Computer Engineering Program Plan

Acad. Year	First Trimester						Second Trimester						Third Trimester					
	Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours		
				Cr	Th	Pr				Cr	Th	Pr				Cr	Th	Pr
1	0827111	Calculus	----	3	4.5	0	0826152	Biology	----	3	4.5	0	1900101	Creed and Doctrines	----	2	3	0
	0921110	Introduction to Computing	----	4	4.5	4.5	0827121	Probability and Statistics	0827111	3	4.5	0	0603103	Business and Accounting	1722111	3	4.5	0
	1722111	Academic English	----	3	4.5	0	0921120	Fundamentals of Programming	0921110	4	4.5	4.5	0814132	Physics	----	4	4.5	3
													0827122	Discrete Mathematics	0827111	3	4.5	0
	Total			10	13.5	4.5	Total			10	13.5	4.5	Total			12	16.5	3
Acad. Year	First Trimester						Second Trimester						Third Trimester					
	Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours		
				Cr	Th	Pr				Cr	Th	Pr				Cr	Th	Pr
2	0921212	Linear Algebra	0827122	3	4.5	0	0923213	Basic Electronics	0814132	4	4.5	4.5	1900102	Islamic Culture	----	2	3	0
	0921211	Data Structure and Algorithms	0921120 0827122	4	4.5	4.5	0923223	Digital Logic and Design	0814132	4	4.5	4.5	0923222	Differential Equations	0923210	3	4.5	0
	0924214	Fundamentals of Computer Networks	0921110	4	4.5	4.5	0923224	Numerical Analysis	0923210	3	4.5	0	0923221	Electric Circuits	0923213	4	4.5	4.5
	0923210	Advanced Calculus	0827111	3	4.5	0							0921220	Fundamentals of Software Engineering	0921120	4	4.5	4.5
	Total			14	18	9	Total			11	13.5	9	Total			13	16.5	9
Acad. Year	First Trimester						Second Trimester						Third Trimester					
	Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours		
				Cr	Th	Pr				Cr	Th	Pr				Cr	Th	Pr
3	0922312	Technical Reports	1722111	3	4.5	0	0923310	Signals and Systems	0921212	3	4.5	0	0922322	Professional Responsibility	0922312 0826152	3	4.5	0
	0923313	Computer Organization and Architecture	0923223	4	4.5	4.5	0921320	Computer Security	0924214	3	4.5	0	0923323	Embedded Systems	0923313	4	4.5	4.5
	0923311	Electronic Circuits	0923221	4	4.5	4.5	0921321	Operating Systems	0923313	4	4.5	4.5	1900???	University Elective(1)	----	2	3	0
													092?4??	Program Elective(1)	?	3	4.5	0
	Total			11	13.5	9	Total			10	13.5	4.5	Total			12	16.5	4.5
	Summer Semester																	
	Course Code	Course Name					Credit Hours	Pre-Requisite										
	0923330	Practical (Co-op) Training					3	"Department Approval and Finish 95 Credit Hours "										
Acad. Year	First Trimester						Second Trimester						Third Trimester					
	Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours			Course Code	Course Name	Pre-req	Hours		
				Cr	Th	Pr				Cr	Th	Pr				Cr	Th	Pr
4	0923410	Project Proposal	Dept. Approval	2	---	---	0923411	Design and Modeling of Digital Systems	0923313	4	4.5	4.5	0923421	Selected Topics in Computer Engineering	0923410	3	4.5	0
	1900???	University Elective(2)	----	2	3	0	0923412	Computer Peripherals and Interfacing	0923311 0923313	4	4.5	4.5	0923422	Parallel and Distributed Systems	0923313	3	4.5	0
							092?4??	Program Elective(2)	?	3	4.5	0	092?4??	Program Elective(3)	?	3	4.5	0
													0923420	Project Implementation	0923410	3	---	---
	Total			4	3	0	Total			11	13.5	9	Total			12	13.5	0

Computer Engineering Program Plan

	Program Elective Courses (3 Courses of 9 Credit Hours Total)					University Elective Courses (2 Courses of 4 Credit Hours Total)			
	Course Code	Course Name	Pre-req.	Hours		Course Code	Course Name	Hours	
				Cr	Th			Cr	Th
Elective Courses	0923413	Computational Intelligence and Expert Systems	0827122	3	4.5	1900103	Islamic Morals and Occupational Ethics	2	3
						1900104	Studies in the Prophet's Biography	2	3
	0923414	Digital Signal Processing	0923310	3	4.5	1900105	Medical Jurisprudence	2	3
	0924415	Multimedia Networks and Applications	0924214	3	4.5	1900106	Economy and Politics in Islam	2	3
	0924416	Telecommunication Networks	0924214	3	4.5	1900107	Social System and Family Behavior	2	3
						0602233	Fundamentals of Entrepreneurship	2	3
	0923423	Robotics	0923313	3	4.5	1900109	Health and Fitness	2	3
	0923424	VLSI Design	0923411	3	4.5	1900110	Research Skills	2	3
	0923425	Image Analysis and Machine Vision	0923310	3	4.5	1900111	Voluntary Work	2	3
						1900112	Medicine: Type and Usage	2	3
	0923426	Computer Graphics	0827122	3	4.5	1900113	Human Rights in Islam	2	3
	0923427	Control Engineering	0923222	3	4.5	1900114	Food and Nutrition	2	3

<table>
<tr><td>Course Name</td><td colspan="3">Introduction to Computing</td><td colspan="2">مقدمة علم الحاسب</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CS110</td><td>0921110</td><td>1st</td><td>4 (3-3-3)</td><td>None</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
The main objective of this course is to present basic concepts of information technology that motivates the study of different disciplines at the College of Computer Sciences and Information Technology. The overall course covers fundamentals concepts categorized in four main modules. The first module introduces the students to key concepts in computer hardware. This includes input, processing and output devices, data representation, analog and digital systems, and number systems. The second module introduces the concepts of data, information and their value to organizations. This module also includes overview of database systems and their role in structuring and organizing data. The third module covers basics of networking including network architecture, technology and the Internet. Finally, the fourth module covers computer software, programming languages and use of computers for problem solving. In this module, basic concepts of programming such as variables, data types, expressions, loops and decision structures are introduced. The course also provides a brief overview of computer security, professional and ethical issues of computers in society.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Describe basic functions of computer hardware and software components [3]
2. Explain fundamental concepts of information systems and its components including hardware, software, database and telecommunication [3]
3. Describe fundamental networking concepts including network topologies, intranet and internet technologies [3]
4. Analyze and design computing solutions using fundamental programming constructs [1, 2]
5. Explain key ethical, legal and social issues related to information technology and how to interpret and comply with ethical principles [4]</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>5%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>25%</td><td rowspan="2">Project</td><td rowspan="2">-</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="7">1. Behrouz A. Forouzan, Firouz Mosharraf, “Foundations of Computer Science”, 3rd Edition, 2018, Cengage Learning. ISBN-13: 978-1473751040.
2. Ralph Stair, George Reynolds, “Principles of Information Systems”, 13th Edition, 2018, Cengage Learning. ISBN-13: 978-1305971776.</td></tr>
<tr><td>References</td><td colspan="7">• Joyce Farrell, “Just Enough Programming Logic and Design”, 1st Edition, 2010, Cengage Learning. ISBN-13: 978-1439039571.
• G. Micheal Schneider and Judith L. Gersting, “Invitation to Computer Science”, 7th Edition, 2016, Cengage Learning. ISBN-13: 978-1305075771.</td></tr>
</table>

Course Name	*Calculus*			التفاضل والتكامل	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	MATH111	0817111	1st	3 (3-0-6)	None
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The main purpose of this course is to introduce the students with methods and applications of differential and integral calculus. It will enable the students to establish the basic concepts of calculus, find the limit of univariate functions, know the continuity of functions, derivate the functions and apply the derivative tests to plot the functions. They will find the integrals and apply definite integrals to compute the area, solids, arc length, and surface of revolutions.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Interpret** a function from an algebraic, numerical and graphical perspective and extract information relevant to the phenomenon modeled by the function. [1, 2]
2. **Calculate** the limit of a function at a point numerically and algebraically using appropriate methods. [1, 2]
3. **Define** derivative of functions and compute derivatives using the rules of differentiation. [1, 2]
4. **Interpret** differentiation and anti-differentiation as inverse operations. [1, 2]
5. **Analyze** the basic techniques of integration to compute integrals. [1, 2]
6. **Evaluate** the definite integral geometrically over the area under a curve. [1, 2]

Assessment Policy	**Assignment**	15%	**Quiz**	15%	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	40%	**Others**	-		
Textbook	G. Thomas, M. Weir and J. Hass, "**Thomas' Calculus Early Transcendentals**", 12th Edition, 2010, Pearson. ISBN-13: 978-0321588760.							
References	• George B. Thomas, "**Thomas' Calculus**", 11th Edition, 2008, Pearson Education. ISBN-13: 9780321526793.							

<table>
<tr><td>Course Name</td><td colspan="3">Physics</td><td colspan="2">الفيزياء</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>PHY132</td><td>0814132</td><td>1st</td><td>4 (3-3-3)</td><td>None</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
This course provides a conceptually-oriented exposure to the fundamental principles of electricity, magnetism and optics. Topics include basic concepts of charge, electric field, Coulomb’s law, Gauss's theorem, electrostatic potential, resistors in series and parallel circuits, capacitors and inductors, dielectric material in alternating electric field, magnetic effect of an electric current, Biot-Savart law, electromagnetic induction, Faraday's Law, Lenz's law, energy stored in magnetic field, Properties of magnetic materials: diamagnetism, paramagnetism and ferromagnetism, properties of light: reflection, refraction and total internal reflection.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the fundamental concepts of electric charge, electrostatic force, electric potential, electric current, current density, magnetic field and magnetic flux. [3]
2. Define capacitance and inductance and analyze the effects associated with capacitors and inductors of various symmetries, in series and parallel combination. [3]
3. Outline the basic principles and mathematical expressions of Gauss’s, Biot-Savart, Ampere’s, Faraday’s and Lenz’s Laws. [3]
4. Calculate electric and magnetic fields from a distribution of charges or current. [1]
5. Estimate and explain the effects of static, non-uniform and uniform magnetic fields on moving charges and current-carrying wires, loops and the magnetic dipole. [1]</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>20 %</td><td rowspan="2">Project</td><td rowspan="2">-</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="7">Douglas C. Giancoli, "Physics for Scientists and Engineers with Modern Physics", Vol. 2, 2008, New Jersey: Pearson Education. ISBN-13: 978-0130215192.</td></tr>
<tr><td>References</td><td colspan="7">• Robert Resnick, David Halliday, and Kenneth S. Krane, "Physics” Vol. 2, 2001, Wiley. ISBN-13: 978-0471401940.
• Raymond A. Serway and John W. Jewett, “Physics for Scientists and Engineers with Modern Physics”, 9th Edition, 2013, Cengage Learning. ISBN-13: 978-1133954057.
• Hugh D. Young and Roger A. Freedman, “University Physics with Modern Physics”, 14th Edition, 2015, Pearson. ISBN-13: 978-0321973610.</td></tr>
</table>

Course Name	*Academic English*			*اللغة الإنجليزية الأكاديمية*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	ENG111	1722111	1st	3 (3-0-6)	None
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

This course aims to provide students with necessary competency in English for academic success. On top of the preparatory year English training, this course tries to enhance academic writing and reading skills in the context of computing and information technology through engaging activities and assignments in and outside the classroom. The course also develops learning skills including practice in listening to lectures, note-taking and group discussion. The course assessment would adopt IELTS-style exams for reading and writing skills along with vocabulary, punctuation, grammar and other academic writing essentials. Various aspects of academic writing including the writing process, grammar and punctuation, sentence and paragraph structure, rhetoric patterns in essays, paraphrasing, summarization, plagiarism and citations and references are covered in this course. After taking this course students will be able to read and write essays describing data or natural phenomenon as well as scientific arguments as found in computing related textbooks, magazines and blogs. This course is a pre-requisite of Technical Report course where students will further develop their English skills for graduation project report and scientific presentation.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Apply** appropriate vocabulary, grammar and punctuation, sentence, paragraph and rhetorical structure in academic English. [3]
2. **Practice** proper process of writing: pre-writing (brainstorming, clustering, and outlining), revising, editing, and proofreading. [3]
3. **Perform** self-editing and peer-editing constructively to improve their own writings as well as the writings of the other. [3, 4, 5]
4. **Compose** focused and well-developed essays of approximately 250 words or more describing data, natural phenomenon and scientific arguments. [3, 4]
5. **Demonstrate** ability to follow university lectures and comprehend textbook materials to answer questions, taking notes and participate in effective group discussions. [3, 4, 5]

Assessment Policy	**Assignment**	20%	**Quiz**	10%	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	40%	**Others**	-		
Textbook	1. Alice Oshima and Ann Houge, "**Introduction to Academic Writing**", 3rd Edition, 2007, Pearson Longman. ISBN-13: 978-0131933958 2. Diana Hacker and Nancy Sommers, "**Rules for Writers**", 7th Edition, 2011, Bedford/St. Martin's, ISBN-13: 978-0312647360							
References	• Natilene Bowker, "**Academic Writing: A Guide to Tertiary Level Writing**", 2007, Massey University. Available at: http://owll.massey.ac.nz/pdf/Academic-Writing-Guide							

<table>
<tr><td>Course Name</td><td colspan="3">Fundamentals of Programming</td><td colspan="2">مبادئ البرمجة</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CS120</td><td>0921120</td><td>2nd</td><td>4 (3-3-3)</td><td>0921110 (Introduction to Computing)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
This course aims to provide students with the basic concepts of computer programming. The course focuses on. developing problem solving skills and to design and develop computer programs. The course content includes: an overview of various and common programming paradigms and the difference in between compilers and interpreters. Concepts of variables, data types, operators, arrays & pointers are covered. It provides in depth knowledge of logic building using selection and iteration control structures. It introduces various operations including string operations, functions and along with methods of passing arguments by value or by reference, function overloading, function overriding and recursion. Concepts of classes and objects are also introduced in this course. The lab focuses on practical aspects of all the covered programming concepts through programs writing, compilation, execution, testing and debugging using C++ environment.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Analyze the requirements for solving basic computing problems and design suitable algorithmic solutions. [1, 2]
2. Design and implement programs that use fundamental programming constructs. [2]
3. Analyze and explain the behavior and output of simple programs involving fundamental programming constructs. [1, 2]
4. Test and debug programs that use the fundamental programming constructs. [2]</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>-</td><td>Quiz</td><td>10%</td><td>Lab</td><td>30%</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>30%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="6">Deitel and Deitel, “C++ How to Program”, 10th Edition, 2016, Pearson. ISBN-13: 978-0134448237.</td></tr>
<tr><td>References</td><td colspan="6">• D.S. Malik, “C++ Programming: From Problem Analysis to Program Design”, 6th Edition, 2013, Cengage Learning. ISBN–13: 978-1-133-62638-1
• Stanley B. Lippman, Josee Lajoie, Barbara E. Moo, “C++ Primer”, 5th Edition, 2012, Addison-Wesley. ISBN: 978-0321714114.</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="3">Probability and Statistics</td><td colspan="2">الاحتمالات والاحصاء</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>MATH121</td><td>0817121</td><td>2nd</td><td>3 (3-0-6)</td><td>0817111 (Calculus)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
This course aims to introduce the students to the basic concepts of probability and statistics with applications in computer science and information technology. Topics include Sample space, events, and probabilities of outcomes, axioms of probability, conditional probability, random variables, discrete and continuous distributions, functions of random variables. In addition, it covers descriptive statistical measures and graphical display of data: sample mean, mode, median, range, variance, stem-and-leaf-diagram, frequency distribution, box-plots and histograms. The students will be introduced to the basics of estimation, test of hypotheses, regression analysis and correlation. Students will use a statistical software to analyze practical datasets.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Identify probability distributions. [1]
2. Compute probabilities by modeling sample spaces. [1, 2]
3. Summarize and present data numerically and graphically using descriptive statistics. [1, 2]
4. Use correlation and linear regression analysis. [1, 2]
5. Compute confidence intervals and test statistical hypotheses. [1, 2]
6. Apply the concepts of probability and statistics on sample datasets using a suitable statistical software. [1, 2]</td></tr>
</table>

Assessment Policy	**Assignment**	10 %	**Quiz**	15%	**Lab**	-	**Project**	-
	Midterm	30 %	**Final**	45%	**Others**	-		

Textbook	D.C. Montgomery and C. Runger, "**Applied Statistics and Probability for Engineers**", 6th Edition, 2013, Wiley. ISBN-13: 978-1118539712
References	• Dekking, Kraaikamp, Lopuhaa, and Meester, "**Modern Introduction to Probability and Statistics: Understanding Why and How**", 2005, Springer Science & Business Media. ISBN-13: 978-1852338961

Course Name	*Discrete Mathematics*			الرياضيات المنفصلة	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	MATH122	0817122	2nd	3 (3-0-6)	0817111 (Calculus)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The main purpose of this course is to provide a foundation to think logically and employ these techniques in solving science and engineering problems. It will enable the students to reason mathematically about basic data types and structures, such as numbers, sets, functions, graphs, and trees used in computer algorithms and systems. Topics involving relations, recursive functions, combinatorial and counting methods are included to improve their relational, recursive, and quantitative skills.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Use** logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers. [1]
2. **Evaluate** mathematical arguments and identify fallacious reasoning. [1, 2]
3. **List** and **apply** the operations of sets and use Venn diagrams to solve applied problems. [1, 2]
4. **Reconstruct** various recurrence functions and use them effectively in problem solving. [1]
5. **Calculate** numbers of possible outcomes of elementary combinatorial processes such as permutations and combinations. [1]
6. **Apply** graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction. [2]

Assessment Policy	**Assignment**	15%	**Quiz**	10%	**Lab**	-	**Project**	-
	Midterm	25%	**Final**	50%	**Others**	-		
Textbook	David J. Hunter, "**Essentials of Discrete Mathematics**", 3rd Edition, 2015, Jones & Bartlett Learning. ISBN-13: 978-1284056242.							
References	• Kenneth Rosen, "**Discrete Mathematics and its Applications**", 7th Edition, 2012, McGraw-Hill. ISBN: 978-0073383095.							

Course Name	*Business and Accounting*	إدارة أعمال والمحاسبة

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	MGT123	0622123	2nd	3 (3-0-6)	1722111 (Academic English)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

This course presents a broad introduction to business and accounting principles for non-business students primarily focusing on accounting. First, the business portion focuses on the nature, structure and working of contemporary business organizations. Second, the accounting part provides a complete vision for recording (using double entry system), classifying and summarizing all the financial transactions by extracting a trial balance to present financial statements. This will cover topics including accounting principles, balance sheet equation, recording financial transactions in journal, posting entries to ledger, preparing trial balance, and financial statements.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** the basic concepts of Business Administration. [3]
2. **Describe** the objectives of financial accounting, basic accounting terminologies, and Generally Accepted Accounting Principles (GAAP). [3]
3. **Identify** the balance sheet equation, record financial transactions, and prepare financial statements. [1, 2]
4. **Evaluate** the accounting transactions according to the effect on balance sheet equation, and apply the double entry basis. [2]
5. **Prepare** recording in the journal, posting to the ledger, trial balance, final accounts, financial statements, and correcting accounting errors. [2]

Assessment Policy								
	Assignment	15%	**Quiz**	10%	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	45%	**Others**	-		

Textbook	1. Ronald Ebert and Ricky Griffin, "**Business Essentials**", 11th Edition, 2016, Pearson. ISBN-13: 978-0134129969 2. Jerry Weygand, Paul Kimmel and Donald Kieso, "**Accounting Principles**", 12th Edition, 2015, Wiley & Sons. ISBN-13: 978-1119133018
References	• John Wild, Ken Shaw and Barbara Chiappetta, "**Fundamental Accounting Principles**", 23rd Edition, 2016, McGraw-Hill Education. ISBN-13: 978-1259536359. • David Grant and Robert McLarty, "**Business Basics**", Business Basics International Edition, 2006, Oxford University Press. ISBN-13: 978-0194577793

Course Name	*Biology*			علم الاحياء	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	BIO152	0816152	2nd	4 (3-3-3)	None
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

Biology is a general science course with a lab component, which is designed for non-biology majors. The course covers the concepts of life, cell, and genetics; different cellular processes; and the forms and functions of human organ systems. The course emphasizes on biological phenomenon in our daily life that relates to human body functions, health and well-being. Students will be made aware of current advances and applications of biology in medicine, agriculture, environment and the society in general and computing in particular. After taking this course, students will also be aware of the challenges in biological research and how computing technologies can help in solving them, and vice versa.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Recognize** the concepts of life, biological organization, evolution, cell, genetics and various cellular activities such as molecular transports, cell metabolism, reproduction and gene expression. [3]
2. **Define** the components, functions and organization of cell and human organ systems. [3]
3. **Perform** basic scientific calculation. [1]
4. **Apply** scientific methods to carry out experiments, interpret results and draw conclusions. [1, 2]
5. **Demonstrate** ability to work independently and as a team member to perform lab experiments. [2, 5]
6. **Collect**, **analyze**, **document**, and **report** biology and computing related information clearly, concisely, logically, and ethically using authentic source with proper citation, reference and acknowledgment. [3, 4]
7. **Operate** related equipment and perform laboratory experiments according to the instruction. [2]

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	20%	**Project**	-
	Midterm	20%	**Final**	40%	**Others**	-		
Textbook	Jane B. Reece, Martha R. Taylor, Eric J. Simon, Jean L. Dickey, "**Campbell Biology – Concepts and Connections**", 8th Edition (Global Edition), 2015, Pearson Benjamin Cummings. ISBN-13: 978-1292057804							
References	• Jane B. Reece, Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Robert B. Jackson, "**Campbell Biology**", 9th Edition, 2011, Pearson. ISBN-13: 978-0321739759							

Course Name	*Advanced Calculus*			التفاضل والتكامل المتقدمه	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE210	0923210	3rd	3 (3-0-6)	0817111 (Calculus)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Advanced Calculus is a continuation of Calculus course to cover the advanced calculus concepts focusing on sequences and series, convergence tests, polar coordinates, cylindrical and spherical coordinates. It will enable the students to establish the basic concepts of Taylor and Maclaurin series, vectors, lines, planes and surfaces, and functions of two and three variables. They will also learn how to calculate partial derivatives, directional derivatives, double integrals and triple integrals.

Course Outcomes

After the completion of this course, the student will be able to:

1. **State and explain** alternating series, power series, Taylor and Maclaurin series. [1]
2. **Define** extrema of functions of two variables. [1]
3. **Describe** polar, cylindrical and spherical coordinates and compute integrals in these coordinates. [1]
4. **Compute** the double integrals in polar coordinates. [1, 2, 6]
5. **Compute** the triple integrals in cylindrical and spherical coordinates. [1, 2, 6]
6. **Compute** the partial derivatives and directional derivatives. [1, 2, 6]

Assessment Policy	**Assignment**	15%	**Quiz**	15%	**Lab**		**Project**	
	Midterm	30%	**Final**	40%	**Others**			
Textbook	G. Thomas, M. Weir and J. Hass, "**Thomas' Calculus Early Transcendental**", 12th Edition, 2010, Pearson. ISBN: 978-0-321-58876-0.							
References	William Briggs and Lyle Cochran, **"Calculus"** International Edition, 2011, Pearson. ISBN: 617-671-3447.							

Course Name	*Data Structure and Algorithms*			*هيكلة البيانات والخوارزميات*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CS211	0921211	3rd	4 (3-3-3)	0921120 (Fundamentals of Programming), 0817122 (Discrete Math)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The aim of this course is to describe the concept of structuring data for use in solving problems by writing efficient algorithms. The concepts of algorithm analysis using flops and memory requirements, and their comparison based on best, worst and average case behavior is reviewed along with asymptotic notation. The concepts of data types, user defined data types, abstract data types are discussed along with methods of static and dynamic memory allocation. Some linear data structures like arrays, stacks and queues are introduced and their common applications using iterative and recursive methods are discussed. Dynamic data structures like linked Lists, Linked stacks and queues, trees and graphs are introduced along with their applications to searching and sorting. The data structures are implemented in lab sessions with a practical application as a team project.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** the concept of structuring various types of data. [3]
2. **Differentiate** between different types of data structures with respect to program efficiency. [1]
3. **Use** searching and sorting algorithms using suitable data structures. [2]
4. **Analyze** the complexity of various searching and sorting algorithms. [2]

Assessment Policy	**Assignment**	-	**Quiz**	10%	**Lab**	20%	**Project**	10%
	Midterm	20%	**Final**	40%	**Others**	-		
Textbook	Mark A. Weiss, "**Data Structures & Algorithm Analysis in C++**", 4th Edition, 2013 Pearson. ISBN-13: 978-0132847377.							
References	• Michael T. Goodrich, Roberto Tamassia, David Mount, "**Data Structures and Algorithms in C++**", 2nd Edition, 2011, John Wiley. ISBN-13: 978-0470383278. • Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "**Introduction to Algorithms**", 3rd Edition, 2009, MIT Press. ISBN-13: 978-0262033848. • Robert Sedgewick, "**Algorithms in C: Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms**", 3rd Edition, 2002, Addison-Wesley. ISBN-13: 978-0201726848.							

Course Name	*Linear Algebra*	*الجبر الخطي*

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CS212	0921212	3rd	3 (3-0-6)	0817122 (Discrete Mathematics)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Linear algebra is a branch of mathematics that covers systems of linear equations, properties of matrices, vector spaces, and linear transformations. Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in computing. The aim of this course is to familiarize the students with the mathematical theory and methods of linear algebra. The course begins with fundamental properties of matrices including matrix algebra, operations, inverses and factorization. Systems of linear equations and basic concepts of the theory of vector spaces in the concrete setting of real linear n-space R^n are also included. The course will enable students to solve linear equations, perform matrix decomposition, linear transformations, calculate determinants, and find eigenvalues and eigenvectors. Students will be able to apply the knowledge of linear algebra in applications related to computer graphics, computer vision and intelligent systems.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Perform** the basic manipulations of vectors and matrices. [2, 3]
2. **Use** vectors and matrices to model and solve systems of linear equations. [2]
3. **Apply** Linear Algebra techniques in intelligent systems and computer graphics applications. [1, 2]
4. **Solve** optimization problems using eigenvalue and matrix decomposition techniques. [2]

Assessment Policy							Project	
	Assignment	15%	**Quiz**	15%	**Lab**	-		
	Midterm	30%	**Final**	40%	**Others**	-		

Textbook	Steven R. Lay and Judi J. McDonald, "**Linear Algebra and Its Applications**", 5th Edition, Pearson, 2015. ISBN-13 978-0321982384
References	• Phillippe G. Ciarlet, "**Introduction to Numerical Linear Algebra and Optimization**", 1st Edition, 1989, Cambridge University Pres. ISBN-13: 978-0521339841 • Phil Kein, "**Coding the Matrix: Linear Algebra Through Computer Science Applications**", 1st Edition, 2013, Newtonian Press. ISBN-13: 978-0615880990

Course Name	*Basic Electronics*	مبادئ الالكترونيات

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CE213	0923213	3rd	4 (3-3-3)	0814132 (Physics)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The principal objective of this course is to develop an understanding of basic electronics and the physical mechanisms governing electronic device characteristics. The course commences on mathematical modeling, representation and circuit analysis techniques such as Ohm's law and Kirchhoff's laws to analyze them accordingly. The course also addresses the physics of semiconductor devices including p-n junction, diodes, bipolar transistor, field effect transistor, and optoelectronic devices. The course will provide students the insight useful for understanding modern semiconductor devices and technologies.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Define** basic concept of: DC Circuits, AC Circuits, diodes, transistors, optoelectronic devices. [1]
2. **Compute** the voltage, current resistance and power in dc circuits. [1]
3. **Analyze** the circuit using Ohms Law and Kirchoff's Laws. [4, 6]
4. **Understand** the operating principles and **determine** quantitatively the relationship between material parameters and semiconductor device performance for diodes and transistors. [2, 4, 6]
5. **Explain** the basic physical properties of semiconductors and the p-n junction. [4, 6]
6. **Understand** the basic electronic components, their device structure, principle of operations, mathematical modeling and analysis, circuit representations and integrations. [2, 4, 6]

Assessment Policy	**Assignment**	5%	**Quiz**	10%	**Lab**	25%	**Project**	
	Midterm	20%	**Final**	40%	**Others**			
Textbook	Thomas L. Floyd, **"Electronics Fundamentals: Circuits, Devices, and Applications"**, Prentice Hall, 10th edition, 2011, ISBN ISBN-13: 978-0135072950.							
References	Richard Drof, **"Introduction to Electric Circuits"**, John Wiley, 6th edition, 2004, ISBN 0471447951.							

Course Name	*Fundamentals of Computer Networks*	*أساسيات شبكات الكمبيوتر*

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CN214	0924214	3rd	4 (3-3-3)	0921110 (Introduction to Computing)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The course covers the five layers of the computer networks layering model: TCP/IP focusing on the upper four layers Top-down approach is implemented in teaching this course. The course starts by an overview of computer networks: network edges concepts and network core concepts: network switching and packet switching, Shannon and Nyquist theorem. Then starting from the application layer towards the data link layer, the main functions and protocols in each layer is discussed in this course. The topics of the course includes: application layer protocols: HTTP, FTP, SMTP, DNS, Transport layer protocols: TCP and UDP, basics of network layer: Addressing, IP protocols (IPv6), circuit-switched networks, datagram networks, virtual-circuit networks, routing protocols, and data link layer concepts: framing, error detection and corrections, examples of flow control protocols, examples of MAC protocols. The course contains a laboratory component in which a network packet analyzer is used to understand network protocol internals.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Define** the different computer networks layering models. [3]
2. **Describe** the main functions and protocols in the five layers of the TCP/IP model. [3]
3. **Compare** between different protocols in each layer of TCP/IP model. [1]
4. **Analyze** the performance of different protocols in each layer of TCP/IP model. [2]
5. **Use** a network packet analyzer to understand network protocol internals. [2]

Assessment Policy								
	Assignment	-	**Quiz**	10%	**Lab**	25%	**Project**	-
	Midterm	25%	**Final**	40%	**Others**	-		
Textbook	James Kurose and Keith Ross, "**Computer Networking: A Top-Down Approach**", 7th Edition, 2017, Pearson Education. ISBN-13: 978-0133594140.							
References	• Behrouz A. Forouzan, "**Data Communications and Networking**", 5th Edition (Global Revised), 2012, McGraw-Hill. ISBN-13: 978-0071315869. • William Stallings, "**Data and Computer Communication**", 10th Edition, 2013, Pearson Education. ISBN-13: 978-0133506488. • Andrew S. Tanenbaum, "**Computer Networks**", 5th Edition, 2010, Pearson Education. ISBN-13: 978-0132126953.							

Course Name	*Fundamentals of Software Engineering*	*أساسيات هندسة البرمجيات*

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CS220	0921220	4th	4 (3-3-3)	0921120 (Fundamentals of Programming)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course aims to provide basic principles and practices of software engineering while emphasizing various phases of software development process. The course provides detailed overview about the system analysis and design while discussing software development processes to help students understand the key activities in systematic engineering of software systems. Concepts and related techniques are covered that are used in each phase of the software development process. This includes requirements elicitation and analysis for gathering and elaborating software requirements specification, system modeling and architectural design, detailed design – based on object-oriented concepts using the UML tools, implementation concerns and software testing methods to verify and validate the specifications. This course also introduces basic concepts of software project management, the importance of managing cost, schedule, and team management during a software development project. The course project aims to provide students with practical skills to analyze, design and develop real world software systems by exercising the software development process and project management techniques. The lab work is organized to enable the students to grasp the technical knowledge about using tools (e.g. Star UML, Gantt Charts, MS Project) and techniques required for conducting system analysis, design and testing of software systems.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Recognize** system development life cycle phases and various software development process models. [1]
2. **Analyze** problems systematically to formulate software requirements specifications. [1]
3. **Design** software systems using requirements specification and software engineering principles. [2]
4. **Create** software systems while working in project teams and apply project management skills. [2, 5]

Assessment Policy								
	Assignment	10%	**Quiz**	10%	**Lab**	15%	**Project**	15%
	Midterm	20%	**Final**	30%	**Others**	-		
Textbook	Ian Sommerville, "**Software Engineering**", 10th Edition, 2015, Pearson Education Limited, ISBN-13: 978-0133943030							
References	• Roger Pressman, "**Software Engineering: A Practitioner's Approach**", 7th Edition, 2009, McGraw-Hill Higher Education. ISBN-13: 978-0-073-37597-7. • Jeffry L. Whitten, Lonnie D. Bentleg and Kevin C. Dittman, "**Systems Analysis and Design Methods**", 7th Edition, 2005, McGraw-Hill Companies Inc. ISBN-13: 978-0073052335. • Stephen R. Schach, "**Object-Oriented and Classical Software Engineering**", 8th Edition, 2010, McGraw-Hill Education. ISBN-13: 978-0073376189 • Soren L., "**Software Requirements: Styles and Techniques**", 1st Edition, 2002, Addison-Wesley Professional. ISBN-13: 978-0201745702							

<table>
<tr><td>Course Name</td><td colspan="3">Electric Circuits</td><td colspan="2">الدوائر الكهربائية</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CE221</td><td>0923221</td><td>4th</td><td>4 (3-3-3)</td><td>0923213 (Basic Electronics)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
The main purpose of the course is to provide a comprehensive and clear coverage of basic electrical concepts and practical applications. This course focuses on DC and AC Circuits. This course will enable the students to analyze circuits using basic theorems and apply them to design and develop various electrical circuits.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Define series and parallel resistive circuits and describe rules for voltage and current dividers. [1]
2. Describe energy storage elements and their voltage-current relationships. [1]
3. Analyze DC circuits using node-voltage and mesh current methods, Thevenin and Norton equivalent, Source transformation, maximum power transfer and superposition theorems. [2, 3, 6, 8]
4. Analyze AC circuits including Phasor steady-state sinusoidal circuit’s analysis. [2, 3, 6, 8]
5. Elucidate responses of first order LR and LC circuits, and second order circuits. [2, 3, 6, 8]</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>5%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>25%</td><td rowspan="2">Project</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="6">Thomas L. Floyd, “Electronics Fundamentals: Circuits, Devices, and Applications”, Prentice Hall, 8th Edition, 2010, ISBN 0-13-219709-0.</td></tr>
<tr><td>References</td><td colspan="6">• Thomas L. Floyd, “Principles of Electric Circuits: Conventional Current Version”, 7th Edition, 2012.
• Richard Drof, “Introduction to Electric Circuits”, John Wiley, 6th edition, 2007, ISBN 0471447951.</td></tr>
</table>

Course Name	*Differential Equations*			المعادلات التفاضلية	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE222	0923222	4th	3 (3-0-6)	0923210 (Advanced Calculus)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course aims to give mathematical foundations to the students to apply differential equations in Engineering perspectives. Topics include differential equations and their solutions, first-order differential equations, linear equations of higher order separable equations and singular solutions, applications of Laplace transform and introduction to partial differential equations.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Define** the terminologies associated with differential equations and their solutions. [1]
2. **Analyze** the direction field associated with a first-order differential equation and be able to use a numerical method of solution. [1, 6]
3. **Describe** the analytical methods of solution by direct integration; separation of variables; and the integrating factor method. [1]
4. **Analyze** real world scenarios to recognize when ordinary differential equations (ODEs) or systems of ODEs are appropriate. [1, 6]

Assessment Policy	**Assignment**	15%	**Quiz**	15%	**Lab**		**Project**	
	Midterm	30%	**Final**	40%	**Others**			
Textbook	Dennis G Zill, **"A First Course in Differential Equations with Modeling Applications"** Loyola Marymount University, 10th Edition, 2013.							
References	Nagle Saff Snider, **"Fundamentals of Differential Equations"**, Pearson, 8nd Edition, 2012, **ISBN:** 9780321747747 / 0321747747.							

<table>
<tr><td>Course Name</td><td colspan="3">Digital Logic and Design</td><td colspan="2">المنطق الرقمي والتصميم</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CE223</td><td>0923223</td><td>4th</td><td>4 (3-3-3)</td><td>0814132 (Physics)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
The main purpose of the course is to study the principles and techniques of modern digital systems. This course will focus on floating-point numbers, basic logic gates, logic expressions, simplification of logic functions using Boolean algebra rules and K-maps. The students will be able to analyze, design and implement various combinational and sequential circuits using logic gates and programmable logic devices.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Define and describe basic concepts of digital systems and logic circuits: adders, subtractors, decoders, encoders, multiplexers, de-multiplexers. [3]
2. Analyze Boolean expression to simplify logic circuits. [1]
3. Design and develop various types of combinational and sequential logic circuits. [2]
4. Reconstruct the logic circuits using Boolean Algebra and K-map. [2]
5. Develop and analyze synchronous and asynchronous counter circuit [1, 2]</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>-</td><td>Quiz</td><td>10%</td><td>Lab</td><td>20%</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="6">Ronald J, Tocci, Neal S. Widmer, and Gregory L. Moss, “Digital Systems: Principles and Applications", 11th Edition, 2010, Prentice Hall. ISBN-13: 978-0135103821.</td></tr>
<tr><td>References</td><td colspan="6">• M. Morris Mano, “Logic Computer Design Fundamentals”, 5th Edition, 2015, Prentice Hall. ISBN-13: 978-0133760637.
• John F. Wakerly, “Digital Design Principles and Practices”, 5th Edition, 2017, Pearson. ISBN-13: 978-0134460093.
• Norman Balabanian, Bradley Carlson, “Digital Logic Design Principles”, 1st Edition, 2000, Wiley. ISBN-13: 978-0471293514.
• Roger L. Tokheim, “Schaum's Outline of Digital Principles” 3rd Edition, 1994, McGraw Hill Education: ISBN-13: 978-0070650503.</td></tr>
</table>

Course Name	*Numerical Analysis*			*التحليل العددي*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE224	0923224	4th	3 (3-0-6)	0923210 (Advanced Calculus)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course aims to develop and understanding of numerical methods aided by technology to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integrals. The course will also discuss about the elements of error analysis for numerical methods. This course will further develop problem solving skills.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** how to solve a system of linear equations using direct and iterative methods. [1]
2. **Develop** and **Approximate** functions by using methods of numerical interpolation. [1, 6]
3. **Evaluate** first and second derivatives using methods of numerical differentiation. [1, 6]
4. **Define** definite integrals using methods of numerical integration.[1]
5. **Analyze** errors and rate of convergence of different numerical methods. [1, 6]
6. **Demonstrate** computer algorithms to implement different numerical methods. [1, 6]

Assessment Policy	**Assignment**	15%	**Quiz**	15%	**Lab**		**Project**	
	Midterm	30%	**Final**	40%	**Others**			
Textbook	Kendall E. Atkinson, **"Elementary Numerical Analysis"**, Wiley, 3rd Edition, 2012.							
References	J. H. Mathews, and K. D. Fink, **"Numerical Methods Using MATLAB"**, Prentice Hall, 4th Edition, 2003.							

Course Name	*Signals and Systems*			*الاشارات والنظم*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE310	0923310	5th	3 (3-0-3)	CS212 (Linear Algebra)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The main objective of this course is to study mathematical theories of responses of systems for variety of signals stimuli. This course discusses basics of signals, systems and their mathematical representations both in discrete-time and continuous-time domains. The course covers linear time-invariant signals and their frequency response in Fourier, Laplace and Z domains. This course is a foundation course for different fields of engineering, such as feedback and control engineering, communication engineering, and digital signal processing.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** convolution as the input-output operation of linear differential equations. [1]
2. **Define** Fourier transform and outline frequency response of linear time-invariant systems. [1]
3. **Evaluate** linear differential equations using Laplace transform and Z-transform techniques. [2]
4. **Design** LTI system models with feedback using state space representation. [2, 6]
5. **Develop** algorithms to implement system modeling and transformations. [2, 6]
6. **Develop** models for physical systems using linear approximation techniques. [2, 6]

Assessment Policy	**Assignment**	15%	**Quiz**	15%	**Lab**		**Project**	
	Midterm	30%	**Final**	40%	**Others**			
Textbook	Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "**Signals and Systems**", 2nd Edition, Pearson Education Limited, Pearson New International Edition, 2013. ISBN-13: 978-1292025902.							
References	James H. McClellan , Ronald W. Schafer , Mark A. Yoder, "**Signal Processing First**", 1st Edition, Prentice Hall, 2003. ISBN-13: 978-0130909992.							

Course Name	*Electronic Circuits*			*الدوائر الإلكترونية*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE311	0923311	5th	4 (3-3-3)	CE221 (Electric Circuits)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The main purpose of the course is to provide a comprehensive understanding of electronic circuits and the related concepts. This course focuses on diodes, transistors, operational amplifiers and their applications. This course will enable the students to analyze and design various electronics circuits.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** basic concepts of Diodes, Transistors and Operational Amplifiers. [1]
2. **Describe** operating principles of digital logic families (TTL, ECL, I^2L, and CMOS circuits). [1]
3. **Design** and **analyze** diode rectifiers and regulator circuits. [1, 2, 3, 6, 8]
4. **Design** and **analyze** BJT and FET amplifiers, and switching circuits. [1, 2, 3, 6, 8]
5. **Design** and **analyze** operational amplifiers circuits. [1, 2, 3, 6, 8]

Assessment Policy	**Assignment**	5%	**Quiz**	10%	**Lab**	25%	**Project**	
	Midterm	20%	**Final**	40%	**Others**			
Textbook	Adel S. Sedra and Kenneth C. Smith, "**Microelectronic Circuits**", 7th Edition. Oxford University Press, 2014.							
References	Robert Boylestad, Louis Nashelsky, "**Electronic Devices and Circuit Theory**", 11th Edition, Prentice Hall, 2012.							

Course Name	*Technical Reports*	*كتابة التقارير التقنية*

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	IS312	0922312	5th	3 (3-0-6)	1722111 (Academic English)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

This course is designed to prepare students to develop their technical writing and presentation skills as needed to successfully conduct course projects as well as Co-op report and the graduation project. Unlike the Academic English course, this course focuses on the aspects of writing full-length papers and reports as well as making oral presentations in professional settings. The skills covered include: methods of planning, researching, organizing, designing and editing technical documents and presentations. The rhetorical strategy and the deductive organization found in computing discipline are particularly emphasized. This course will review in detail the function, the organization and the design of each part of technical documents of various types. This course introduces the basic techniques and methods for writing technical documents collaboratively with other students in the form of writing assignments including a major report on IT related topics like a graduation project. This course requires intensive writing, reading and participation in editing and peer-review as assignments, projects and exams.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Apply** technical information and knowledge in practical report and presentation for a variety of audiences (including technical, managerial and public). [3]
2. **Collect**, **analyze**, **document**, and **report** technical information clearly, concisely, logically, and ethically using authentic source with proper citation, reference and acknowledgment. [1, 2, 3, 4]
3. **Recognize**, **explain**, and **use** the rhetorical strategies and the formal elements of these specific genres of technical communication: technical abstracts, data and system based research reports, instructional manuals, technical descriptions, web pages, wikis and blogs. [2, 3]
4. **Practice** the unique qualities of professional writing style, including sentence conciseness, readability, clarity, accuracy, honesty, avoiding wordiness or ambiguity and plagiarism, unbiased analysis, summarizing and coherence. [3, 4]
5. **Participate** actively in writing activities (individually and in collaboration) that model effective scientific and technical communication in the IT workplace. [3, 5]

Assessment Policy								
	Assignment	25%	**Quiz**	-	**Lab**	-	**Project**	20%
	Midterm	15%	**Final**	35%	**Others**	5%		
Textbook	K. Woolever, "**Writing for the Technical Professions**", 4th Edition, 2007, Longman. ISBN- 13: 978-0-321-47747-7.							
References	Gerald Alred, "**Handbook of Technical Writing**", 10th Edition, 2011, St. Martin's Press. ISBN-13: 978-1250004413.							
Course Name	*Computer Organization and Architecture*		معمارية الحاسب وتنظيم					

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CE313	0923313	5th	4 (3-3-3)	0923223 (Digital Logic and Design)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The main objective of this course is to familiarize students about the basic structure and various functional modules of the computer system. It introduces the modern computer organization and architecture concepts and deals with instruction sets, CPU structure, memory system organization, system I/O and multiprocessors. The emphasis is on analyzing issues in architecture design and their impact on performance.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** the simple computer by explaining its basic organization. [3]
2. **Explain** the different instruction set architectures and addressing modes. [3]
3. **Elucidate** memory hierarchy by defining different types of memory. [3]
4. **Discuss** different Input / Output storage systems. [3]
5. **Differentiate** and **analyze** different parallel and multiprocessor architectures. [1, 2]

Assessment Policy								
	Assignment	-	**Quiz**	10%	**Lab**	20%	**Project**	10%
	Midterm	20%	**Final**	40%	**Others**	-		
Textbook	L. Null and J. Lobur, "**Essentials of Computer Organization and Architecture**", 4th Edition, 2015, Jones & Bartlett Learning. ISBN-13: 978-1284074482.							
References	• D. A. Patterson, J. L. Hennessy, "**Computer Organization and Design**", 4th Edition, 2009, Morgan Kaufmann, ISBN-13: 978-0123744937. • Morris Mano, "**Computer System Architecture**", 3rd Edition, 1992, Morgan Koufman, ISBN-13: 978-0123747501. • William Stallings, "**Computer Organization and Architecture: Designing for performance**", 9th Edition, 2012, Pearson Education, ISBN-13: 978-0273769194.							

Course Name	*Computer Security*			حماية الحاسوب	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CS320	0921320	6th	3 (3-0-6)	0924214 (Fundamentals of Computer Networks)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

The course introduces the basic concepts of computer security and focuses on the need of computer security for keeping the systems and networks secure. The course begins with the introduction of objectives of computer security, and identifying threats and vulnerabilities. The course demonstrates implementation of system access control via authentication mechanism including password, token-based, and biometric approaches. Furthermore, data access control techniques will be demonstrated that includes discretionary, mandatory, and role based access control; The types and counter measures of malicious code will be demonstrated. Concepts of cryptography including notion of public key, private key, classic cryptographic algorithms, digital signatures, key management, and cryptographic protocols will be taught. The network security fundamentals and basic concepts of firewalls, intrusion detection, and intrusion prevention systems, DoS attacks will be introduced. Finally, the students will learn the skills of security management including risk management and analysis, security plans, security policies, security audit, and legal aspects of security.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** security management & policy rules for organizations. [3]
2. **Explain** system and data access control mechanism. [3]
3. **Analyze** the tradeoffs of balancing key security properties (Confidentiality, Integrity, Availability). [1, 4]
4. **Identify** and **classify** various types of vulnerabilities and threats that exist for computers and networks. [1]
5. **Practice** encryption & decryption using variety of simple cryptographic algorithms. [2]

Assessment Policy	**Assignment**	15%	**Quiz**	10%	**Lab**	-	**Project**	15%
	Midterm	20%	**Final**	40%	**Others**	-		
Textbook	W. Stallings & L. Brown, "**Computer Security, Principles and Practice**", 3rd Edition, 2015, Prentice Hall. ISBN-13: 978-0133773927.							
References	• Rick Lehtinen, Deborah Russel, G.T. Gangemi, Sr., "**Computer Security Basics**", 2nd Edition, 2006, O'Reilly Media. ISBN-13: 978-0-596-00669-3. • Charles P. Pfleeger, Shari Lawrence, Jonathan Marglies, "**Security in Computing**", 5th Edition, 2015, Prentice Hall. ISBN-13: 978-0134085043.							

Course Name	*Operating Systems*	نظم التشغيل

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CS321	0921321	6th	4 (3-3-3)	0923313 (Computer Organization and Architecture)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

This course aims to provide a strong foundation for students to understand the Operating System. It covers the main objectives, functions, evolution, characteristics and architectures of modern operating systems. In addition, process description and control including process definition, states, description and process synchronization will be illustrated. The needs for threads and relationship between processes and threads are demonstrated. Introduction to the Concurrency, mutual exclusion and deadlock concepts will be covered. Moreover, this course covers the main memory and virtual memory concepts, requirements, policies and techniques. Uni-processor scheduling and I/O scheduling concepts, algorithms and criteria will be explained. Finally, this course discusses the file and storage managements, security and protection. Lab sessions and projects in this course provide an in-depth experience with operating system internals through kernel programming to develop and test several data structures and algorithms.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Explain** the main concepts, objectives and functions of the typical and modern operating systems. [3]
2. **Describe** the design of the process description and control and uni-processor and I/O scheduling algorithms. [3]
3. **Compare** the structuring methods of the operating systems. [1]
4. **Differentiate** the processes and threads concepts and their uses. [1]
5. **Discuss** and **analyze** main memory and virtual memory concepts, policies techniques and uni-processor and I/O scheduling. [1]
6. **Use** Unix commands and kernel programming to develop and test several data structures and algorithms. [1, 2]

Assessment Policy								
	Assignment	-	**Quiz**	10%	**Lab**	20%	**Project**	10%
	Midterm	20%	**Final**	40%	**Others**	-		
Textbook	Avi Silberschatz, Peter Baer Galvin, Greg Gagne, "**Operating System Concepts**", 10th Edition, 2018, John Wiley & Sons, Inc. ISBN- 978-1-118-06333-0							
References	• William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, 2017, Prentice Hall International. ISBN-13: 978-0134670959. • Robert Love, "**Linux Kernel Development**", 3rd Edition, 2010, Addison-Wesley Professional. ISBN-13: 978-0672329463.							

Course Name	*Professional Responsibility*	المسؤولية المهنية

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	IS322	0922322	6th	3 (3-0-6)	0816152 (Biology) and 0922312 (Technical Reports)
Course Track	☐ University Requirement ☒ College Requirement ☐ Specialized Core ☐ Electives				

Course Description

This course introduces the students to the legal, social and ethical aspects of Information Technology and makes them understand selected codes of ethics and professional conducts to apply in real situations. In addition, it aims to foster students' ability to communicate, both in written and oral form, for the analysis and reporting of real situations indicating potential ethical problems in professional context. Topics included are: information rights, intellectual property rights, liability, accountability, privacy, security, cybercrime, ethical principles, codes of ethics, role of government, role of law enforcement, role of business and industry, professional conduct, and social responsibility. Students are required to read, write, discuss, and present reports on topics such as fraud and abuses, security, privacy protection, copyright and patent statute, communication decency, IT law as well as software engineering code of ethics.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** the social and ethical impacts of Information Technology. [3, 4]
2. **Describe** the concept of rights and laws related to intellectual property, privacy and computer crimes. [3, 4]
3. **Make** ethical decisions based on ethical principles, professional code of ethics and laws. [4]
4. **Analyze** and **report** realistic ethical cases involving Information Technology in the professional context. [1, 4]
5. **Prepare** ethical guidelines for Information Technology professionals. [3, 4]

Assessment Policy								
	Assignment	10%	**Quiz**	10%	**Lab**	-	**Project**	15%
	Midterm	25%	**Final**	35%	**Others**	5%		

Textbook	Sara Baase, Timothy Henry, "**A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet**", 5th Edition, 2017, Pearson. ISBN-13: 978-0134615271
References	• John P. Grillo, Ernest A. Kallman, "**Ethical Decision Making & Information Technology: An Introduction with Cases**", 2nd Edition, 1995, McGraw Hill. ISBN-13: 978-0134615271. • Michael J. Quinn, "**Ethics for the Information Age**", 7th Edition, 2016, Pearson. ISBN-13: 978-0134296548. • **Saudi Anti-Cyber-Crime Law:** http://www.citc.gov.sa/English/RulesandSystems/CITCSyste/Documents/LA_004_%20E_%20Anti-Cyber%20Crime%20Law.pdf

Course Name	*Embedded Systems*	الأنظمة المدمجة

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CE323	0923323	6th	4 (3-3-3)	0923313 (Computer Organization and Architecture)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Introduction to embedded systems, Embedded hardware units and devices in a system, Microcontroller organization, Advanced processor architectures, Memory organizations and interfacing, CPU and bus systems, serial and parallel communication devices, Embedded programming techniques, Programming elements, Object oriented programming, Programming modeling concepts, development and debugging, Network and multi processors, inter process communication, synchronization of process, Real time operation systems, system design techniques and examples.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** microcontrollers, components of microcontrollers, and embedded systems. [1]
2. **Describe** the special requirements for embedded systems. [1]
3. **Evaluate** the interaction of microprocessor, memory, peripheral components and buses in an embedded system. [1, 2, 6, 8]
4. **Evaluate** how architectural and implementation decisions influence the performance and power dissipation. [1, 2, 6, 8]
5. **Optimize** code for embedded systems. [1, 2]

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	25%	**Project**	
	Midterm	20%	**Final**	40%	**Others**	5%		
Textbook	Wayne Wolf, "**Computers as Components: Principles of Embedded Computing System Design**", Third Edition, Morgan Kaufmann, 2012.							
References	Robert Reese, J.W. Bruce, Bryan A. Jones, "**Microcontrollers: From Assembly Language to C Using the PIC24 Family**", Second Edition, CENGAGE Learning, 2009.							

Course Name	*Practical (Co-op) Training*			*التدريب (التعاوني) العملي*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE330	0923330	After 6th	3	95 Credits Completed, CE223, CE311, and CE313
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

The Cooperative (Co-op) training program is a joint venture between King Faisal University and employers to better prepare students for employment upon graduation. The training must constitute a link between theoretical and scientific academic background with the work environment to provide a better understanding and a clear view of the real-world experiences. It also provides students with complementary knowledge and training such as confronting real world issues and working as part of a team. Co-op training is a 3-credit-hours course and is taken by those students who have completed at least 95 credit hours. Student must be oriented in one of the companies for a period of 12 weeks in the summer session, and well supervised by a faculty supervisor and a site supervisor, to accomplish the training objectives correctly. Courses to be completed before training for Computer Engineering students are:

- CE223: Digital Logic and Design (0923223)
- CE311: Electronic Circuits (0923311)
- CE313: Computer Organization and Architecture (0923313)

Course Outcomes

After the completion of this course, the student will be able to:

1. **Develop** practical skills through real-world applications. [1, 2, 4]
2. **Apply** acquired knowledge to different domains. [1, 2, *7*]
3. **Relate** the courses studied in the university with real world application. [1, 2, 4, 5]
4. **Relate** the attitude and the manner of the work environment. [4, 5]
5. **Write** a comprehensive report according to predetermined guidelines summarizing the training. [3, 4]
6. **Perform** oral presentation to convey in a limited time, the range of experience obtained and the skills learned. [4]

Assessment Policy	**Faculty Supervisor Evaluation**	50%	**Report**	20%
	Site Supervisor Evaluation	20%	**Presentation**	10%
Textbook	No specific textbook for the course.			
References	No specific reference book for the course.			

Course Name	*Project Proposal*	*مقترح مشروع*

Course Information	Course Code	Course No.	Course Level	Credit Hour	Prerequisite(s)
	CE410	0923410	7th	2 (0-6-6)	Department Approval
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

In this course, students form a group of two to four members and choose an applied or theoretical project topic under the supervision of a faculty member. The course enables the students to apply the skills learned in other courses to define and analyze a computing problem, define its solution requirements, review related work, identify and compare candidate solutions and select/justify the chosen solution. A logical design is developed using the selected approach. The writing skills of students are developed and assessed from their project report, and oral communication skills are assessed through presentations. The students learn how to work in a group. Awareness of their ethical, professional and legal responsibilities in the society is also inculcated in the students through this course. The progress of students is monitored and evaluated by the supervisor and committee members at three milestones. Constant feedback is provided by the supervisor and two committee members to improve the quality of students' work.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Analyze** a theoretical or applied computing problem and develop its solution requirements. [1, 2]
2. **Design** a computer based system or solution based on a set of requirements or goals. [2]
3. **Analyze** and **evaluate** other people's work related to their problem. [1, 2]
4. **Work** in a team to accomplish a common goal under time and design constraints. [5]
5. **Use** written and oral communications skills to communicate with diverse audiences. [3]
6. **Practice** professional, ethical, legal and social issues related with Computer Engineering discipline. [4]

Assessment Policy	**Committee Evaluation**	**Milestone-1**	10%	**Supervisor Evaluation**	40%
		Milestone-2	20%		
		Milestone-3	30%		
Textbook	There is no single textbook for this course. The students are encouraged to select and read various related texts under the recommendation of their supervisor.				
References	• Jeremy T. Miner and Lynn E. Miner, "**Proposal Planning & Writing**", 5th Edition, 2013, Greenwood. ISBN-13: 978-1440829697. • **Graduation Project Handbook**, CCSIT, King Faisal University, 2013. • Christian Dawson, "**Projects in Computing and Information Systems: A Student's Guide**", 3rd Edition, 2015, Pearson. ISBN-13: 978-1292073460.				

Course Name	*Design and Modeling of Digital Systems*			تصميم ونمذجة النظم الرقمية	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE411	0923411	7th	4(3-3-6)	0923313 (Computer Organization and Architecture)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description:

Introduction: Course Overview, Grading policy, Differentiating S/W vs H/W, Design Space Exploration, Digital design methodology & design flow, Combinational Logic – Verilog: Combinational Building Blocks – Verilog: Sequential Logic – Verilog: Sequential Logic Design – Verilog & Synthesizable Verilog Coding Programmable Logic Devices, Reading, Synthesizing correctly using Verilog: Blocking and Non-Blocking Statements & Design Partitioning FPGAs Understanding Xilinx FPGA Architecture, Design Partitioning: Design Partitioning : Controllers : FSMs, Design Partition Micro-Processor Design: Design Partitioning : Micro-Processor Design, Speed of a Digital Design : Understanding Speed of a Digital Design : Clock, Throughput, Fixed Point Arithmetic: Fixed Point (Q-Format) Arithmetic : Addition & Multiplication, Fixed Point – Multi-Addition: Fixed Point (Q-Format) Arithmetic : Multi-Operand Addition, Fixed Point – Multiplication: Fixed Point (Q-Format) Arithmetic : Multiplication Fixed-Point – BOOTH Multiplier: Fixed Point (Q-Format) Arithmetic : BOOTH Recoding CORDIC: CORDIC : Trigonometric Functions, Division, FIR Filtering: Feed Forward Pipeline : FIR Filtering, Cross clock domain issues: Buffers & Circular FIFOs, Course Review: Project Demonstration & VIVA.

Course Outcomes:

1. **Recognize** the difference between various state of the art technologies ranging from software, hardware & hybrid architectures that form the basics of digital design space exploration and knowing the design steps. [1]
2. **Design** practical and complex digital circuits using HDL and its implementation on FPGA. [1, 2, 6, 8]
3. **Design** the Micro-Architecture & planning for Design Partitioning (Data path FSM & Controller) for Digital Systems. [1, 2, 4, 6, 8]
4. **Use** an HDL to model Sequential & Combinational Logic. [1, 2, 6]
5. **Assess** the specification of complex digital designs and justify the selection of a particular optimization scheme from either Latency, Throughput or Timings based optimization. [4, 6]

Assessment Policy	**Assignment**	10%	**Quiz**	15%	**Lab**		**Project**	
	Midterm	30%	**Final**	40%	**Others**	5%		
Textbook	Shoab A Khan, "**Digital Design of Signal Processing Systems: A Practical Approach**", Wiley, 2011**.**							
References	• M. D. Ciletti, "**Advanced Digital Design with the Verilog HDL**," (Prentice Hall), 2/e 2010. • Morris Mano and Charles R. Kime, "**Logic and Computer Design Fundamentals**", Prentice Hall, ISBN: 013140539X, Latest Edition. • Steve Kilts , "**Advanced FPGA Design: Architecture, Implementation, and Optimization**" August 2007, Wiley-IEEE Press.							

Course Name	*Computer Peripherals and Interfacing*			التواصل مع طرفيات الحاسب	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE412	0923412	7th	4(3-3-6)	0923311 (Electronic Circuits), 0923313 (Computer Organization and Architecture)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description:

Introduction to Microcomputer hardware systems and interface design, Hardware and software considerations in developing a microcomputer instrumentation and control system, Processor and Busses: PC Processor, Memory, I/O ports; Explanation of standard bus types: ISA, EISA, PCI, PXI busses, Introduction to IEEE 488 (GPIB) and RS-232 standards, Interrupts: Hardware and software interrupts, programmable interrupt controllers, interrupt service routines, DMA control and DMA controllers, Parallel Port Interfacing: Introduction to parallel port; Parallel port as output port; Parallel port as input port; applications involving programming for parallel port interfacing, Serial Port Interfacing: Introduction to serial port; Serial port as output port; Serial port as input port; Applications involving programming for serial port interfacing, USB Port Interfacing: Introduction to USB port; USB port as output port; USB port as input port; Applications involving programming for USB port interfacing, Data Acquisition using Plug-in Cards: Introduction to plug-in multifunction cards and their specifications. Signal conditioning and Analog to Digital Conversion. Digital to Analog (D/A) conversion and Analog to Digital (A/D) conversion. Interfacing digital inputs/outputs. Timers and Counters.

Course Outcomes:

1. **Describe** the features and functions of different I/O peripheral devices and their interfaces. [1]
2. **Describe** how the processor communicates with and controls peripheral devices. [1]
3. **Design** and **write** software for programmable peripheral devices to create real-time programs which interact with the external world and use interrupts. [1, 2, 6, 8]
4. **Recognize** hardware in relation to the installation, maintenance, identification, manipulation and interconnection of systems and apply device connection techniques to microcomputer pins. [1, 2, 6]
5. **Prepare** the data path for different types of transfers and locate bottlenecks in multiple transfers between devices. [6]
6. **Calculate** the minimum expected transfer time between a memory and a device or between devices. [1]
7. **Calculate** bus throughput at different levels (internal bus, local bus, system bus, expansion bus, peripheral buses) and demonstrate the features of a bridge between buses. [1, 2, 6]

Assessment Policy	**Assignment**		**Quiz**	10%	**Lab**	20%	**Project**	10%
	Midterm	20%	**Final**	40%	**Others**			
Textbook	D. A. Patterson, and J.L. Hennessy, "**Computer organization and design: the hardware/software interface**", 5th Edition, Elsevier Morgan Kaufmann, 2014.							
References	H.W. Huang, "**PIC microcontroller: an introduction to software and hardware interfacing**", Thomson/Delmar Learning, 2005.							

Course Name	*Project Implementation*			تنفيذ مشروع	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE420	0923420	8th	3 (0-9-6)	0923410 (Project Proposal)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course is the continuation of Project Proposal course completed in the previous semester. Students focus on the implementation of the Project Proposal they defended earlier by using the selected technology, methodology and approach. The implemented solution is generally tested and results are validated. These results are compared against the objectives and solution requirements identified during Project Proposal phase. The writing skills of students are developed and assessed through project report and oral communication skills are improved through presentations. The students learn how to work in a group. They also gain awareness of their ethical, professional and legal responsibilities in the society. The progress of students is monitored and evaluated by the supervisor as well as two committee members over two milestones during the semester. Necessary feedback is provided by the supervisor and committee members at each milestone to improve the quality of students' work.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Develop** and **evaluate** a computer-based system to meet a set of solution requirements. [2]
2. **Work** in a team to accomplish a common goal under time and design constraints. [5]
3. **Use** written and oral communications skills to communicate with diverse audience. [3]
4. **Practice** professional, ethical, legal and social issues related with Computer Engineering discipline. [4]

Assessment Policy	**Committee Evaluation**	**Milestone-3**	20%	**Supervisor Evaluation**	40%
		Milestone-4	40%		
Textbook	There is no single textbook for this course. The students are encouraged to select and read various related texts under the recommendation of their supervisor.				
References	• Jeremy T. Miner and Lynn E. Miner, "**Proposal Planning & Writing**", 5th Edition, 2013, Greenwood. ISBN-13: 978-1440829697. • **Graduation Project Handbook**, CCSIT, King Faisal University, 2013. • Christian Dawson, "**Projects in Computing and Information Systems: A Student's Guide**", 3rd Edition, 2015, Pearson. ISBN-13: 978-1292073460.				

Course Name	*Selected Topics in CE*			موضوعات مختارة في هندسة الحاسب	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE421	0923421	8th	3(3-0-3)	0923410 (Project proposal)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description:

This course is an advanced course to include special topics that are newly emerging or applied in the area that are not covered in the normal curriculum. The aim of this course is to provide the students of computer engineering with an insight into newer trends in the field and to excite them to discover new knowledge and to apply it in their own domains.

Course Outcomes:

1. **Recognize** the new trends and technologies in computer engineering [1, 4, 7].
2. **Develop** skills in collecting information about global issues in computing [1, 2, 3, 4, 6, 7].
3. **Demonstrate** team work and organization skills [3].
4. **Demonstrate** skills in oral presentation and report writing [3].
5. **Research** impact of new technology and analyze their potential for future applications. [1, 2, 3, 4, 6].

Assessment Policy	**Assignment**	5%	**Quiz**	10%	**Lab**		**Project**	20%
	Midterm	20%	**Final**	40%	**Others**	5%		
Textbook	• Gonzalez, R. & Woods, R., "**Digital Image Processing**", 3rd Edition, Prentice-Hall, 2008. • Anil Jain, Arun A. Ross, Karthik Nandakumar, "**Introduction to Biometrics**", Springer Science & Business Media, 2011.							
References	• Gonzalez, R., Woods, R., & Eddins, S., "**Digital Image Processing Using MATLAB**", 2nd Edition, Prentice-Hall, 2008. • 2. Ben Coppin, "**Artificial Intelligence Illuminated**", Jones & Bartlett Learning, 2009.							

Course Name	*Parallel and Distributed Systems*			*النظم الموزعة و المتوازية*	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE422	0923422	8th	3(3-0-3)	0923313 (Computer Organization and Architecture)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description:

Parallel/distributed programming models and interfaces - shared memory vs. message passing vs. remote procedure call (RPC) vs. global address space languages: e.g., pthreads, MPI, MapReduce, OpenMP, HPF, UPC, language-level threads (e.g., Java), Parallel machine architectures - shared and distributed memory machines, multicore and multithreaded chips, interconnection networks, Parallel program optimization techniques - synchronization granularity, dependences, scheduling, load balancing, Synchronization - hardware primitives, logical and physical clocks, mutual exclusion, distributed transactions, transactional memory, Consistency and coherence - data-centric versus client-centric consistency models, cache coherence protocols, Fault tolerance and reliability - fail-stop versus byzantine failure models, two- and three-phase commits, reliable group communication, checkpointing, message logging.

Course Outcomes:

1. **Define** the main concepts of Parallel/distributed programming models. [1]
2. **Describe** the parallel machine architectures. [1]
3. **Outline** the parallel program optimization techniques. [1]
4. **Describe** fault tolerance and reliability concepts and techniques. [1]
5. **Contrast** the shared memory, message passing, remote procedure call (RPC), and global address space. [6]
6. **Explain** consistency and coherence. [1]
7. **Differentiate** the fault tolerance and reliability techniques. [1, 2, 4, 6]
8. **Develop** the appropriate parallel techniques to build efficient program. [1, 2, 6]

Assessment Policy	**Assignment**	5%	**Quiz**	10%	**Lab**		**Project**	20%
	Midterm	20%	**Final**	40%	**Others**	5%		
Textbook	Anantha Grama, George Karypis, Vipin Kumar, and Anshul Gupta , "**Introduction to Parallel Computing**", 2nd Edition, Addison-Wesley, 2013.							
References	Thomas Rauber, Gudula Reunger, "**Parallel Programming For Multicore and Cluster Systems"**, Springer 2013.							

Course Name	*Computational Intelligence and Expert Systems*			الذكاء الحوسبي والنظم الخبيرة	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE413	0923413	7th	3 (3-0-3)	MATH122 (Discrete Math)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

Artificial Intelligence and Expert Systems (AIES) course introduces design and analysis of solutions for real-life problems that cannot be solved efficiently using classical methods. It deals with the approaches that identify appropriate representations and reasoning mechanisms for a problem and to implement and evaluate the solution. This course will offer the basic concepts of Artificial Intelligence (AI), different kinds of knowledge representations, search algorithms, learning paradigms, and expert systems. This course will enable the students to apply appropriate AI concepts and variety of search algorithms to develop efficient solutions for expert systems.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Define** the basic concepts of artificial intelligence.
2. **Outline** standard algorithms for uncertainty and inconsistence in knowledge representation.
3. **Describe** the features and characteristics of expert systems.
4. **Interpret** knowledge symbolically in a form suitable for automated reasoning such as procedural representations, predicate logic, semantic net and frame based approach.
5. **Analyze** and justify different planning and learning paradigms suitable for recent expert systems.
6. **Demonstrate** search problems and expert systems employing Lisp, PROLOG, MATLAB or Java programming.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**		**Project**	20%
	Midterm	20%	**Final**	40%	**Others**			
Textbook	Ben Coppin, "**Artificial Intelligence Illuminated**", Jones & Bartlett Learning, 2009.							
References	• Dan W. Patterson – "**Introduction to Artificial Intelligence and Expert Systems**", PHI Learning, 2009. • D.W. Rolston, "**Principles of AI & Expert System Development**," TMH, New Delhi, 2012. • Stuart J. Russell, Peter Norvig, "**Artificial Intelligence: A Modern Approach** ", Prentice Hall, 3rd Edition, 2009.							

Course Name	*Digital Signal Processing*			معالجة الاشارات الرقمية	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE414	0923414	7th	3 (3-0-6)	CE310 (signals and Systems)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The aim of this course is to study the basic concepts of signal processing and to design and implement digital signal processing in the fields of electrical, communication and control engineering. The course discusses Linear Time Invariant (LTI) systems, frequency responses, Fourier Transforms, Z-Transforms, Fast Fourier Transforms, Discrete Time Fourier Transform, FIR and IIR Filters and their frequency and magnitude responses and system canonical forms.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** FIR, IIR filters, various Transforms and inverse transforms to meet specific magnitude and phase requirements.
2. **Perform** Fourier transform and inverse Fourier transform transforms using the definitions, Tables of Standard Transforms and Properties.
3. **Perform** Z and inverse Z using tables, Partial Fraction Expansion, and power series expansion.
4. **Design** digital filters and implement using Matlab.
5. **Elicit** and **analyze** system requirements.
6. **Plot** and **interpret** magnitude and phase of LTI system frequency responses.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**		**Project**	20%
	Midterm	20%	**Final**	40%	**Participation**			
Textbook	J.G. Proakis, and D.G. Manolakis, "**Digital Signal Processing**", 4th Edition, Prentice Hall, 2006, ISBN-13: 978-0131873742.							
References	E.C. Ifeachor, and B.W. Jervis, "**Digital Signal Processing: A Practical Approach**", 2nd Edition, Addison Wesley, 2001, ISBN-13: 978-0201596199.							

Course Name	*Multimedia Networks and Applications*			شبكات الوسائط المتعددة وتطبيقاتها	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CN415	0924415	7th / 8th	3 (3-0-6)	CN214 (Fundamentals of Computer Networks)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

Multimedia Networks and Applications is an introductory course to the architecture of multimedia networks designed to transport multimedia contents. The objective of this course is to provide an in depth details of various types of network architectures, protocols, and mechanisms designed especially to support multimedia content.

This course examines and explores recent advances in multimedia networking technologies. Major topics include Multimedia(audio/video) compression and standards, multimedia Protocols, (RTP,RTCP,SIP), quality of service (QoS) support mechanisms and protocols, multimedia applications (e.g., IPTV, VOIP, Podcasting), streaming in peer-to-peer networks, and multimedia transport over wireless networks.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe multimedia compression techniques and standards [6]
2. Describe various types of network architectures, protocols, and mechanisms to support multimedia [6]
3. Define the key characteristics of multimedia transport over wireless networks [6]
4. Analyze the functionality of multimedia protocols [1]
5. Analyze and justify the functionality of multimedia applications [1,2]
6. Design and implement multimedia solution(s) using the latest techniques and tools within a group [2,5]

Assessment Policy	**Assignment**	-	**Quiz**	15%	**Lab**	-	**Project**	15%
	Midterm	30%	**Final**	40%	**Participation**	-	**Case Study**	-
Textbook	Multimedia Networks : Protocols, Design and Applications EPUB, Hans W. Barz, Gregory A. Bassett, January 2016.							
References	Multimedia Networking From Theory to Practice, Jenq-Neng Hwang, University of Washington, ISBN:9780521882040, April 2009.							

<table>
<tr><td>Course Name</td><td colspan="3">Telecommunication Networks</td><td colspan="2">شبكة الاتصالات السلكية واللاسلكية</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CN416</td><td>0924416</td><td>6th or 8th</td><td>3 (3-0-6)</td><td>CN214 (Fundamentals of Computer Networks)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
The purpose of this course is to develop the concepts of networking principles and techniques of design, implementation, and analysis of various telecommunication architectures. It includes the basis of voice, video and data communication, SONET/SDH, network architecture and its topologies, network design and basic queuing analysis, routing techniques, PSTN, broadband infrastructure, cellular networks, and introduction to telecommunication network management.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Explain the general architecture of a Telecommunication Network and its importance in society. [6]
2. Define the basic standards of telecommunication networks and its signaling protocols [6]
3. Evaluate problem solving approaches as applied in telecommunication networking domains [1,2]
4. Demonstrate the characteristics of telephony, broadband and cellular systems. [6]
5. Illustrate telecommunication network design techniques and its practical implementation issues. [2]</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>-</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td>Project</td><td>25%</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Participation</td><td>5%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="5">Fundamentals of Telecommunications by Roger L. Freeman, 2nd Edition, 2013, Wiley-IEEE Press. ISBN-13: 978-0-471-71045-5.</td></tr>
<tr><td>References</td><td colspan="5">• Data Communications and Networking by Behrouz A. Forouzan, 5th Edition (Global Revised), 2012, McGraw-Hill. ISBN-13: 978-0-07-131586-9.
• Data and Computer Communication by William Stallings, 10th Edition, 2013, Pearson Education. ISBN-13: 978-0-133-50648-8.
• Communication Networks by Sheram Hekmat, 2005, Pragsoft Corporation. Online at http://www.pragsoft.com.</td></tr>
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<tr><td>Course Name</td><td colspan="3">Robotics</td><td colspan="2">تصميم وتشغيل الإنسان الآلي</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CE423</td><td>0923423</td><td>8th</td><td>3 (3-0-3)</td><td>CE313 (Computer Organization and Architecture)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description
This course aims to provide a hands-on approach to introduce the basic concepts in robotics. The course focuses on the fundamental concepts of robotics, including coordinate transformations, sensors, path planning, forward and backward kinematics, feedback and control for robotic operations. It will motivate the students to design, analyze and implement robotic operations.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the basic concepts of robotics: coordinate transformations, end-effector configurations parameters, manipulators, robotic vision.
2. Describe the forward and reverse kinematic operations.
3. Design and develop various types of manipulator, tele robots and entertainment robots using Legos.
4. Estimate the location and orientation parameters for forward and inverse kinematics.
5. Develop vision based applications for robotic operations.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2">20%</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Participation</td><td></td></tr>
<tr><td>Textbook</td><td colspan="6">J. J. Craig, “Introduction to Robotics”, 3rd Edition, Prentice Hall, 2009.</td></tr>
<tr><td>References</td><td colspan="6">• M. Mataric, "The Robotics Primer", MIT Press, 2012.
• B. Siciliano and S. Khatib, “Handbook of Robotics", Springer, 2008.</td></tr>
</table>

Course Name	*VLSI Design*			تصميم الدوائر المتكاملة ذات الكثافة العالية جداً	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE424	0923424	8th	3 (3-0-6)	CE411 (Design and Modeling of Digital Systems)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The main objective of this course is to introduce the modern integrated circuit design and testing technology. This course will expose the students to MOS & BIOS circuits, and VLSI circuit design. The students will learn VLSI implementation of basic gates and subsystems like ALUs, shifters and adders. It will enable the students to estimate and optimize combinational circuit delays using RC delay models, understand the importance of CPLDs and FPGAs for implementing different logic functions, and demonstrate the fabrication of IC using cadence tools.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** IC technology, list of fabrication steps, and the advantages of BICOS technology.
2. **Define** the basic electrical properties of MOS and BICMOS circuits.
3. **Compare** CMOS and BIPOLAR Technologies.
4. **Design** the logic gates and counters, and ALUs.
5. **Apply** design rules to get Layout of IC.
6. **Calculate/compute** electrical properties of MOS circuits.
7. **Demonstrate** the fabrication of IC using cadence tools and different strategies for testing of IC‘s.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**		**Project**	20%
	Midterm	20%	**Final**	40%	**Others**			
Textbook	Kamran Eshraghian, Eshraghian Dougles and A.Pucknell, “**Essentials of VLSI Circuits and Systems**”, 3rd Edition, Prentice Hall, 2005							
References	• D. A. Pucknell & K. Eshraghian, “**Basic VLSI Design**”, 3rd Edition, Prentice Hall, 1994. • Weste and Eshraghian, “**Principles of CMOS VLSI Design**”, Pearson Education, 1999.							

Course Name	*Image Analysis and Machine Vision*			تحليل الصور والرؤيا بالحاسب	
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	CE425	0923425	8th	3 (3-0-6)	CE310 (Signals and Systems)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The main objective of this course is to introduce the fundamental concepts, techniques, and algorithms of image analysis, enhancement, segmentation and stereo vision. This course will focus on image digitization, data structures for image analysis, segmentation, shape representation and description. This will provide a solid foundation for students to apply image analysis techniques in image transformation, image compression and 3D vision.

Course Outcomes

After the completion of this course, the student will be able to:

1. **Describe** appropriate data structures for image representation [a].
2. **Evaluate** the different image segmentation techniques [e].
3. **Analyze** and **interpret** the different image enhancement and transformation techniques [a, e].
4. **Compare** and **contrast** different lossless and lossy compression methods [a, e].
5. **Illustrate** the fundamental image analysis techniques for object recognition [a, e].
6. **Demonstrate** stereo vision algorithms to reconstruct the 3D scene [a, e].

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**		**Project**	20%
	Midterm	20%	**Final**	40%	**Others**			
Textbook	Gonzalez, R. & Woods, R., "**Digital Image Processing**", 3rd edition, Prentice-Hall, 2008							
References	• Gonzalez, R., Woods, R., & Eddins, S., "**Digital Image Processing Using MATLAB**", 2nd edition, Prentice-Hall, 2008. • Anil K. Jain, "**Fundamentals of Digital Image Processing**", 4th Edition, Prentice Hall, 2007.							

<table>
<tr><td>Course Name</td><td colspan="3">Computer Graphics</td><td colspan="2">الرسم باستخدام الحاسب</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CE426</td><td>0923426</td><td>8th</td><td>3 (3-0-3)</td><td>Math122 (Discrete Math)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐College Requirement ☐Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description

This course aims to provide fundamental concepts of 2D and 3D computer graphics. Topics include basic image synthesis techniques, geometric transformations, projections, Bézier and B-Spline functions for geometric modeling, animation, and rendering through ray tracing, shading and lighting. Students will use a standard computer graphics API in OpenGL to reinforce the concepts of computer graphics algorithms through projects.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Evaluate line, circle, and ellipse drawing algorithms.
2. Define and describe 2D and 3D points by applying affine transformations.
3. Analyze curves and surfaces using both implicit and parametric forms.
4. Develop algorithms using OpenGL API for 2D and 3D graphics applications.
5. Compare and contrast the different rendering techniques like ray tracing, shading and lighting.
6. Interpret the transformations and clipping operations on 2D images.
7. Demonstrate the concepts and applications of geometric modeling, animation and texture mapping.</td></tr>
</table>

Assessment Policy	☒**Mid-term**	20%	☒ **Assignments**	10%	☒**Quizzes**	10%	☒**Project**	20%
	☒**Final**	40%	☐**Lab.**		☐ **Participation**		☐**Others**	

Textbook	Edward Angel, Interactive Computer Graphics, 7th Edition, Pearson, 2012, ISBN: 9780321535863.
References	• Peter Shirley and Steve Marschner, Fundamentals of Computer Graphics, 3rd Edition, CRC Press, 2009. (ISBN 978-1-56881-469-8). • OpenGL Programming Guide, 8th Edition by Dave Shreiner et al. (Addison-Wesley, 2013).

<table>
<tr><td>Course Name</td><td colspan="3">Control Engineering</td><td colspan="2">هندسة التحكم</td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>CE427</td><td>0923427</td><td>8th</td><td>3 (3-0-6)</td><td>CE222 (Differential Equations)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="6">Course Description
This course aims to introduce the principles and applications of control systems. It will provide comprehensive study of various systems exhibiting control mechanisms and understand their operations, relate mathematical representations in feedback control systems. It will enable the students to know the importance of a control system model and its applicability and motivate them to design the feedback controllers.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Describe control systems and transfer functions of linear systems.
2. Describe root locus technique and frequency response methods.
3. Evaluate differential equations of physical systems.
4. Analyze, design and evaluate feedback control systems.
5. Apply control system theories to complex real world problems.
6. Evaluate root locus technique and frequency response methods.
7. Demonstrate computer aided design applications.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td></td><td rowspan="2">Project</td><td rowspan="2">20%</td></tr>
<tr><td>Midterm</td><td>20%</td><td>Final</td><td>40%</td><td>Others</td><td></td></tr>
<tr><td>Textbook</td><td colspan="6">Richard C. Drof and Robert H. Bishop, “Modern Control Systems”, 12th Edition, Pearson International, 2011.</td></tr>
<tr><td>References</td><td colspan="6">• Katsuhiko Ogata, “Modern Control Engineering”, 5th edition, Prentice Hall, 2010.
• Benjamin C.Kuo, “Automatic Control Systems”, 9th Edition, Wiley, 2009.</td></tr>
</table>