	
CCE 331	Optical Fiber	3	8	20	30	--	50	
CCE 332	Microwave Engineering	3	8	20	30	--	50	
CCE 341	Distributed systems	3	8	20	30	--	50	
CCE 342	Multimedia	3	8	20	30	--	50	
CCE 343	Computer System Programming	3	8	20	30	--	50	
CCE 344	Software Engineering	3	8	20	30	--	50	
CCE 345	Control (2)	3	8	20	30	--	50	
Level 400								
CCE 411	Industrial Electronics	3	8	20	30	--	50	
CCE 412	Introduction to Nanotechnology	3	8	20	30	--	50	
CCE 421	Information Theory	3	8	20	30	--	50	
CCE 422	Selected Topics in Communications Engineering	3	8	20	30	--	50	
CCE 423	Satellite Communications	3	8	20	30	--	50	
CCE 424	Communication Security	3	8	20	30	--	50	
CCE 425	Adapative Filters	3	8	20	30	--	50	
CCE 426	Phonics	3	8	20	30	--	50	
CCE 427	Wireless Communications	3	8	20	30	--	50	
CCE 441	Computer Networks (2)	3	8	20	30	--	50	
CCE 442	Design and Programming of Web server	3	8	20	30	--	50	
CCE 443	Big Data Analytics	3	8	20	30	--	50	
CCE 444	Selected Topics in ComputersEngineering	3	8	20	30	--	50	
CCE 445	Game Theory and Decision	3	8	20	30	--	50	
CCE 446	Internet Engineering	3	8	20	30	--	50	
CCE 447	Languages Compilers	3	8	20	30	--	50	
CCE 461	Digital Image Processing	3	8	20	30	--	50	
CCE 462	Biomedical Engineering	3	8	20	30	--	50	
CCE 463	Communication Engineering for Genetics and Bioinformatics	3	8	20	30	--	50	
CCE 464	Neural Engineering	3	8	20	30	--	50	

Table 5: Graduation projects and field training
(7 credit hours, 4.375% of the total 160)

Code	Course Name	Credit	Total SWL	Marks Distribution			
				Mid Term	semester Works	Lab	Final Term
CCE 271	Field Training (1)	1	3	--	--	--	--
CCE 371	Field Training (2)	1	3	--	--	--	--
CCE 481	Graduation Project (1)	2	6		50	--	50
CCE 482	Graduation Project (2)	3	9	--	50	--	50
Total		7	21				

4. CCE Program Curriculum

The curriculum presents the credit units, weekly contact hours either for lectures, tutorial and practical work for all courses. The curriculum also presents SWL and Marks distribution in addition to the senior project and the summer training according to **NARS 2018**. It is clear from the table that the total contact hours (lectures + tutorial+ practical) in addition to the hours of self-learning range from 44 to 49 hours per week for all levels with an average of 46 hours per week.

LEVEL 000

First Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
BAS 011	Mathematics (1)	3	2	2	-	4	8	20	30	-	50	100	-
BAS 021	Mechanics (1)	3	2	2	-	4	8	20	30	-	50	100	-
BAS 031	Physics (1)	3	2	1	1.5	4.5	9	20	20	10	50	100	-
BAS 041	Principals of Engineering Chemistry	3	2	1	1.5	4.5	9	20	20	10	50	100	-
PDE 052	Engineering Drawing	3	2	2	-	6	10	20	30	-	50	100	-
UNR 061	English (1)	2	1	2	-	2	5	20	30	-	50	100	-
Total		17	11	10	3	25	49	120	160	20	300	600	-
Total Contact hours = 24 hrs/week, Total SWL = 49 hrs/week													

Second Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
BAS 012	Mathematics (2)	3	2	2	-	4	8	20	30	-	50	100	BAS011
BAS 022	Mechanics (2)	3	2	2	-	4	8	20	30	-	50	100	BAS021
BAS 032	Physics (2)	3	2	1	1.5	4.5	9	20	20	10	50	100	-
CSE 042	Intduction to Computer Systems	3	2	1	1.5	4.5	9	20	20	10	50	100	-
PDE 051	Principles of Manufacturing Engineering	3	2	-	3	3	8	20	20	10	50	100	-
UNR062	English (2)	2	1	2	-	2	5	20	30	-	50	100	UNR061
Total		17	11	8	6	22	47	120	160	30	300	600	
Total Contact hours = 25 hrs/week, Total SWL = 47 hrs/week													

LEVEL 100

Third Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
BAS 113	Mathematics (3)	3	2	2	-	4	8	20	30	-	50	100	BAS 012
UNR 171	History of Engineering and Technology	1	1	-	-	1	2	20	30	-	50	100	-
ECE 121	Electrical Circuits	3	2	2	-	4	8	20	30	-	50	100	BAS 032
CSE 141	Digital Design (1)	3	2	1	1	4	8	20	20	-	50	100	CSE 042
ENG 111	Technical Reports Writing	2	1	2	-	3	6	20	30	10	50	100	UNR 061
ECE 122	Solid State Electronics	3	2	2	-	4	8	20	30	-	50	100	BAS 031 BAS 032
Total		15	10	9	1	20	40	120	170	10	300	600	
Total Contact hours = 20 hrs/week, Total SWL = 40 hrs/week													

Fourth Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
BAS 114	Mathematics (4)	3	2	2	-	4	8	20	30	-	50	100	BAS 113
CSE 112	Algorithms and Data Structure	3	2	1	1.5	4.5	9	20	20	10	50	100	CSE 042
BAS 115	Statistics and Probabilty Theory	2	1	2	0	2	5	20	30	-	50	100	BAS 012
ECE 131	Signals and Systems	2	2	0	0	4	6	20	30	-	50	100	BAS 113
ECE 123	Electronic Basics	3	2	1	1.5	4.5	9	20	20	10	50	100	ECE 121 ECE 122
ELE 151	Electrical Power and Machines	3	2	2	-	4	8	20	30	-	50	100	ECE 121
Total		16	11	8	3	23	45	120	160	20	300	600	
Total Contact hours = 22 hrs/week, Total SWL = 45 hrs/week													

LEVEL 200

Fifth Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
BAS 215	Mathematics (5)	3	2	2	-	5	8	20	30	-	50	100	BAS 113
CSE 211	Digital Design (2)	3	2	2	-	5	9	20	30	-	50	100	CSE 141
CSE 212	Data Base Systems	3	2	-	3	4	9	20	20	10	50	100	CSE 112
ECE 231	Digital Signal Processing	3	2	2	-	5	9	20	30	-	50	100	ECE 131
UNR 241	Communication and Presentation Skills	2	2	-	-	3	5	20	30	-	50	100	-
Total		14	10	6	3	22	41	100	140	10	250	500	
Total Contact hours = 19 hrs/week, Total SWL = 41 hrs/week													

Sixth Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
CSE 221	Control (1)	3	2	2	-	4	8	20	30	-	50	100	BAS 113 ECE 121
CSE 213	Computer Architecture	3	2	-	2	5	9	20	20	10	50	100	CSE 211
ECE 232	Analog Communication Systems	3	2	2	-	4	8	20	30	-	50	100	BAS 114 ECE 131
ECE 221	Electronic Circuits	3	2	-	2	5	9	20	30	10	50	100	ECE 123
UNR 281	Law and Human Rights	2	2	-	-	2	4	20	30	-	50	100	-
CCE 271	Training (1)	1	-	-	-	-	3	-	-	-	-	-	-
Total		15	10	4	4	20	41	100	140	20	250	500	
Total Contact hours = 18 hrs/week, Total SWL = 41 hrs/week													

LEVEL 300

Seventh Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
CSE 311	Operating Systems	3	2	-	2	5	9	20	20	10	50	100	CSE 213
ECE 331	Digital Communication Systems	3	2	2	-	4	8	20	30	-	50	100	ECE 232
CSE 313	Microprocessors	3	2	2	-	5	9	20	30	-	50	100	CSE 213
ECE 341	Electromagnetic Fields	3	2	2	-	4	8	20	30	-	50	100	BAS 113 ECE 121
CSE 312	Computer Networks (1)	3	2	-	2	4	8	20	20	10	50	100	CSE 042
Total		15	10	6	4	22	42	100	130	20	250	500	
Total Contact hours = 20 hrs/week, Total SWL = 42 hrs/week													

Eighth Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
ECE 342	Waveguides and Antennas	3	2	1	1.5	4.5	9	20	20	10	50	100	ECE 341
Elective Table 13	Elective course (1)	3	2	2	-	4	8	20	30	-	50	100	Course Specs.
	Elective course (2)	3	2	2	-	4	8	20	30	-	50	100	
CSE 315	Embedded Systems	3	2	1	1.5	4.5	9	20	20	10	50	100	CSE 213
CSE 314	Computer Drawing	3	2	-	2	5	9	20	20	10	50	100	CSE 042
CCE 371	Field Training (2)	1	-	-	-	-	3	-	-	-	-	-	CCE 271
Total		16	10	6	5	22	46	100	120	30	250	500	
Total Contact hours = 21 hrs/week, Total SWL = 46 hrs/week													

LEVEL 400

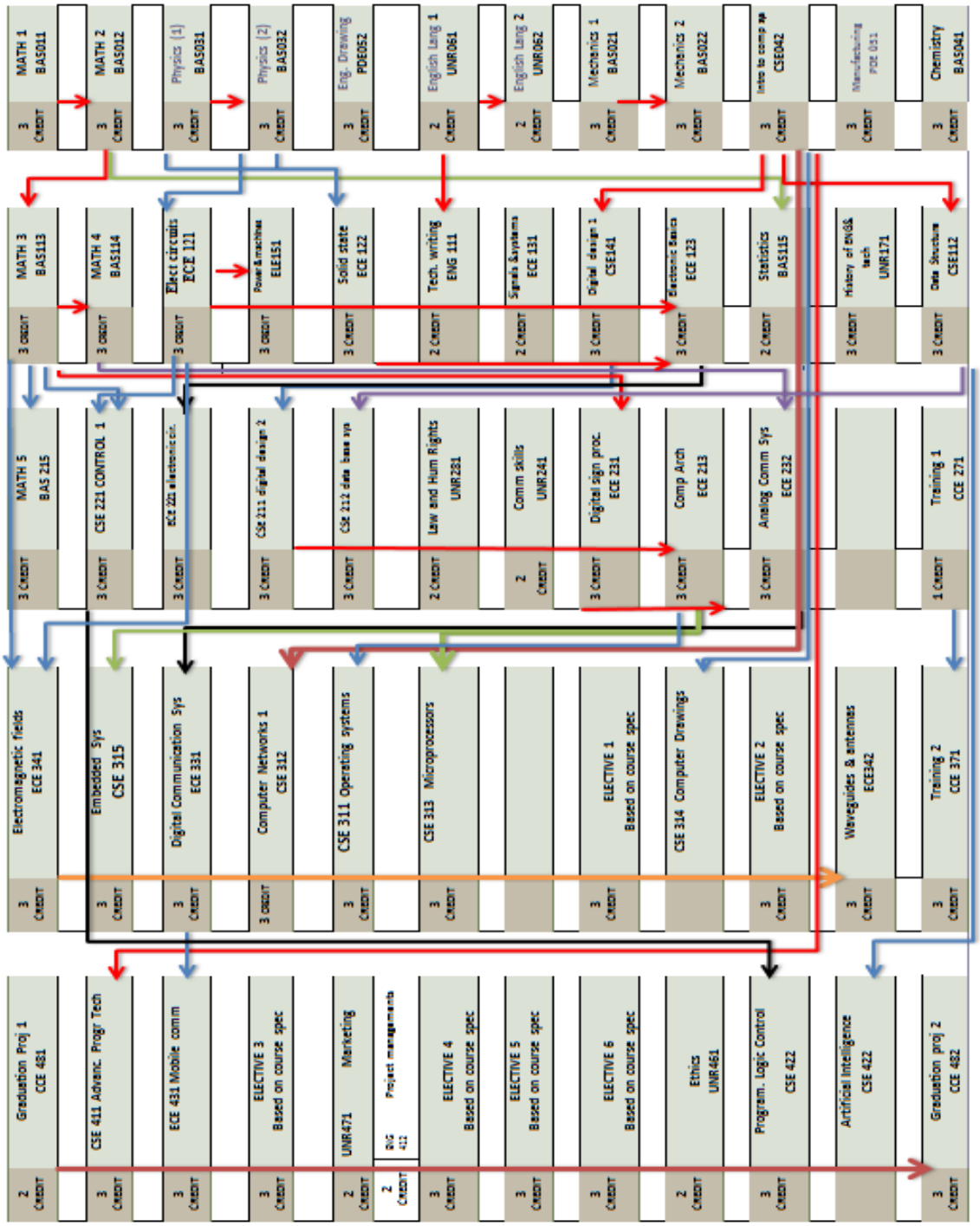
Ninth Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
CCE 481	Graduation Project (1)	2	1	-	3	2	6	-	50	-	50	100	Level 400
ECE 431	Mobile Communications	3	2	2	-	4	8	20	30	-	50	100	ECE 331
Elective Table 13	Elective course (3)	3	2	2	-	4	8	20	30	-	50	100	Course Specs.
	Elective course (4)	3	2	2	-	4	8	20	30	-	50	100	
CSE 411	Advanced Programming Techniques	3	2	-	2	5	9	20	20	10	50	100	CSE 042
UNR 461	Ethics and Morals of The Profession	2	2	-	-	4	6	20	30	-	50	100	-
ENG 412	Project Management	2	1	2	-	2	5	20	30	-	50	100	-
Total		18	12	8	5	25	50	120	220	10	350	700	
Total Contact hours = 25 hrs/week, Total SWL = 50 hrs/week													

Tenth Semester

Code	Course Name	Hours/Week						Marks Distribution					Prerequisites
		Credit	Lecture	Tutorial	Lab.	Free work	SWL	Mid Term	Semester Work	Lab	Final Term	Total	
CCE 482	Graduation Project (2)	3	1	-	6	2	9	-	50	-	50	100	CCE 481
Elective Table 13	Elective course (5)	3	2	2	-	4	8	20	30	-	50	100	Course Specs.
	Elective course (6)	3	2	2	-	4	8	20	30	-	50	100	
CSE 421	Programmable Logic Control	3	2	1	1.5	4.5	9	20	20	10	50	100	CSE 221
CSE 422	Artificial Intelligence	3	2	1	1.5	4.5	9	20	20	10	50	100	CSE 112
UNR 471	Marketing	2	2	-	-	4	6	20	30	-	50	100	-
Total		17	11	6	9	23	49	100	180	20	300	600	
Total Contact hours = 26 hrs/week, Total SWL = 49 hrs/week													

Figure (2) Courses Dependency for CCE Program



Level	Course Code	Course Name	CCE Graduate Competencies According to NARS 2018														
			A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	C1	C2
000	BAS011	Mathematics (1)	√														
	BAS021	Mechanics (1)	√														
	BAS031	Physics (1)	√	√													
	BAS041	Basics of Chemical Engineering	√	√													
	PDE052	Engineering Drawing	√		√												
	UNR061	English Language (1)								√							
	BAS012	Mathematics (2)	√														
	BAS022	Mechanics (2)	√														
	BAS032	Physics (2)	√	√													
	CSE042	Introduction to Computer Systems	√				√										
	PDE051	Principles of Manufacturing Engineering	√	√		√											
	UNR062	English Language (2)								√							
100	BAS 113	Mathematics (3)	√														
	ENG 111	Technical Report Writing					√			√							
	UNR 171	History of Engineering and Technology				√	√			√		√					
	ECE 121	Electric Circuits	√	√			√					√					
	CSE 141	Digital Logical Design 1	√	√									√	√			
	ECE 122	Solid state electronics	√	√									√	√			
	BAS 114	Mathematics (4)	√														
	BAS 115	Probability Theory and Statics	√	√				√									
	CSE 112	Algorithms and Data Structures	√	√			√					√					
	ECE 131	Signals and Systems	√	√			√					√					
	ECE 123	Electronic Basics	√	√									√	√			
	ELE 151	Electric Power and Machines	√	√									√	√	√		
200	BAS 215	Mathematics (5)	√	√													
	CSE 211	Digital Design 2	√		√	√					√				√		
	CSE 212	Data base Systems	√		√	√					√				√		√
	ECE 231	Digital signal processing	√		√	√					√				√	√	√
	UNR 241	Communication and Presentation Skills						√	√	√	√	√					
	CSE 221	Control 1	√		√	√					√				√		

	CSE 213	Computer Architecture	√		√	√					√				√	√	√
	ECE 232	Analog communication systems	√		√	√					√				√	√	√
	ECE 221	Electronic circuits	√									√	√	√		√	
	UNR 281	Law and Human Rights	√				√		√	√		√					
	CCE 271	Field Training (1)	√	√	√		√	√	√	√	√				√	√	√
300	CSE 311	Operating systems	√		√	√					√				√	√	√
	ECE 331	Digital communication systems	√		√	√					√				√	√	√
	CSE 313	Microprocessors	√		√	√					√				√	√	√
	ECE 341	Electromagnetic Fields	√									√		√			
	CCE 311	Integrated Circuits	√		√	√					√				√	√	
	CCE 331	Optical Fiber	√		√	√					√				√	√	
	CCE 332	Microwave Engineering	√		√	√					√				√	√	
	CCE 341	Distributed systems	√		√	√					√				√		√
	CCE 342	Multimedia	√		√	√					√				√		√
	CCE 343	Computer System Programming	√		√	√					√				√		√
	CCE 344	Software Engineering	√		√	√					√				√		√
	CCE 345	Control (2)	√		√	√					√				√	√	√
	CSE 312	Computer Networks (1)	√	√		√	√					√				√	√
	ECE 342	Waveguides and Antennas	√	√		√	√					√				√	
	CSE 315	Embedded Systems	√	√		√	√					√				√	√
	CSE 314	Computer Drawing	√	√		√	√					√					√
	CCE 371	Training 2		√	√	√		√	√	√	√	√	√	√	√	√	√
400	CCE 481	Graduation Project (1)	√	√	√	√	√	√	√	√	√	√			√	√	√
	ECE 431	Mobile Communications	√	√		√	√					√				√	
	CSE 411	Advanced Programming Techniques	√	√		√	√					√					√
	UNR 461	Ethics and Morals of the Profession	√			√	√		√	√	√	√					
	ENG 412	Project Management	√	√	√	√	√	√	√	√	√						
	CCE 482	Graduation Project (2)	√	√	√	√	√	√	√	√	√	√			√	√	√
	CSE 421	Programmable Logic Control	√	√		√	√					√				√	√
	CSE 422	Artificial Intelligence	√	√		√	√					√				√	√
	UNR 471	Marketing	√	√		√	√	√	√	√	√	√					
	CCE 411	Industrial Electronics	√	√		√	√					√				√	
	CCE 412	Introduction to Nanotechnology	√	√		√	√					√				√	

	CCE 421	Information Theory	√	√		√	√					√				√	√
	CCE 422	Selected Topics in Communications Engineering	√	√		√	√					√				√	
	CCE 423	Satellite Communications	√	√		√	√					√				√	
	CCE 424	Communication Security	√	√		√	√					√				√	√
	CCE 425	Adaptive Filters	√	√		√	√					√				√	√
	CCE 426	Phonics	√	√		√	√					√				√	
	CCE 427	Wireless Communications	√	√		√	√					√				√	
	CCE 441	Computer Networks (2)	√	√		√	√					√				√	√
	CCE 442	Design and Programming of Web server	√	√		√	√					√					√
	CCE 443	Big Data Analytics	√	√		√	√					√					√
	CCE 444	Selected Topics in Computers Engineering	√	√		√	√					√					√
	CCE 445	Game Theory and Decision making	√	√		√	√					√					√
	CCE 446	Internet Engineering	√	√		√	√					√					√
	CCE 447	Languages Compilers	√	√		√	√					√					√
	CCE 461	Digital Image Processing	√	√		√	√					√					√
	CCE 462	Biomedical Engineering	√	√		√	√					√				√	
	CCE 463	Communication Engineering for Genetics and Bioinformatics	√	√		√	√					√				√	√
	CCE 464	Neural Engineering	√	√		√	√					√				√	√

5. CCE Program Courses Syllabi

5.1. University Requirements:

UNR061	English (1)								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	1st	---
Main skills of the English language - listening to short and long conversations - reading scientific passages - writing reports, summaries, and scientific articles - speaking and presenting new ideas									
References: ▪ *Mark Ibbotson, Cambridge English for Engineering Student's book free, Cambridge press 2011*									

UNR062	English (2)								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	2nd	UNR061
Analysis and interpretation of engineering issues - summarizing engineering issues - preparation for language tests.									
References: ▪ *Mark Ibbotson, Cambridge English for Engineering Student's book free, Cambridge press 2011*									

UNR 171	History of Engineering and Technology								Prerequisites
1 Cr	Lecture	1	Tutorial	--	Lab.	--	Semester	3rd	---
Engineering history: Art, Science, Engineering and technology - Role of engineering and technology in development and establishment of civilizations -Technology and environment - Examples on development of engineering activity.									
References: ▪ *Roger S. Kirby, Engineering in History, Dover Publications Inc. New York, United States, 1990, ISBN10 0486264122*									

UNR281	Law and Human Rights								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	6th	---
Systems and laws of institutions - Introduction to Accounting - Labor legislation and laws governing engineering professions - Industrial security legislation and environment - Historical philosophical origins of human rights - international sources of human rights - national sources of human rights - global bodies based on the protection of human rights.									

UNR241	Communication and Presentation Skills								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	5th	---
Communication skills - Presentation planning and preparation - Delivery skills such as eye contact, voice control, gestures, body language and appearance - Presenter's characteristics - Using visuals - Presentation structure - Elevator Pitch									
References: ▪ *Joan van Emden, Lucinda Becker, Presentation Skills for Students, 3rd Edition, Red Globe Press, 2016* ▪ *M. Wa Mutua, S. Mwaniki, P. Kyalo, B. Sugut, Communication Skills: A University Book, Succex Publishers, 2016* ▪ *Ian Tuhovsky, Wendell Wadsworth, Communication Skills Training, Ian Tuhovsky, 2015* ▪ *Tabitha Wambui, Alice W. Hibui, Elizaeth Gathuthi, "Communication skills " Vol.1, Students' coursebook, LAP LAMBERT Academic Publishing, 2012*									

UNR461	Ethics and Morals of The Profession								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	9th	---
General principles of professional ethics - Commitments to society - Responsibilities of the engineer - Detection of violations - Behavior - Case studies and general issues.									
References: ▪ *Lizabeth A. Stephan, David R. Bowman, William J. Park, Benjamin L. Sill, Matthew W. Ohland, "Thinking like an engineer", Published by Pearson 2018.* ▪ *Harris, C. E., Jr., Pritchard, M. S., & Rabins, M. J. Engineering Ethics. Second edition. Belmont, CA: Wadsworth, 2000*									

UNR471	Marketing								Prerequisites
2 Cr	Lecture	2	Tutorial	--	Lab.	--	Semester	10th	---
Principles of products marketing - Marketing research - Customers buying behavior - Marketing mix - Plotting marketing strategy - Building marketing plan - Pinpointing the target market - Marketing on the world wide web - Branding strategy - Developing new products - Advertising and promotions - Costing and pricing strategies - Case studies on products marketing									
References: ▪ *Principles of Marketing, University of Minnesota Libraries Publishing, 2015, ISBN 13: 9781946135193*									

4.2. Faculty Requirements:

BAS011	Mathematics (1)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Calculus: Function (definition - theorems) - Basic functions - limits - Continuity - Derivation - definition - theorems - types - higher orders - Applications on derivatives - partial derivatives - indefinite integral - theories and properties of integration. Algebra: Binomial theorem (with any exponent and applications) - Partial Fractions - Theory of Equations - Matrices - System of linear equations - Gauss elimination method.									
References: ▪ *Akhtar & Ahsan, Textbook of Differential Calculus, second edition, 2009, PHI Learning Private Limited.* ▪ *Alan Jeffrey, Matrix operations for Engineers and Scientists, 2010, Springer Science & Business Media.*									

BAS021	Mechanics (1)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Newton's laws - Types of forces، coplanar forces، Rectangular components of vector (1D, 2D, Space), Forces in space - Equilibrium of a particle - Conditions, Free-body diagram - Moment - Couple moment - Resultant of a system of forces and couples as a force and couple system - General procedure for reducing force and couple systems - Equilibrium of a rigid body - Conditions of equilibrium of a rigid-body، free body diagrams – friction									
References: ▪ *R.C. Hibbeler, "Engineering Mechanics: Statics and Dynamics, 14th Edition", Pearson Prentice Hall, New Jersey, 2016.* ▪ *J. L. Meriam, L. G. Kriage, and J. N. Botton, "Engineering Mechanics: Statics, 8th Edition", John Wiley & Sons, New York, 2016.*									

BAS012	Mathematics (2)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	3rd	**BAS011**

Integral Calculus: Definite integral - Methods of integration - Applicationson definite integral (plane area - volume of revaluation - length of a plane curve - area of surfaces of revolution) - improper integral.
Analytic Geometry: Equations of second degree - Equation of pair of straight lines - Translation of axes - Conic sections - parabola - ellipse - hyperbola) Equation of plane - Equation of sphere.

References:

- *Jumarie, G., Fractional Differential Calculus for Non-Differentiable Functions: Mechanics, Geometry, Stochastics, Information Theory. 2013: LAP Lambert Academic Publishing.*
- *Hestenes, D. and G. Sobczyk, Clifford algebra to geometric calculus: a unified language for mathematics and physics. Vol. 5. 2012: Springer Science & Business Media.*

Grossman, S.I., Multivariable calculus, linear algebra, and differential equations. 2014: Academic Press.

BAS022	Mechanics (2)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	2ed	**BAS021**

Kinematics of a particle: curvilinear motion - Normal and tangential components. - Newton's laws - motion of projectiles - Work and energy of a particle - applications of friction.

References:

- *R.C. Hibbeler, "Engineering Mechanics: Statics, 11th Edition", Pearson Prentice Hall, 2006.*
- *F. P. Beer, and E. R. Johston, Jr., D. F. Mazurek, P. J. Cornwell, E. R. Eisenberg, "Vector Mechanics for Engineering, Statics and Dynamics, 9th Edition", McGraw-Hill, New York, 2010.*

BAS031	Physics (1)								Prerequisites
3 Cr	Lecture	2	Tutorial	1	Lab.	1.5	Semester	1st	---

Material properties: Physical quantities - Standard units and dimensions - Mechanical properties for materials - Fluid properties - Periodic motion - Mechanical waves - Sound waves - Waves in elastic media.
Heat and thermodynamics: Temperature measurements and thermometers - Thermal expansion - Specific and latent heat - Heat transfer - Gas motion theory - First law of thermodynamics - Entropy and second law of thermodynamics.

References:

- *Physics for Scientists and Engineers, R.A. Serway and J.W. Jewett, 6th Edition, Thomson Brooks/Cole 2014.*
- *Paul A. Tipler, " Physics for scientists and engineers" sixth edition, 2008.*

BAS032	Physics (2)								Prerequisites
3 Cr	Lecture	2	Tutorial	1	Lab.	1.5	Semester	2nd	---

Electricity and Magnetism: Electric charge - Electric force - Electric field- Column's law- Electric flux- Gauss law- Electric potential- Electric capacitance and Dielectrics - Ohm's law and simple circuits- Magnetic field - Baiot and Savart laws.
Optics and Modern physics: Nature of light and laws of geometric optics - Interference - Diffraction - polarization - optical fiber - laser - photoelectric effects - principle of quantum theory - special theory of relativity.

References:

- *Physics for Scientists and Engineers, R.A. Serway and J.W. Jewett, 9th Edition, Thomson Brooks/Cole 2014.,*
- *Paul A. Tipler, " Physics for scientists and engineers" sixth edition, 2008.*

BAS041	Principals of Engineering Chemistry								Prerequisites
3 Cr	Lecture	2	Tutorial	1	Lab.	1.5	Semester	1st	---
Equations of state-chemical thermodynamics - Material and energy balance in chemical processes- properties of solutions - Basic principles in electrochemistry and it's applications- selected topics in chemical industry.									
References: ▪ *Brown, L. T, LeMay H. E. Jr; Bursten, B. E.; Murphy, C.J., and Woodward, P.; " Chemistry The Central Science", Pearson International Edition (11th edn), Pearson Printice Hall, (2009).*									

PDE051	Principles of Manufacturing Engineering								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2ed	---
Introduction to the following processes (Casting- Forging- Metal filing - Machining- Forming- Woodworking)									
References: ▪ *Hitomi, Katsundo. Manufacturing Systems Engineering: A Unified Approach to Manufacturing Technology, Production Management and Industrial Economics. Routledge, 2017.*									

PDE052	Engineering Drawing								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	1st	---
Two-dimensional drawings - Free-hand sketching - Sectional views - Auxiliary views and conventions - Computer-aided drawing (CAD) of 2D and 3D figures.									
References: ▪ *Mcgraw-hill Mint, "Mechanical Drawing Board & CAD Techniques", Student Edition,2011*									

ENG111	Technical Reports Writing								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	3rd	UNR062
Technical writing definition - audience analysis - technical writing styles - technical document characteristics - automated document organization - official and unofficial document types - structure of different types of technical documents.									
References: ▪ *G. J. Alred, W. E. Oliu, The Handbook of Technical Writing, 12th Edition, Bedford/St. Martin's; 2018* ▪ *K. Hyland, Teaching and researching writing. 3rd edition Routledge academic publisher, 2016* ▪ *M. Markel, Technical Communication, 11th edition, MacMillan, 2015.*									

BAS113	Mathematics (3)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	3rd	**BAS012**
Applications of partial differentiation - Maximum values of functions in more than one variable and applications - First order differential equations - Second order differential equations - Laplace transform and its applications - Analytical geometry in space.									

References:

- *D. Backman, "Advanced Calculus Demystified", McGraw-Hill, 2007.*
- *S. A. Wirkus, and R. J. Swifi, "A Course of Ordinary Differential Equations", Taylor & Francis Group, LLC, 2015.*

BAS114	Mathematics (4)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	4th	**BAS113**
Fourier series - Fourier transform - Complex numbers - Functions of a complex variable - Complex integration - Residue theorem - Direction derivatives - Double integrals - Triple integrals - Line integrals - Surface integrals.									
References: ▪ *J. Brown, and R. Churchill, "Complex Variables and Applications", 9th Edition, McGraw-Hill, 2013.* ▪ *D. Backman, "Advanced Calculus Demystified", McGraw-Hill, 2007.*									

BAS 115	Statistics and Probabilty Theory								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	4th	**BAS012**
Measures of tendency and dispersion - Probability distributions - Sampling theorem - tests of hypothesis - non-parametric tests - regression and correlation - time series.									
References: ▪ *Mary C. Meyer, Probability and Mathematical Statistics: Theory, Applications, and Practice in RSBN-10: 1611975778, SIAM (June 24, 2019)*									

ELE151	Electrical Power and Machines								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	4th	---
Power: Electrical power systems - three phase systems - Theory and models of transformers - Transmission line models - Voltage and frequency control - effective and ineffective power - Optimal work of power systems. Machines: The theory of operation - The construction of the Direct Current motors. The speed، torque، and current characteristics - applications of the DC motors. The theory of operation and construction of stepper motors - Permanent-magnet DC motor and Low-inertia DC Motors. The theory of operation، construction of three phase induction motors.									
References: ▪ *Nilsson, J.W. and S.A. Riedel, Electric circuits. 2015: Pearson Upper Saddle River, NJ.* ▪ *Slade, P.G., Electrical contacts: principles and applications. 2017: CRC press.*									

BAS215	Mathematics (5)								Prerequisites
3 Cr	Lecture	2	Tutorial	2	Lab.	--	Semester	5th	**BAS113**
Numerical solution of linear and non-linear systems of equations - Iterative methods - Curve fitting: Least square of (Straight lines, Polynomials), Linearization of nonlinear relationship. Interpolation and polynomial approximation -finite difference operators - Numerical integration and differentiation.									
References: ▪ *Mazumder, Numerical Methods for Partial Differential Equations, Finite Difference and Finite Volume Methods, science direct ,2016.* ▪ *Sheldon Rose, A First course in probability, Eighth edition, 2010, Pearson Prentice Hall.*									

ENG 412	Project Management								Prerequisites
2 Cr	Lecture	1	Tutorial	2	Lab.	--	Semester	9th	---
Basics of project management - basic administrative functions - planning, preparatory for different engineering applications. Elements of human resources management: recruitment, mentoring, and control. Total quality management, continuous improvement. - Integration management - Domain management - Time management - Cost management - Communication management - Risk management - Procurement management									
References: ▪ *Kerzner, H. and H.R. Kerzner, Project management: a systems approach to planning, scheduling, and controlling. John Wiley & Sons, 2017.* ▪ *Kalpakjian, S., K. Vijai Sekar, and S.R. Schmid, Manufacturing Engineering and technology. Pearson, 2014.* ▪ *Nigel J. Smith, "Engineering Project Management", 3rd Edition, Wiley-Blackwell, 2008.*									

5.3. CCE Program Requirements

5.3.1. CCE Program Compulsory courses

CSE042	Introduction to Computer Systems								Prerequisites
3 Cr	Lecture	2	Tutorial	--	Lab.	3	Semester	2ed	---
Introduction to the design and operation of digital computers: types of data and its representation and number systems - the basic components of the computer and the organization of the computer and the ways of transfer of information- programming with Visual Basic - Introduction to information networks Introduction to Programming: Program Structure and Command Types - Presentation of key commands - simple software development Training Fundamentals: Dealing with Common Operating Systems (Windows – Linux) - Software Development and Desktop Software									
References: - Peter Van Roy, Seif Haridi, "Concepts, Techniques, and Models of Computer Programming" The MIT Press (February 20, 2012)									

ECE 121	Electrical Circuits								Prerequisites
3Cr	3rd	Semester	-	Lab.	2	Tutorial	2	Lecture	BAS 032

Elements of electrical circuits - Simple resistive circuits - Analysis of DC circuits - Theories of electrical circuits - First-order circuits –steady AC sinusoidal circuits - Power and power factor - Resonance circuits - Three-phase circuits.

References

- *William Hayt, Jack Kemmerly, Steven Durbin,Engineering Circuit Analysis, 8th ed. 2011*

ECE122	Solid State Electronics								Prerequisites
3Cr	3rd	Semester	-	Lab.	2	Tutorial	2	Lecture	BAS 032 BAS 031

Introduction to quantum physics; Quantum mechanics; Atomic Physics; Molecules and solids; energy states and spectra of molecules, bonding in solids, introduction to crystalline properties of semiconductors, free electron theory of metals, band theory of solids, electrical conduction in metals, insulators and semiconductors, superconductivity. PN ode, Zener diode and tunnel diodejunction di

References

- *Hill-Donald Neamen, Semiconductor physics and Devices, McGraw 2003*

ECE 141	Digital Design (1)								Prerequisites
3Cr	3rd	Semester	1	Lab.	1	Tutorial	2	Lecture	CSE 042

Numeric Systems - Converting between binary, decimal, octal and hexadecimal numbers – Booleanalgebra - Logic gates –simplification of logic functions – Karnaugh map (Sum of product) minimization - Karnaugh map (Product of sum) minimization - Combinational logic analysis - Combinational logic using NAND and NOR gates – Functions of combinational logic : (Adders, Comparators, Decoders/Encoders، Code converters, Multiplexers, Parity generators) – Applications using FPGA – Experimental : Implementation of digital combinational circuit using TTL ICs.

References

- *Mano, M. Morris, and Charles R. Kime. Logic and computer design fundamentals. Pearson Higher Education, 2015.,*
- *Thomas L. Floyed, Digital fundamentals, Pearson international edition, 11th edition, 2019*

CSE 112	Algorithms and Data Structure								Prerequisites
3Cr	4th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	CSE 042

Introduction to data structures - Different Data representations- Study the Introduction to data structures - Different Data representations- Study the structure، properties، and implementation issues of different data structures (Array – Stack – queue،..) -Data Structure Storing ، ordering and sorting algorithms. - Study Different search algorithms - Evaluation and analysis of studied algorithms using a recent programming

language.

References

- *Allen Weiss Mark. Data structures and algorithm analysis in C++. Pearson Education India, 2007.*
- *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles, Fifth Edition 5thEdition, 2017.*

ECE 123	Electronic Basics								Prerequisites
3Cr	4th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	ECE122 ECE 121

Diode Circuit Analysis and Applications, Rectifier Circuits, Peak-Inverse-Voltage (PIV), Diode Power Dissipation, Clipping and Clamping Circuits, Power Generation from Solar Cells, Bipolar Transistors and Their Properties and Applications in DC Circuits - Field Impact Transistors (JFET / MOSFET) and their Properties and Applications in DC Cases.

References

- *Thomas L.* Floyd. ELECTRONIC. DEVICES. *Prentice Hall, 9th ed., 2012.*
- *Ulrich Tietze, Christoph Schenk, Eberhard Gamm "Electronic Circuits: Handbook for Design and Application", Springer; 2nd edition (March 11, 2008).*

ECE 131	Signals and Systems								Prerequisites
2Cr	4th	Semester	0	Lab.	0	Tutorial	2	Lecture	BAS 113

Continuous time and discrete time signals and systems - basic system properties - Linear Time Invariant Systems – The C.T and D.T. convolution –Properties of LTI systems - Fourier Series Representation of C.T. and D.T. Periodic Signals - Parseval's relation - The C.T. Fourier Transform for periodic and aperiodic signals - Properties of continuous time F.T. – The D.T. Fourier Transform – Properties of D.T. Fourier Transform - Complex exponential and sinusoidal Amplitude Modulation-Demodulation for Sinusoidal AM - Frequency Division Multiplexing - Representation of continuous time signal by its samples - The sampling Theorem - The effect of under-sampling or aliasing - sampling with zero order hold - The Z Transform

References

- *Lizhe Tan Jean Jiang, "Digital Signal Processing Fundamentals and Applications", cademic Press, 9thNovember 2018.*

CSE 221	Control (1)								Prerequisites
3 Cr	6th	Semester	0	Lab.	2	Tutorial	2	Lecture	BAS 113 ECE 121

Introduction to control systems - Open and closed loop control systems – Laplace transformation and transfer function - Block diagram reduction – Signal flow graph - Modeling of systems: (Electrical circuits ، Mechanical systems, DC motors, AC servo motors, Synchro, Potentiometers, stepper motors – Hydraulicservo motor – Thermal systems – liquid level systems) – Linearization of nonlinear mathematical model – Time response analysis: (First order systems – second order systems – steady state error) – Stability ofcontrol systems: (Routh stability analysis – Determining relative stability using Routh and root locusmethod) – Applications of the previous topics using MATLAB/Simulink toolboxes

References

-Ogata, Katsuhiko. Modern control engineering. Upper Saddle River, NJ: Prentice Hall, 2015
-Farid Golnaraghi, Benjamin Kuo, "Automatic Control Systems", McGraw-Hill Education, 10 edition, 2017

CSE 212	Data Base Systems								Prerequisites
3Cr	5th	Semester	2	Lab.	0	Tutorial	2	Lecture	CSE 112

Basic database concepts - data structures and operations - data modeling –database system architecture - data definition and data manipulation languages - query languages including Algebra and SQL - software package training

References

Jukic, Nenad, Susan Vrbsky, and Svetlozar Nestorov. Database systems: Introduction to databases and data warehouses. Prospect Press, 2016

CSE 211	Digital Design (2)								Prerequisites
3Cr	5th	Semester	0	Lab.	02	Tutorial	2	Lecture	CSE 141

Latches – SR Flip flops – D Flip flops – JK flip flops – T Flip flops– Edge triggered flip flops – Sequential circuit analysis – Analysis of clocked sequential circuits – state reduction – flip flop excitation tables – design procedure – registers – shift registers – ripple counters – synchronous counters – random access memory (RAM) – memory decoding – Algorithmic state machine (ASM): (timing consideration – control implementation – design with multiplexers) – Applications using FPGA - Practical experiments using TTL logic chips with the aid of 555 timer IC.

References

-Mano, M. Morris, and Charles R. Kime. Logic and computer design fundamentals. Pearson Higher Education, 2015.
-Thomas L. Floyed, Digital fundamentals, Pearson international edition, 11th edition, 2019.

CSE 213	Computer Architecture								Prerequisites
3Cr	6th	Semester	02	Lab.	0	Tutorial	2	Lecture	CSE 211

Computer arithmetic - design of ALU - pipelined ALU and processor – multiprocessors - multicomputers control unit - instruction repertoires (RISC, CISC) - interrupt circuits - bus synchronization - I/O devices - channels - memory architectures - connection of computer peripherals - Distributed Systems- parallel processors architecture - scalable computer platforms - vector processors - vectorizing compilers - systolic arrays - loosely and tightly coupled processors - symmetric and CC-NUMA multiprocessors- data flow machines - interconnecting networks - clustering - parallel programming - performance evaluation - case studies

References

- *Andrew S. Tanenbaum, Structured Computer Organization (5th Edition) 5th Edition, Pearson; 5 ed. 2005*
- *M. Morris Mano, Computer System Architecture, Prentice Hall, 1992*

CSE 311	Operating Systems								Prerequisites
3Cr	7th	Semester	2	Lab.	0	Tutorial	2	Lecture	CSE 213

Types of operating systems - functions of operating systems - process states - memory management - virtual memory - processor management - process scheduling - case study (Unix)- Real Time Operating systems- Multithreading. Multiprocessor systems - device management - deadlock prevention - file systems - system resilience - network and distributed operating systems - programming project.

References

- *Silberschatz, Abraham, Greg Gagne, and Peter B. Galvin. Operating system concepts. Wiley, 2018*.

CSE 312	Computer Networks (1)								Prerequisites
3Cr	7th	Semester	2	Lab.	0	Tutorial	2	Lecture	CSE 042

Seven layer communication model - network architecture and protocols routing techniques and algorithms - network planning and design - Network layers, TCP / IP Network protocol, Routing protocols, Network Design, Network Management, Congestion, Examples of LAN's and WAN's, High Speed Networks, Other Network Protocols.

References

- *Mosharraf, Firouz. Computer Networks: A Top-down Approach. McGraw-Hill, 2016.*

CSE 313	Microprocessors								Prerequisites
3Cr	7th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 213

Computer architecture - CPU architecture - fetch-decode-execute cycle - addressing modes - instruction set - memories (RAM-ROM-Cache-Flash) - memory interfacing - timing diagrams - assembly language - instruction formats - data representation - arithmetic operations, Program controlled and interrupt driven I/O - I/O interfacing - connection of terminals, discs and I/O ports - assembly language - macros and kernels - introduction to embedded systems

References

- *Ahmet Bindal, "Fundamentals of Computer Architecture and Design", Springer; 2nd ed. 2019 edition (January 31, 2019).*

ECE 231	Digital Signal Processing								Prerequisites
3Cr	5th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 131

General Introduction - Speech Characteristics - Short time Processing - Pitch & Formants Estimation - Vector Quantization - Linear Predictive Coding - speech Coding Techniques - Speech Synthesis - Speech Recognition - Speaker Recognition - Image Coding - Video Coding - ReviewProjects.

References

- *Lizhe Tan Jean Jiang, "Digital Signal Processing Fundamentals and Applications", cademic Press, 9th November 2018.*

ECE 232	Analog Communication Systems								Prerequisites
3Cr	6th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 131 BAS 114

All Types of AM (DSB-LC, DSB-SC, SSB, VSB, QAM) – AM modulators, and demodulators, advantages and disadvantages-Synchronization circuits - AM applications: Telephone channel multiplexing and super heterodyne receiver -Angle Modulation - Narrow band angle modulated signals - Spectrum of sinusoidal signal (N.B and W.B) - Generation of wide band FM (Indirect and Direct methods)-Demodulation

(slope detector, PLL) - De-emphasis and pre-emphasis filtering -compatible stereo - Intersystem comparison – Sampling process – PAM – Quantization (uniform and non-uniform) – PCM – Time division multiplexing – Delta, and adaptive delta modulation – Differential PCM – random process – Stationary and ergodic processes – Mean, correlation, and covariance functions – Power spectral density – Narrow band noise.

References

- *K.C. Raveendranathan, " Analog Communications Systems: Principles and Practices", Orient Blackswan (September 23, 2008).*

ECE221	Electronic circuits								Prerequisites
3Cr	6th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	ECE 123

AMPLIFICATION, Circuit MODELS FOR AMPLIFIERS-Impedance level transformation; VOLTAGE, current, Power gain; Frequency Response of Amplifiers, SINGLE-TRANSISTOR AMPLIFIERS; SMALL-SIGNAL MODELING AND LINEAR AMPLIFICATION; The BJT Amplifier. The MOSFET Amplifier Coupling and Bypass Capacitors Circuit Analysis Using dc and ac Equivalent circuits, Multistage amplifiers and composite circuits - Current mirrors – High frequency analysis and frequency response – Differential amplifiers - Feedback amplifiers - Digital logic gates – Sequential circuits (flip-flops, shift registers, counters) – Power amplifiers, Active filters based Operational amplifiers.

References

- *Thomas L.* Floyd. ELECTRONIC. DEVICES. *Prentice Hall, 9th ed., 2012.*
- *Ulrich Tietze, Christoph Schenk, Eberhard Gamm "Electronic Circuits: Handbook for Design and Application", Springer; 2nd edition (March 11, 2008).*

ECE 331	Digital Communication Systems								Prerequisites
3Cr	7th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 232

Baseband Pulse transmission: Matched filters, Intersymbol Interference, Nyquist Criterion for distorionless baseband binary transmission - Signal- Space Analysis: Geometric representation of signals, likelihood functions, coherent detection of signals in noise: ML and MAP decoding rules, the correlation receiver. Probability of error calculation – Pass-band Digital Transmission: Description of ASK, FSK, PSK, DPSK, QAM, MSK modulation schemes - their implementation PSD c/cs - B.W efficiency (spectral efficiency) - performance in AWGN channels.

References

- *DR. J. S. CHITODE, "DIGITAL COMMUNICATION", Technical Publications; 1st edition, 2011*

ECE 341	Electromagnetic Fields								Prerequisites
3Cr	7th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 121 BAS 113

Vector analysis, static electric field, steady currents, electromagnetic fields. static magnetic fields, time varying and time harmonic Maxwell's equations, wave equation and its solutions, boundary conditions, introduction to electromagnetic wave propagation

References

- *Salam, Md. Abdus, "Electromagnetic Field Theories for Engineering", Springer Singapore, 2014.*
- *Sadiku, Matthew N. O.* Elements of Electromagnetics*. New York: Oxford University Press, 2001.*

ECE 342	Waveguides and Antennas								Prerequisites
3Cr	8th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	ECE 341

Time varying fields and Maxwell's equations, boundary conditions at different media interface, retarded potentials, plane wave propagation in free space, TEM transmission lines, transmission line equivalent circuit, transmission line circuit theory, Smith chart, lossy transmission lines, matching techniques. Antenna fundamentals, basic antenna parameters, radiation fromwire antennas, aperture antennas, radiation from microstrip antennas, antenna arrays, array polynomial, phased arrays and nullsteering, receiving antennas, polarization mismatch, antennadesign techniques, introduction toterrestrial and extra terrestrial radio wave propagation, surface wave propagation, iono spheric propagation, microwave and millimeter wave

References

- *Bansal, Rajeev. Fundamentals of engineering electromagnetics. CRC press, 2018.*
- *Carlo G. Someda, "Electromagnetic Waves ", CRC Press; 2 edition (January 13, 2006).*
- *U. A. BAKSHI, "ANTENNA & WAVE PROPAGATION", Technical Publications; 1st edition, 2011.*

CSE 315	Embedded Systems								Prerequisites
3Cr	8th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	CSE 213

Embedded system design process - embedded computing platform- program design and analysis- Hardware accelerators - distributed embedded architectures- system analysis and architecture design- Design example – Programming project.

References

- *Ibrahim, Dogan. Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC 18F Series. Newnes, 2016.*

CSE 314	Computer Drawings								Prerequisites
3Cr	8th	Semester	2	Lab.	0	Tutorial	2	Lecture	CSE 042

Fundamentals of computer graphics - display devices - fundamentals of graphic algorithms - two dimensional graphics - polygon representation - polygon filling - polygon clipping - three dimensional graphics - back face removal - scan line and ray tracing - illumination and shading models - programming projects

References

- *Computer Graphics: Principles and Practice in C, by J. D. Foley, A. Van Dam, S. K. Feiner, J. F. Hughes. Addison-Wesley, 2nd ed..*

CSE 411	Advanced Programming Techniques								Prerequisites
3Cr	9th	Semester	2	Lab.	0	Tutorial	2	Lecture	CSE 042

Programming Techniques in Network and various Media Types – New Programming Techniques (e.g. Internet programming-Web based applications – workflow automation – multithreaded programming –

introto embedded programming–Languages for Internetworking programming and Data Transfer

References

- *Rick Bitter, Advanced Programming Techniques, 2nd ed., CRC Press 2017*

CSE422	Artificial Intelligence								Prerequisites
3Cr	10th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	CSE 112

Introduction to artificial intelligence concepts and definitions -state-space and search - knowledge representation - logic- production systems - semantic networks - frames - knowledge issues - inference - inheritance - nonmonotonic reasoning- uncertainty - fuzziness- game playing - AI-programming languages - Introduction to expert systems and knowledge engineering.- application fields that need intelligence (natural languages- learning-planning-robotics- decision support systems- intelligent agents – Semantic web
Russell, Stuart J., and Peter Norvig. Artificial intelligence: a modern approach.

References

- *Malaysia; Pearson Education Limited, 2016.*
- *Devangini Patel, Hands on Artificial Intelligence for search, 2018*

CSE 421	Programmable Logic Control								Prerequisites
3Cr	10th	Semester	1.5	Lab.	1	Tutorial	2	Lecture	CSE 221

Modular structure of Programmable Logic Controllers (PLCs) – Advantages of using PLCs in Industrial Automation – PLC Programming – Ladder Logic – Handling of Inputs and Outputs in PLCs – Markers – Timers –Counters – PLC Program Development for Control Applications – Interlocking Logic – Sequential Logic - Micro processor control systems – Interfacing controllers with sensors and actuators – Programming of Control Algorithms -Three-term control using micro processors – Controller Fault Tolerance.

References

- *Bolton, William. Programmable logic controllers. Newnes, 2015*

ECE 431	Mobile Communications								Prerequisites
3Cr	9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 331

Conventional telephone systems – Traffic theory – Conventional mobile system – Frequency spectral efficiency – Methods of increasing system capacity – System architecture – Multiple access schemes – Interference in cellular systems – Hand off – Fading and Doppler in cellular system – GSM system architecture – GSM channel coding- Ciphering and modulation – System management.

References

- *Alexander Kukushkin, "Introduction to Mobile Network Engineering: GSM, 3G-WCDMA, LTE and the Road to 5G", 1st Edition, Wiley; 2018.*

Elective Courses Level 300

CCE 311	Integrated Circuits								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 221

IC technology – Tuned amplifiers – Noise analysis – Operational amplifiers and applications – Waveform generation – Analog IC applications (analysis and design) – Evaluation of circuit performance by computer-aided circuit simulations – Phase locked loops - Electronic circuits in radio and television –Video recording

References

- *D. Widmann, H. Mader, H. Friedrich, "Technology of Integrated Circuits", Springer-Verlag Berlin Heidelberg, 1 edition, 2000.*

CCE 331	Optical Fiber								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 341

Optical versus radio frequency communications – Optical fibers – Ray representation in optical fibers – Model analysis in step and graded index optical fibers – Signal degradation – Optical receivers – Optical properties of III – V semiconductors – Emitters: SC laser diodes, light emitting diodes –Photo detectors PIN and avalanche photo diode (APD).

References

- *Rongqing Hui, "Introduction to Fiber-Optic Communications 1st Edition", Academic Press Elsevier, 2019.*
- *John P. Dakin, Robert Brown, "Handbook of Optoelectronics: Concepts, Devices, and Techniques", CRC Press Published October 11, 2017.*

CCE 332	Microwave Engineering								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 341

Rectangular and circular wave guides, cavity resonators, excitation of waveguides, surface guiding and dielectric optical waveguides, analysis of microstrip and strip lines, scattering parameters, wave propagation inferrite media, passive microwave components.

References

- *Nguyen, Cam. Radio-frequency integrated-circuit engineering. John Wiley & Sons, 2015.*
- *Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", 2nd Edition, 2003.*
- *Christopher Bowick, "RF Circuit Design", 2nd Edition, Newnes, Elsevier, 19th October 2007.*

CCE 341	Distributed Systems								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 042

The course deals with the distributed systems technology. It explains the principles of distributed systems such as communication, naming, synchronization, replication, fault tolerance, and security using examples and case studies. It covers architectures in distributed systems, reflecting the progress that has been made on organizing distributed systems, and new topics such as peer-to-peer computing, sensor networks, web services, grid computing, virtualization, cloud computing and its roots in distributed systems mechanisms, and self-management of distributed systems. The course illustrates design concepts for each topic with

concept-oriented assignments and a small high-level programming assignment. Students complete a term project on the design and implementation of a realdistributed system.

References

- *Van Steen, Maarten, and Andrew S. Tanenbaum. "A brief introduction to distributed systems." Computing 98.10 (2016): 967-1009*

CCE 342	Multimedia								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 042

Multimedia - design and implementation of GUI- hardware interfacing- programming project.

References

- *Iain E G Richardson, H.264 and MPEG–4 Video Compression: Video Coding for Next–generation Multimedia Hardcover – Import, 17 Oct 2003*

CCE 343	Computer System Programming								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 042

Functions of system software components - design of hardware drivers, loaders and linkers, compilers, assemblers, interpreters and utilities - case study of real system programming

References

- *Randal E. Bryant and David R. O'Hallaron, Computer Systems: A Programmer's Perspective, 3/E (CS:APP3e)*

CCE 344	Software Engineering								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 042

Software Development processes: Waterfall models, Agile methods, Rapid application development – System modeling using UML: Context models, Interaction models, Structural models, Behavioral models ، Model-driven engineering - System architecting and design: Architectural design decisions, Architecturalviews, Architectural patterns, Application architectures – Testing: Development testing, Test-drivendevelopment, Release testing, User testing – Software Maintenance: Evolution processes, Understanding software evolution, Making changes to operational software systems, Legacy system management ، Making decisions about software change - Quality Assurance& Configuration Management, recent trendsin software development - Software project management..

References

- *Sommerville, software engineering, 10 ed., Pearson India 2018*

CCE 345	Control (2)								Prerequisites
3Cr	8th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 221

Introduction to discrete time control systems –Impulse sampling and holding –pulse transfer function – Mapping between S-plane and Z plane –closed loop transfer function using SFG –Stability analysis of closed loop systems in Z plane –Transient and steady state response analysis –design based on root locus method – design based on frequency response analysis -state space representation of discrete time systems –solving discrete time state space equations –pulse transfer function matrix –discretization of continuous time state equations –Lyapunov stability analysis

References

- *Ogata, Katsuhiko. Modern control engineering. Upper Saddle River, NJ: Prentice Hall, 2015*..

Elective Courses Level 400

CCE 411	Industrial Electronics								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CCE 311

Data acquisition systems – Sensors – Signal Conditioning – Digitizing – Microprocessor based systems – Memory interface – I/O interfaces – Applications in industry.

References

- *Bogdan M. Wilamowski, J. David Irwin, Fundamentals of Industrial Electronics, CRC Press2017.*
- *Shih-Chii Liu, Jorg Kramer, Giacomo Indiveri, "Analog VLSI: Circuits and Principles", A Bradford Book (November 15, 2002).*
- *G S Sawhney, "Biomedical Electronics and Instrumentation", I.K.International Publishing House; 1st Edition 2011 edition (November 29, 2011).*

CCE 412	Introduction to Nanotechnology								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 341

Introduction to nano technology science - Wave Nature of Light - Dielectric Waveguides and Optical Fibers - Polarization and Modulation of Light – nsno plasmonic wavrguide – plasmonic sensors – medical applications of nano technology

References

- *Sergey V. Gaponenko, "Introduction to Nanophotonics" 1st Edition, Cambridge University Press; 2010*.

CCE 421	Information Theory								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 232

Introduction to information theory (Information, Entropy, Discrete memory- less channels – Mutual information – Channel capacity). Compression and source coding (Properties of source codes, construction of instantaneous codes, lossy data compression). Channel coding (linear block codes, syndrome calculation,

Cyclic codes, Convolutional coding, The code tree, trellis and state diagram, ML decoding of convolutional codes, the Viterbi algorithmShannon theorem of perfect secrecy.

References

- *Yeung, Raymond W, "Information Theory and Network Coding", Springer US, 2008.*

CCE 422	Selected Topics in Communications Engineering								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 331
This course covers the most recently introduced topics in communication systems and applications.									

CCE 423	Satellite Communications								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 331

The Geo-stationary (GEO) orbit – The space link – Transmission losses – The link power budget – System noise – Uplink and downlink carrier-to- noise ratios – Inter-modulation noise – Pre-assigned and demand assigned FDMA – TDMA – Frame efficiency and channel capacity – CDMA –Interference between satellite circuits – Antenna gain function – Pass- band interference – Protection ratio – Coordination criterion – LEO satellites – CDMA in LEO satellite systems – Signal to interference ratio (SIR) – Spread slotted ALOHA for LEO satellites – Modified power control –Transmit permission control scheme; non-fading and fading channel – Packet admission control scheme – Power control – Multi-beam LEO satellites

References

- *Louis J. Ippolito Jr., "Satellite Communications Systems Engineering: Atmospheric Effects, Satellite .*

CCE424	Communication Security								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 331

Students have gained fundamental knowledge of security terms and concepts, such as threats, vulnerabilities, protection and incident handling. The purpose of the course is to provide the student with an overview of the field of communication / information security and respective implementation issues for communication systems. The students will be exposed to the spectrum of security activities, its methods, methodologies and mechanisms. Coverage will include cryptographic functions, inspection and protection of assets, detection of and reaction to threats to communication systems, and analysis of incident procedures. Another focus will be set on security related organizational structures and product / system certification with respect to standardized security evaluation crietria.

References

- *Peter Stavroulakis, Mark Stamp.,Handbook of Information and Communication Security. Springer Science & Business Media, Feb 23, 2010 .*

CCE 425	Adapative Filters								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 231

A course that examin es the fundamentals of optimal filtering and estimation,Wiener filters,linear prediction, steepest-descent and stochas ticgradient algorithms; frequency-domain adaptive filters; method of least squares, recursive least squares, fast fixed order and order-recursive (lattice) filters; misadjustment, convergen ceand tracking analyses, stability issues, finiteprecisioneffects; connections with Kalman filtering; and nonlinear adaptive filters.

References

- *Haykin, Simon,* Adaptive Filter Theory*, Prentice-Hall, Inc., 4 ed. 2001*
- *Hayes, Monson H.,* Statistical Digital Signal Processing and Modeling*, John Wiley & Sons, 1996*.

CCE426	Phonics								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CCE 332

Plane and spherical waves – Simple and compound sound sources – Dynamically analogous mechanical and acoustical circuits – Acoustic transducers – Loudspeakers; types and systems – Microphone; types and systems - Measurements of sound – Acoustics and hearing – Acoustic environment outdoors – Acoustic environment indoors - Ultrasonic applications.

References

- *Frank J. Fahy. Foundations of Engineering Acoustics, Academic Press; 1 ed, 2000*

CCE 427	Wireless Communications								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 331

DFT and its properties – Fading (fast, slow, and flat) – Frequency selective and non-selective – Dual Multi-Tone (DMT) – OFDM – Multi-path propagation – Delay spread values – Guard time and cyclic extension – OFDM parameters – OFDM versus single carrier modulation - Spread Spectrum – PN sequence generators – Direct sequence Spread Spectrum –Probability of error – Frequency Hopping Spread Spectrum – CDMA– DS-CDMA.

Reference

- *Andrea Goldsmith, "Wireless Communications", Cambridge University Press; 1 edition (August 8, 2005).*

CCE 441	Computer Networks (2)								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 312

Theoretical foundations for building next generation Internet. To provide a detailed introduction to advanced topics in computer net-works including advanced transport layer concepts, adaptive queue management, Quality of Service fundamentals, packet scheduling, multimedia networking, content distribution networks and network measurements. Methodologies and tools in undertaking research in networking - Performance issues and QoS mechanisms in the Internet. Expertise in network programming and computer network simulation.

References

- *Comer, Douglas E. The Internet book: everything you need to know about computer networking and how the Internet works. Chapman and Hall/CRC, 2018.*
- *Cisco Networking Academy. Routing and Switching Essentials Companion Guide. Pearson Education, 2014.*
- *Roger L. Freeman, "Telecommunication System Engineering", Fourth Edition, Wiley; May 2004.*

CCE 442	Design and Programming of Web server								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 042

This course concentrates on major technologies used in building Web servers. Alternate versions are to be given each year: the Windows-based IIS Server and the Linux-based Apache server. For IIS, ASP. NET along with C# are used for programming Web servers. For Apache, PHP is the language of choice. The course starts with a fast track on client programming, the HTTP protocol, SQL database servers, and XML programming. A weekly lab, two application projects, and a research project constitute the major requirements of the course.

Reference

- *Thomas A. Powell, Web Design: The Complete Reference Paperback – May 12, 2000*

CCE 443	Big Data Analytics								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 212

Introduction to Data Mining, Data, Collection, Sampling andPreprocessing, Predictive andDescriptive Analytics, Survival Analysis, Social Networks Analysis, Modelling and Benchmarking and privacy, Mini project Application using Hadoop and Map Reduce tools.

Reference

- *Peter Ghavami, Big Data Analytics Methods: Analytics Techniques in Data Mining, Deep Learning and Natural Language Processing 2nd ed., de Gruyter; 2019*

CCE 444	Selected Topics in Computer Engineering								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 213

Selected topics related to the state of the art in computer engineering.

CCE445	Game Theory and Decision making								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 411

Game theory provides asset oftools, approaches, and perspective son decision making to mimic the human elements of decision making that is best described by strategy,coercion and cooperation. This course offers an introduction to fundament also fgame theory and decision making with a special emphasis on the foundations of the mathematical background. Topics covered include: static, evolutionary,supermodular, repeated, cooperative, network, potential and congestion games as well as bargaining and uncertainty in games. Students will be assigne dreal-world examples of game theory and strategic decision making to

investigate as projects.

Reference

- *R. Duncan Luce , Howard Raiffa, Games and Decisions: Introduction and Critical Survey, Dover Publications; 1989.*

CSE 446	Internet Engineering								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 042

A course that examines major protocols used in internet engineering: IP, ICMP, TCP, UDP; new technologies introduced on the internet, such as IP Multicast, Mobile IP, IPv6, VPNs, and quality of service; routing on the Internet; network security and firewall design; and an overview of the application protocols such as SMTP, HTTP, RTP, and SNMP.

Reference

- *Computer Networking: A Top-Down Approach, Featuring the Internet, James Kurose and Keith Ross, Addison-Wesley Pub Co, 2004.*
- *Internet & World Wide Web How to Program, 4th edition, Harvey M. Deitel and Paul J. Deitel, , Prentice Hall , 2008.*

CCE 447	Languages Compilers								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CSE 311

Introduction to the theory of languages - evolution of computer languages and translators - formal specification of languages - context dependent and context free languages - logical structure of a compiler - lexical, syntax and semantic analysis - code generation and optimization - storage and register allocation - runtime considerations

Reference

- *Douglas Thain, Introduction to Compilers and Language Design1st ed. Paperback 2019.*

CCE461	Digital Image Processing								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	CCE 231

Image representation - methods of image processing - enhancement - data compression - reconstruction from projection - features extraction - image analysis - pattern recognition - computer vision

References

- *Understanding digital image processing, Vipin Tyagi, CRC press, 2018.*

CCE462	Biomedical Engineering								Prerequisites
3Cr	10th - 9th	Semester	0	Lab.	2	Tutorial	2	Lecture	----------

This course includes an introduction to: general instrumentation configuration, performance ofinstrumentation systems; types and characteristics of transducers; sources and characteristics of bioelectric signals; types and characteristics of electrodes; temperature regulation and measurement; cardiovascular system, measurements, and diagnostic equipment; blood instruments; patient care and monitoring; and electrical safety of medical equipment

References

- *G S Sawhney, "Biomedical Electronics and Instrumentation", I.K.International Publishing House; 1st Edition 2011 edition (2011)*
- *W. Mark Saltzman, Biomedical Engineering, Cambridge University Press; 2 ed 2015*

CCE463	Communication Engineering for Genetics and Bioinformatics								Prerequisites
3Cr	10^{th} - 9^{th}	Semester	0	Lab.	2	Tutorial	2	Lecture	----------

This course presents current research efforts in the emerging interdisciplinary field of communications engineering for genetics and bioinformatics. It shows how concepts and techniques from the field of communications engineering can be applied to central problems from the fields of genetics and bioinformatics. As a basic analogy, voice information is digitized, transmitted, and processed in communications, and DNA information is replicated, transmitted, and processed in genetics. The main topics covered include DNA compression, mutual information for functional genomics, channel coding for gene expression, genomic signal processing, and biological computation

References

- *Rastogi, Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery" paperback 2013*
- *Ruchi Singh and Richa Sharm, Bioinformatics: Basics, Algorithms and Applications Paperback – December 1, 2010*

CCE 464	Neural Engineering								Prerequisites
3Cr	10^{th} - 9^{th}	Semester	0	Lab.	2	Tutorial	2	Lecture	ECE 231

Introduction to basic concepts for NN-single and multilayer perceptrons- learning algorithms- feedforward and feedback architectures - recurrent networks- associative memory networks- design and hardwareimplementation of NN- typical examples.Introduction to Deep Learning - Deep Computer Vision - Deep Reinforcement Learning - Data Visualization for Machine Learning - Learning and Perception - Deep Sequence Modeling - Deep Generative Models

References

- *Metin Akay, Handbook of Neural Engineering, 2006*

CCE 271	Field Training (1)								Prerequisites
1 Cr	6^{th}	Semester	3	Lab.	0	Tutorial	0	Lecture	107 Cr

Training on industrial establishments relevant to the program. Training lasts for total of 90 hours, during a period about three weeks. The program training advisor schedules at least one follow up visit to the training venue and formally report on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. The course is graded as Pass/Fail grade-system.

CCE 371	Field Training (2)								Prerequisites
1 Cr	8th	Semester	3	Lab.	0	Tutorial	0	Lecture	CCE 271
Training on industrial establishments relevant to the program. Training lasts for total of 180 hours, during a minimum period of six weeks. The program training advisor schedules at least two follow-up visits to the training venue and formally report on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. The course is graded as Pass/Fail grade-system.									

CCE 481	Graduation Project (1)								Prerequisites
2 Cr	9th	Semester	3	Lab.	0	Tutorial	1	Lecture	125cr
A supervised project in groups of normally 3 students aimed at providing practical experience in some aspects of computer, communications and electrical engineering. Students are expected to define the project, state its objectives, complete a literature survey, set project specifications and select a design method. They are also expected to do some preliminary modeling and analysis and to acquire the necessary material needed for the completion of the project in the spring term. A professional report and an oral presentation are also required from the students.									

CCE 482	Graduation Project (2)								Prerequisites
3 Cr	10th	Semester	6	Lab.	0	Tutorial	1	Lecture	CCE 481
This is a continuation of CCE 401. Students are asked to deliver a product that has passed through the design, analysis, testing and evaluation stages. The course also requires the production of a professional report that includes a description of the design process, implementation and testing, verification and validation and a critical appraisal of the project. An oral presentation and a poster are also within the project deliverables									